



MANOA REDD+ PROJECT



BIOFÍLICA



Project title	Manoa REDD+ Project
Project ID	1571
Crediting period	01 January 2013 – 31 December 2052; 40 years
Original date of issue	28-November-2024
Most recent date of issue	21-May-2026
Version	V7
VCS Standard Version	VCS Standard V4.7
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M A N O A
REDD+
P R O J E C T



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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Manoa REDD+ Project is a partnership between Biofílica Ambipar Environmental Investments S.A. and Manoa Sustentável, Exploração e Serviços Florestais Ltda, located on the Manoa Farm, in the municipality of Cujubim, state of Rondônia. Over its more than 30 years of history, Manoa has improved its management techniques, becoming a global reference model for forestry exploration combined with nature conservation.

With more than 72 thousand hectares of forest, it is known for its pioneering work in reduced-impact forest management, recognized in 2010 by the FAO (Food and Agriculture Organization of the United Nations) as an example to be followed, in addition to being one of the few remaining forests in private areas in the region, constantly threatened by invasions and timber theft. Manoa plays a fundamental role in the connectivity of the landscape, being close to conservation units, and adjoining the Jamari and Jacundá National Forests, together forming a forest block of 480 thousand hectares.

In the scenario prior to the implementation of the project, in social terms, the low level of education in the region resulted in lower salaries and deficiencies in specialized sectors. Schools faced a lack of structure and materials, which hindered education. There were no longer any traditional communities in the area, and the region was already part of the "Arc of Deforestation", with illegal logging and agricultural expansion. This encouraged rural exodus and urban marginalization, in addition to environmental impacts. These environmental impacts threatened the forest in the project area, characterized by an open rainforest, with palm trees in lowlands, followed by a submontane variant with vines and patches of palm trees. Surveys at the Manoa Farm continually reveal the existence of endangered species of flora and fauna. Since the beginning of the project, two "High Conservation Value Attributes" have been identified, which continue to be preserved, highlighting exceptional elements due to their environmental and/or social importance.

To reduce unplanned deforestation (UD) and consequently reduce greenhouse gas emissions, the Manoa Project will promote the following activities:

Deforestation Containment: Monitoring deforestation through satellite images and generating annual reports (Biophilic and Manoa Monitoring); Asset Surveillance; Obstruction of post-management accesses at strategic points.

Fire Prevention and Mitigation: Training Manoa employees in fighting forest fires; Carrying out fire prevention campaigns with neighbors; Training rural landowners in the LMA on firefighting techniques and sustainable pasture preparation alternatives; Maintaining existing accesses to strategic points at risk of fire.

Educational Actions: Technical training on low-impact forest management for Manoa employees and interested institutions; Carrying out environmental education activities with schools in Cujubim.

Low-Impact Forest Management: Ensuring the continuity of high-quality forest management standards regardless of variations in the forest market.

Infrastructure: Promoting infrastructure improvements in the municipality of Cujubim.

Biodiversity Monitoring: Monitoring the increase in forest growth in permanent plots; Monitoring the impact of forest management (post-exploration report); Monitoring of HCVAs (salt pan and waterfall); Monitoring of fauna in the project area.

Incentive for scientific research: Incentive for scientific research by local universities within the project area.

With the Manoa REDD+ Project, it is expected that, at the end of the second baseline period, which covers 6 years (from 2023 to 2028), the project will contribute to the mitigation of climate change, avoiding a total of 6,374,227 tCO₂eq in emissions. During this period, avoided deforestation will be 16,206 hectares, with an annual average of 1,062,371 tCO₂eq of reduced emissions, contributing to the preservation of the regional climate.

In the first baseline period of the Manoa REDD+ Project (first “Project Description” of the project), activities were planned that included training in techniques to promote sustainable development practices, such as Agroforestry Systems and Low Carbon Agriculture. In addition, strengthening and technical assistance for local producer associations were planned, with the aim of supporting small farmers and promoting their social empowerment. However, these initiatives were removed due to changes in the local context over the years, making these practices no longer applicable.

1.2 Audit History

Audit Type	Period	Program	VVB	Number of years
Validation	01-january-2013	VCS and CCB	Rainforest Alliance	-
Verification	01-january-2013 -- 31-december-2016	VCS	Rainforest Alliance	4
Verification	01-january-2017 – 07-august-2020	VCS	Earthood Services Private Limited (ESPL)	4
Verification	08-august-2020 – 31-december-2022	VCS	Earthood Services Private Limited (ESPL)	2
Validation and verification	08-august-2020 – 31-december-2022	SD VISta	KBS Certification Services Ltd.	2
Baseline Revalidation	01-january-2023	VCS	EPIC Sustainability Services Private Limited	-
Revalidation	01-january-2023	CCB	EPIC Sustainability Services Private Limited	-

Verification	01-january-2023 -- 30-september-2024	VCS, CCB, SD VSta	EPIC Sustainability Services Private Limited	1
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1.3 Sectoral Scope and Project Type

Sectoral Scope	14 – Agriculture, Fores and Other Land Use (AFOLU)
Project Type ¹	Reducing Emissions from Deforestation and Forest Degradation (REDD)
Project Activity Type	Avoided Unplanned Deforestation (AUD)

1.4 Project Eligibility

1.4.1 General eligibility

The project falls under the REDD (Reducing Emissions from Deforestation and Forest Degradation) category and applies to one of the activities eligible for this category, which is AUD (Avoided Unplanned Deforestation). The AUD activity includes actions that reduce net GHG emissions by avoiding unplanned deforestation and/or forest degradation that would have occurred without the project.

The project is eligible, as established in section 2.1 of the VCS Standard v4.7, because it falls under item 3 of the VCS program scope, as a 'Project with activities supported by a methodology approved under the VCS Program through the methodology development and review process'. In addition, it is not subject to exclusion categories, such as projects that generated GHG emissions for the purposes of subsequent reduction, removal or destruction, and does not fall under any of the exclusion categories presented in the table in section 2.1 of the standard.

The project meets all eligibility deadlines required by the VCS program. It was listed within the applicable pipeline deadline and held the opening meeting with the validation/verification body (VVB) before the established deadline. In addition, the validation is scheduled to be completed within the deadline determined by the program rules.

The methodology applied is VM0015 V1.2, developed by Verra, details regarding its applicability within the methodology specifications will be discussed in section 3.2. The project is represented by a single area, not being part of a larger project fragment. In addition, it is not grouped, and the methodology does not impose scale or capacity limits for this type of project scope, making these limitations inapplicable in this case.

1.4.2 AFOLU project eligibility

The AFOLU category of this project is REDD (Reducing Emissions from Deforestation and Forest Degradation), as defined in Appendix 1 of the VCS Standard V4.7. This appendix describes the types of

¹ See Appendix 1 of the VCS Standard

AFOLU categories accepted and the activities that fall under each of them. This appendix contains requirements A1.5, A1.6, A1.7 and A1.8, which are necessary to define and ensure the eligibility of projects in the REDD category.

According to the requirements mentioned above, one of the activities that falls under the REDD category is AUD (Deforestation and Degradation due to Avoided Unplanned Deforestation). According to the standard, this category encompasses activities that aim to reduce net greenhouse gas emissions by avoiding deforestation and/or degradation of mature or degraded forests.

As described in section 1.12, the main objective of this project's activities is to prevent unplanned degradation, which makes it eligible to be classified as a REDD project with AUD activity.

Furthermore, as described in requirement A1.5 of VCS Standard V4.7, "The project area must meet an internationally accepted definition of forest, such as those based on the UNFCCC host country boundaries or FAO *definitions and* must have qualified as forest for a minimum of 10 years prior to the project start date." The definition of "Forest" used by the Project is in accordance with resolution number 2 of the Interministerial Commission on Global Climate Change (CIMGC²). Regarding the minimum period of 10 years since the start of the project, data from the Brazilian Amazon Forest Monitoring Program by Satellite (PRODES³), developed and maintained by the National Institute for Space Research (INPE), were used. Since 1988, PRODES has not computed vegetation loss in areas originally without tropical forest or in regenerated areas. PRODES classifies only mature forests as forests, which proves that the area in question had this condition before the project.

1.4.3 Transfer project eligibility

Not applicable, as this is not a project being transferred from another GHG program.

1.5 Project Design

- ☒ Single location or installation
- ☐ Multiple locations or project activity instances (but not a grouped project)
- ☐ Grouped project

1.5.1 Grouped project design

Not applicable, as this is not a grouped project.

1.6 Project Proponent

² Definition of forest by the Designated National Authority: minimum area of 1 hectare with 30% of the surface covered by trees with the potential to reach a minimum height of 5 meters.

³ PRODES — Coordenação-Geral de Observação da Terra (inpe.br)

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Organization Name	Manoa Sustentável, Exploração e Serviços Florestais Ltda ⁵
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Position	Executive Director
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1.7 Other Entities Involved in the Project

Organization Name	UNIR – Universidade Federal de Rondônia
Project Role	Partnership for carrying out environmental research
Contact	Mariluce Rezende Messias
Position	Coordinator of the Laboratory of Mammalian and Terrestrial Vertebrates

⁴ In July 2021, Ambipar Participações e Empreendimentos S.A. concluded the acquisition of 53.6% of the share capital of Biofílica Environmental Investments S.A. The main objective of this transaction was to accelerate the company's growth, boosted by the Ambipar Group, resulting in the expansion of its portfolio of environmental services provided. As a result of this acquisition, the company underwent a name change, resolved at an extraordinary general meeting, becoming Biofílica Ambipar Environmental Investments S.A. The entry of the partner (Ambipar) into Biofílica did not change the Company's Corporate Purpose, which continues to be strongly related to the promotion and financing of activities related to the environment and environmental conservation. A detailed description of this can be found in Article 3 of the company's updated Bylaws, made available to VVB.

⁵ Project proponent – Change of land ownership. In 2019, the Manoa Farm was incorporated into the share capital of the company Manoa Sustentável Extração e Serviços Florestais Ltda., with the aim of facilitating bureaucratic procedures in the public agencies that carry out the release and inspection of the Forest Management Plan. Previously, the owner was Triângulo Pisos e Painéis Ltda., the proponent indicated in the original PDD of the project. This action was necessary because those responsible for the public agencies always had difficulty understanding why the owner of the area was not the company Manoa Sustentável Extração e Serviços Florestais Ltda., since it is responsible for the exploration of the forest management plan.

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Organization Name	Florestal – Planejamento, Paisagismo e Consultoria Ltda
Project Role	Forest inventory for carbon stocks quantification
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Position	Forest Engineer – Technical Manager
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Organization Name	Ação Ecológica Guaporé - Ecoporé
Project Role	Socioeconomic diagnosis development
Contact	Marcelo Lucian Ferronato
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Email	marcelo@ecopore.org.br

Organization name	Casa da Floresta Assessoria Ambiental LTDA.
Role in the project	Socio-economic and Environmental Diagnosis, Flora, Fauna and Physical Environment modules and Geographic Information Systems, of the Manoa REDD+ Project region
Contact person	Mônica Cabello de Brito

Title	Director
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1.8 Ownership

The project area is characterized as private property belonging to Manoa Sustentável Extração e Serviços Florestais Ltda. The right of possession and use are demonstrated through the following documents:

- Definitive land title, approximately 75.554,1847 hectares in the municipality of Cujubim, state of Rondônia;
- Rural Property Registration Certificate – CCIR;
- Full-text Certificate;
- Vintenária Certificate;
- Title of Recognition of Domain;
- Rural Environmental Registry (CAR);
- Negative certificate of embargo from IBAMA.

Additional documentary research concludes that the property is in good standing, with no liens, encumbrances or limitations on its full use, and therefore there are no obstacles to the implementation of the Manoa REDD+ Project, such as blockages, seizures, mortgages, foreclosures or land disputes. Proof of this legitimacy can also be demonstrated by obtaining the FSC and PEFC certification seals, which attest to the legality of the enterprise, as previously explained.

There are no records of disputes with third parties over ownership of the property nor the existence of disputes over access to natural resources or use of the property, and Fazenda Manoa has a good relationship with the surrounding populations.

1.9 Project Start Date

Project start date	January 1 st , 2013
Justification	The proponents chose January 1, 2013, as the start date, since the construction of the training center, as well as the renovation of surveillance houses and the logging of vulnerable areas occurred between 2012 and 2013, and in early 2013 the first Biofílica studies were carried out to assess the possibility of

structuring a REDD+ project. Based on this historical context, the proponents chose January 1, 2013, as the start date for the project, a date that represents the milestone for the beginning of planning aimed directly at the implementation of REDD+ project activities. This date is in accordance with the VCS Program, since item 3.8 of the VCS Standard V4.7 establishes that *“The start date of an AFOLU project is the date on which the activities that lead to the generation of reductions or removals are implemented.”*

1.10 Project Crediting Period

Crediting period	☐ Seven years, twice renewable ☐ Ten years, fixed ☒ Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)
	The project crediting period is 40 years, and complies with the VCS Standard V4.7, in its item 3.9.3, which states that <i>“For all AFOLU projects, except ALM projects described in 3.9.2, the initial project crediting period shall be a minimum of 20 years and a maximum of 100 years.”</i> Therefore, the defined crediting period is in accordance with the requirements of the VCS program.
Start and end date of first or fixed crediting period	01-January-2013 to 31-December-2052

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

- ☐ < 300,000 tCO₂e/year (project)
☒ ≥ 300,000 tCO₂e/year (large project)

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
01-January-2023 to 31-December-2023	1,041,913
01-January-2024 to 31-December-2024	1,046,098
01-January-2025 to 31-December-2025	1,062,390
01-January-2026 to 31-December-2026	1,066,490

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
01-January-2027 to 31-December-2027	1,070,527
01-January-2028 to 31-December-2028	1,086,809
Total estimated ERRs during the first or fixed crediting period	6,374,227
Total number of years	6
Average annual ERRs	1,062,371

1.12 Description of the Project Activity

The activities developed by the project aim to avoid GHG emissions, while promoting benefits for the stakeholders involved, both directly and indirectly, and environmental benefits (biodiversity, for example).

These activities were defined based on a “Theory of Change”, in which the respective short- and medium-term results and expected impacts were identified for each activity/action. These impacts aim to provide long-term benefits, contributing to the resilient and lasting maintenance of the forest.

All activities will occur annually.

Description of the activities and theory of change of the Manoa REDD+ Project.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
			Monitoring Avoided Deforestation and Emissions Reduction	Count the areas of avoided deforestation and avoided emissions in the project area	13 15.1	Establishment of a reliable baseline for quantifying avoided deforestation areas and avoided GHG emissions in the project area	Decrease in greenhouse gas (GHG) emissions, deforestation rate and forest degradation in the project area and comparison with the baseline	Maintaining and strengthening the trend of reducing deforestation, degradation and avoided emissions, helping to mitigate global climate change. The project is expected to avoid a total of 6,374,227 tCO ₂ eq in emissions (between 2023 and 2028). During this period, 16,206 hectares of deforestation will be avoided.	Area of avoided deforestation.
				Count the areas of avoided deforestation and avoided emissions in the leakage belt	13 15.1	Establishing a reliable baseline for quantifying avoided deforestation areas and avoided GHG emissions in the leakage belt	Decrease in greenhouse gas (GHG) emissions, deforestation rate and forest degradation in the leakage belt and comparison with the baseline	The project is expected to avoid a total of 809,436 tCO ₂ eq in emissions (between 2023 and 2028). During this period, 14,001 hectares of deforestation will be avoided.	Area of avoided deforestation.
				Satellite image monitoring to generate monthly bulletins	15.1 15.2	Implementation of a satellite monitoring system with regular monthly bulletins, specifically during the dry season. Establishing a specific monitoring calendar for the dry season. Immediate identification of changes in forest cover, deforestation, fire, etc. Creation of an initial database with detailed information and satellite images of the monitored region.	Identification of trends and patterns from the large quantity of data records, allowing for a more in-depth analysis of the places most at risk, necessary and effective actions, etc. throughout the year, especially during the dry season.	Reduced deforestation and environmental degradation due to informed intervention and effective conservation strategies throughout the year, especially during the dry season. The project is expected to avoid a total of 6,374,227 tCO ₂ eq in emissions (between 2023 and 2028). During this period, 16,206 hectares of deforestation will be avoided.	Number of monthly bulletins generated. Number of deforestation alerts detected. Number of incidents detected and controlled.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
				<i>Improve and monitor asset surveillance actions</i>	15.1 15.2	Improvement of surveillance actions to prevent third parties from entering and improvement of the reports carried out, allowing for better information and strategies.	Preventing third parties from breaking in	Maintaining the integrity of the area's forest cover. Reduces direct pressures on the forest and strengthens the permanence of carbon stocks	Number of incidents detected and controlled. Number of patrols carried out.
				<i>Obstructing strategic access to the farm after forest management activity</i>	15.2	Implementation of physical barriers at strategic access points to limit unauthorized access	Preventing third parties from breaking in	Maintaining the integrity of the area's forest cover This activity contributes to reducing deforestation, as it controls physical access to the territory, reducing the risk of irregular occupation and illegal extraction after management.	Number of obstructed accesses
				<i>Carry out training in monitoring techniques following the project's premises</i>	15.1 4.4	Training for managers in advanced monitoring techniques. Implementation of the techniques learned	Improving monitoring techniques. Increased effectiveness in monitoring and responding to incidents.	Establishment of a robust monitoring system that becomes an integral part of project operations. Continuous integration of monitoring techniques into the management of the area, with the training of new leaders. This activity contributes to reducing deforestation, as it improves the quality of environmental monitoring, ensuring reliable data for adaptive management and correction of deviations that could result in forest degradation.	Number of actions/workshops/trainings/lectures held. Number of employees qualified/trained

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
			Promoting environmental education and encouraging science	<i>Carry out environmental education activities with schools in Cujubim with the support of universities</i>	4.7 13.3	Implementation of environmental education actions in local schools, with the active participation of students and teachers. More young people with access to information related to science and technology	Disseminating and increasing students' knowledge and awareness of the importance of forest conservation and sustainable practices. More young people interested in science subjects in the region's schools	This activity contributes to reducing deforestation, as it helps changes in the local population's attitude towards the environment, such as adopting sustainable practices, reducing the occurrence of hunting and predatory fishing and supporting forest conservation. Creating a culture of appreciation for science and environmental education in the community, with a positive impact on regional development. An increase in the number of students pursuing careers in science and technology.	Evaluation of the level of knowledge before and after the actions/trainings Number of actions/workshops/trainings/lectures held Number of participants Percentage of Cujubim schools served
				<i>Hold training workshops for local teachers on topics related to forest conservation</i>	4.7 13.3	Teachers from the region with up-to-date and practical knowledge of forest conservation, incorporating the topics covered into lessons	Teachers and students develop more positive attitudes towards environmental conservation and begin to adopt sustainable behaviors.	Generating students who are more aware of and engaged in environmental conservation, who can influence their families and communities, as well as reducing environmentally damaging practices. This contributes to the maintenance of the forest.	Evaluation of the level of knowledge before and after the actions/trainings. Number of actions/workshops/trainings/lectures held. Number of participants.
			Prevention and mitigation of fires and respiratory diseases	<i>Conduct forest firefighting training for Manoa employees</i>	15.1 4.4 13.3	Training Manoa employees in forest firefighting techniques, increasing the readiness and effectiveness of fire responses. Fighting fires while ensuring the safety of employees involved in the fight	Reduction in response time and in the extent of damage caused by forest fires, due to the effective intervention of trained staff.	Establishing a culture of fire prevention and firefighting within the company, with continuous training and improvement over the years. Maintaining the integrity of the Manoa farm's forest cover	Number of employees qualified/trained. Number of incidents detected and controlled. Average response time to fire incidents.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
				<i>Fire and respiratory disease prevention campaigns with neighbors</i>	3.9 15.1 13.3	Promoting communication with neighbors on how to prevent fires and respiratory diseases from these activities	Raising awareness among Manoa's neighbors about preventive measures against forest fires and their harmful effects	Development of a more resilient and prepared community, with fire prevention and health care practices. Reduction in forest fires around the project area.	Number of campaigns promoted. Burn scars in the leakage management area.
				<i>Maintain access to strategic points at risk of fire</i>	13.2 15.1	Identification and regular maintenance of strategic accesses, ensuring that they are in good condition for quick use in the event of a fire.	Protecting the boundaries of the Manoa farm. Improved fire response capacity, with well-maintained accesses allowing quick and effective interventions at high-risk points.	Maintaining the integrity of the Manoa farm's forest cover. Maintaining an effective access network that contributes to the prevention of major fires and the ongoing protection of risk areas.	Number of accesses cleared and maintained.
			Ensuring the continued high quality of forest management	<i>Maintaining forest conservation certifications (e.g. forest management)</i>	15.2	Maintenance of existing certifications, ensuring compliance with high standards of forest management and conservation.	Maintaining Manoa's credibility and reputation in the market, with recognition of the sustainable practices adopted. Continued low impact and sustainable forest management at Manoa.	Continued contribution to forest conservation and sustainability of Manoa's operation, with a positive long-term impact on the ecosystem and local communities. Continuation of Manoa's image as an example of low-impact forest management	Number of approved forest certifications Corrective measures implemented per year
				<i>Ensure compliance with labor rights requirements for low-impact forest management employees</i>	8.8	Employees informed about their labor rights. Compliance with legal requirements by Manoa.	Improved employee satisfaction and morale	Execution of decent work in the forest management sector for the employees of the Manoa farm, with an organizational culture based on valuing and respecting labor rights, with a positive impact on the company's reputation.	Employee satisfaction index. Number of labor complaints resolved. Seasonal Employee Return Rate. Number of actions/workshops/trainings/lectures held. Number of employees qualified/trained.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
			Qualification of the workforce	Carry out technical training on low-impact forest management for Manoa employees	15.2 4.4	Training employees to apply low-impact forest management techniques, with a focus on sustainable practices.	Effective ongoing implementation of sustainable management techniques, resulting in greater operational efficiency and conservation of forest resources.	Perpetuation of a culture of sustainable management within the company, with low-impact practices consistently applied. Contribution to increasing the number of professionals in the timber sector with appropriate technical training to ensure sustainable forest management This activity contributes to reducing deforestation, as it minimizes collateral damage to the forest, reducing degradation that could lead to future deforestation.	Number of actions/workshops/trainings/lectures held. Number of employees qualified/trained. Evaluation of the level of knowledge before and after the actions/trainings.
				Hold ongoing training workshops for workers on forest conservation (e.g. REDD+) and health and safety	4.4. 8.8	Workers better informed and trained about forest conservation and health and safety practices.	Reduction in occupational safety incidents and greater worker engagement in forest conservation practices.	Integration of conservation and safety practices into the daily lives of workers, with a positive impact on sustainability and employee well-being, reducing practices that are harmful to the environment.	Number of actions/workshops/trainings/lectures held. Number of employees qualified/trained. Evaluation of the level of knowledge before and after the actions/trainings. Number of accidents at work.
				Carry out actions that promote knowledge about low-impact forest management for interested institutions	4.7 15.2	Dissemination of technical knowledge on low-impact forest management and related topics to other interested institutions.	Implementation of practices related to forest management by other institutions that participated in the training, contributing to forest conservation on a wider scale.	Creation of a network of institutions knowledgeable about good forest management practices, promoting forest conservation on a broader scale. Disseminates good practices, expanding impact beyond the project area and contributing	Evaluation of the level of knowledge before and after the actions/trainings. Number of actions/workshops/trainings/lectures held. Number of partnerships

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
								to regional reduction in deforestation.	established formally and informally. Number of participants.
			Encouraging education for employees and their families	<i>Developing internal communication campaigns to encourage the importance of education and keeping employees' children and families in school.</i>	4.1 4.2 4.3	Immediate increase in awareness of the importance of education among employees. Awareness among Manoa employees of the importance of their children's education Identification and possible increase in the number of school-age children of Manoa employees attending schools in Cujubim.	Improved employee attitudes and behavior towards education. Increased positive perception of the company, increasing employee satisfaction and engagement.	A stronger organizational culture that values education Contribution to reducing school dropout rates in the municipality of Cujubim Increased rate of employees' children enrolled and regularly attending school in Cujubim A more educated and skilled generation, with positive impacts on the community and the job market.	Number of employees qualified/trained. Number of campaigns promoted. Rate of employees' children enrolled and attending school regularly.
			Community Partnerships and Investments	<i>Establish institutional partnerships with public bodies and private entities</i>	17.17	Increased visibility and communication between the project and relevant institutions in the region. Establishment of initial agreements and collaborations with partners.	Dissemination of the importance of the project to partner institutions. Improved problem-solving capacity through inter-institutional collaboration. Implementation of shared initiatives.	Creating a solid network of institutional connections. Increased reach of initiatives developed with partners.	Number of partnerships established formally and informally.
				<i>Contributing to infrastructure improvements in the municipality of Cujubim</i>	11	Improving the quality of infrastructure in the municipality of Cujubim. Increased community satisfaction with the improvements implemented.	Increased quality of life for residents. Reduced infrastructure problems.	To improve the quality of life of the residents of the municipality of Cujubim. Encouraging sustainable development in the municipality.	Community assessment of the improvements made. Number of improvements made.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
				<i>Making donations to institutions in the municipality of Cujubim</i>	11	Contribution to social and/or environmental actions and activities carried out by Cujubim institutions. Immediate support for local institutions with financial resources, materials or services. Increased visibility and reputation of the project and Manoa in the community.	Improving the capacity of beneficiary institutions to meet their objectives. Increased community confidence in the project and in Manoa, supporting forest conservation.	Contribution to the maintenance of institutions in Cujubim, strengthening their positive social impact on the community. Establishing a long-term relationship with local institutions and the community that support forest conservation.	Institutions' assessment of donations received. Number of donations made to Cujubim institutions.
			Monitoring impacts on biodiversity and HCVAs	<i>Monitoring forest increment in permanent plots</i>	15.2	Obtaining data on the impact of management on biodiversity in the project area. Collecting data on forest growth Establishing a database for future analysis.	Identification of trends in forest growth and regeneration and possible influencing factors.	Contribution to the preservation and sustainable recovery of forests. Improved long-term forest management, based on consistent data.	Recruitment and mortality Richness and composition Status and presence of Vulnerable, Endangered or Critically Endangered species (according to the IUCN) Forest increment rate
				<i>Monitoring the impact of forest management (analysis of the post-exploration report)</i>	15.2 6.6	Immediate identification of the impacts caused by management activities Establishment of a database for future analysis.	Implementation of corrective and preventive actions based on monitoring results. Continuous improvement in forest management practices to minimize negative impacts.	Reduce environmental impacts and improve the sustainability of forestry operations. Strengthen compliance with environmental regulations and certification standards. Improving long-term forest management, based on consistent data.	Total area of protected Permanent Preservation. Percentage of permanent infrastructure. Percentage of temporary infrastructure. Volume of timber harvested.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
				<i>Monitoring the AAVCs (saleiro and cachoeira)</i>	15.5	Monitoring the integrity of HCVAs, identifying possible alterations or impacts on areas of high conservation value. Documentation and immediate protection of these sensitive areas.	Maintaining the ecological integrity of the monitored areas. Implementing more effective conservation strategies based on the data collected. Contributing to increased knowledge about the richness of local biodiversity and the maintenance of key species and attributes of high conservation value.	Preservation of critical areas for biodiversity and ecological balance. Improved long-term management and protection of HCVAs, preventing biodiversity loss and fragmentation that could facilitate subsequent deforestation.	Monitoring HCVAs. Status and presence of Vulnerable, Endangered or Critically Endangered species (according to the IUCN).
				<i>Fauna monitoring</i>	15.5	Contribute to the monitoring of local biodiversity by collecting initial data on the presence and abundance of animal species and identifying possible threats or declines in fauna populations.	Better understanding of population dynamics and ecosystem health. Adjustments to management practices to mitigate negative impacts on fauna, if necessary Use of the database for biodiversity management activities, if necessary	Contribution to the conservation of endangered species and the maintenance of biodiversity. Development of long-term strategies for the protection of fauna. Increasing the number of technical and scientific materials on local biodiversity	Abundance and frequency. Richness and composition. Status and presence of Vulnerable, Endangered or Critically Endangered species (according to the IUCN).
				<i>Train staff to carry out sighting monitoring</i>	4.4 15.5	Involving employees in biodiversity monitoring Training employees to carry out effective and accurate monitoring. Increase in the quality and quantity of sighting data collected.	Increase Manoa employees' knowledge of local biodiversity Improve the efficiency and accuracy of fauna and flora monitoring.	Establishment of a highly qualified environmental monitoring team. Continuous contribution to environmental conservation and protection through qualified monitoring. Greater employee involvement and awareness of the importance of conservation.	Evaluation of the level of knowledge before and after the actions/trainings. Number of actions/workshops/trainings/lectures held. Number of employees qualified/trained.

C	C	B	Theme	Proposed activities	SDG	Short-term results	Medium-term results	Long-term results (Impacts)	Indicator
			Supporting and encouraging scientific research	<i>Establish partnerships with universities, research centers and scientific institutions for collaborative projects</i>	17.17	Beginning collaborations with academic and scientific institutions, encouraging researchers and research activities. Access to resources and expertise through partnerships.	Contribution to data collection for the development of joint research projects, generating new knowledge. Establishment of a solid network of academic and scientific cooperation with the private sector.	Positive impact on the innovation and development of Manoa and the project. Recognition as a reliable and influential partner in the scientific and academic community.	Number of partnerships established formally and informally. Number of scientific projects supported
				<i>Supporting scientific research</i>	9.5 13.3 17.17	Identification and selection of relevant research projects for support. Providing resources to carry out the research.	Development of scientific research with significant impact potential. Increased production of knowledge and solutions that benefit both the scientific community and society. Improve conservation strategies based on the data obtained by the Manoa REDD+ Project	Increase in the number of technical and scientific materials on the project region. Strengthening of the project's position as an active promoter of science and technology. Contribution to scientific progress in strategic areas Maintaining Manoa's good relationship with the local population	Number of researchers working in the project area Number of incentivized searches
				<i>Monitoring the publication of scientific articles and participation in conferences, seminars and congresses to disseminate research results</i>	9.5 17.17	Encouraging participation in relevant conferences and congresses.	Increase in the number of scientific publications associated with the project. Active participation in scientific events, promoting the results of the research carried out.	Strengthening the project's presence and influence in the scientific community. Expanding the impact of the research carried out by disseminating knowledge about the region.	Number of scientific articles published by researchers associated with the Project

Deviations in the project description in relation to the initial PD:

Monitoring deforestation through satellite images (Landsat and Resourcesat) and generation of annual bulletins – Satellite monitoring carried out by Manoa

Initially, in item 2.2 of the PDD, specifically within the activity “Monitoring deforestation through satellite images (Landsat and Resourcesat) and generation of annual bulletins”, it was expected that the annual deforestation bulletins prepared by Biofílica Ambipar would help direct Manoa's asset surveillance activities. The bulletins, which began to be prepared in 2014, use satellite images to understand the context of deforestation and invasions and should, consequently, improve the agility and assertiveness of field surveillance to maintain forest cover. However, the bulletins depend on the frequency of PRODES, which takes about a year to be published with data from the previous year. Therefore, the 2021 and 2022 bulletins, for example, were produced in 2022 and 2023, respectively.

The surveillance activities, carried out by the Manoa team, began in 1997 and, as of 2014, the beginning of the REDD+ Manoa crediting period, began to occur monthly. Throughout the monitoring of the project, the record of each of the surveillance activities was improved to better monitor the activity and to better archive evidence. According to the PDD, the surveillance activities should be combined with remote monitoring activities using satellite images (the bulletins) to develop strategies that would improve the efficiency of the surveillance and increase the security of the project area boundaries.

However, since the validation of the project, the annual frequency of the bulletins did not fully meet the proposal, since the surveillance activities occurred monthly and required monitoring of areas at risk of deforestation. with an interval of less than one year to act. In order to meet the satellite monitoring frequency required by the surveillance team, the team responsible for managing the Manoa Farm began a new monthly monitoring activity during the dry season to identify deforestation and fire outbreaks in the area surrounding the farm. This monitoring has two stages (1) deforestation monitoring and (2) monitoring of hotspots, both carried out by the Manoa team and covering a 10km buffer from the Manoa Farm boundaries.

Deforestation monitoring is carried out during the dry season (usually between May and August) by observing deforestation around the farm using data from the Planet satellite and/or the Sentinel satellite and analyzed using QGIS or ARCGIS software. If loss of forest cover is identified within or near the farm boundaries, the information resulting from the analysis serves as support for field investigation, carried out by the surveillance team, and remotely, carried out by the person responsible for preparing the reports. In the field, the surveillance team tries to contact those responsible for deforestation to reinforce Manoa's presence and the property boundaries, thus avoiding losses within the project area.

Heat hotspots are monitored by registering on the NASA website. Whenever there is a heat hotspot within the buffer registered on the website, the Manoa employee responsible for monitoring is alerted by email (usually received up to 24 hours after the hotspot is detected) and receives information about the time, date, satellite that recorded the hotspot, and the coordinates of the location. With this, the points of interest on the BDQueimadas website are checked to confirm the fire, since a heat hotspot does not always correspond to a forest fire. In addition, the moment in which the fire is located (if it is extinguished, at the height of the burning or starting) is analyzed by observing the heat hotspot graphs available on

BDQueimadas, which indicate the intensity of the temperature of the recorded hotspot. With this information, a map of the hotspots is generated, and the surveillance team is called to check it in the field. Generally, since this information needs to be checked as soon as possible, the surveillance team receives the raw data of the occurrence, and the report is generated later.

There is no frequency in the preparation of reports, since they only occur in the case of deforestation and/or fire outbreaks close to the farm's boundaries. Monitoring, on the other hand, occurs constantly in the case of fire outbreaks and at least once a month, during the dry season, for deforestation in the surrounding area.

It is worth noting that, within the scope of the surveillance and patrolling activities carried out by the Project, it is clarified that the use of firearms by the teams involved is not adopted under any circumstances. Patrol activities are exclusively preventive, educational, and dissuasive in nature, and are conducted based on safety protocols, respect for human rights, current legislation, and applicable socio-environmental guidelines.

1.13 Project Location

The Manoa REDD+ Project is located in Brazil, in the state of Rondônia, in the municipalities of Cujubim, Itapoã do Oeste and Porto Velho (Figure 1). Access to the area is via the BR-364, Porto Velho-Ariquemes, traveling approximately 140 km to the RO-205 highway, which connects to the municipality of Cujubim via a 50 km dirt road.

The surrounding area is characterized by the presence of several Conservation Units, as well as Agrarian Reform Settlements of the National Institute of Colonization and Agrarian Reform (INCRA). More recently, the region where the project is located has undergone extensive change due to the expansion of soybean farming.

The Project Area (72,661 hectares) is located within the Manoa Farm property, which totals an area of 75.554,1847 hectares (data from the most recent Rural Property Registration Certificate – CCIR). The vertices of the project area are shown in Table 1 and the location of the area in Figure 1.

Table 1 Geographic coordinates of the vertices of the Manoa Farm.

Vertex	Coordinate X	Coordinate Y
V 01	62° 31'59,243"W	8° 59'45,312"S
V 02	62° 51'4,501"W	9° 0'0,117"S
V 03	62° 51'4,595"W	8° 56'10,852"S
V 04	62° 50'5,834"W	8° 54'38,506"S
V 05	62° 48'19,203"W	8° 50'26,109"S
V 06	62° 47'35,825"W	8° 52'15,333"S

V 07	62° 45'50,68"W	8° 50'41,41"S
V 08	62° 47'12,746"W	8° 48'33,748"S
V 09	62° 43'58,219"W	8° 39'39,696"S
V 10	62° 40'38,687"W	8° 40'54,938"S

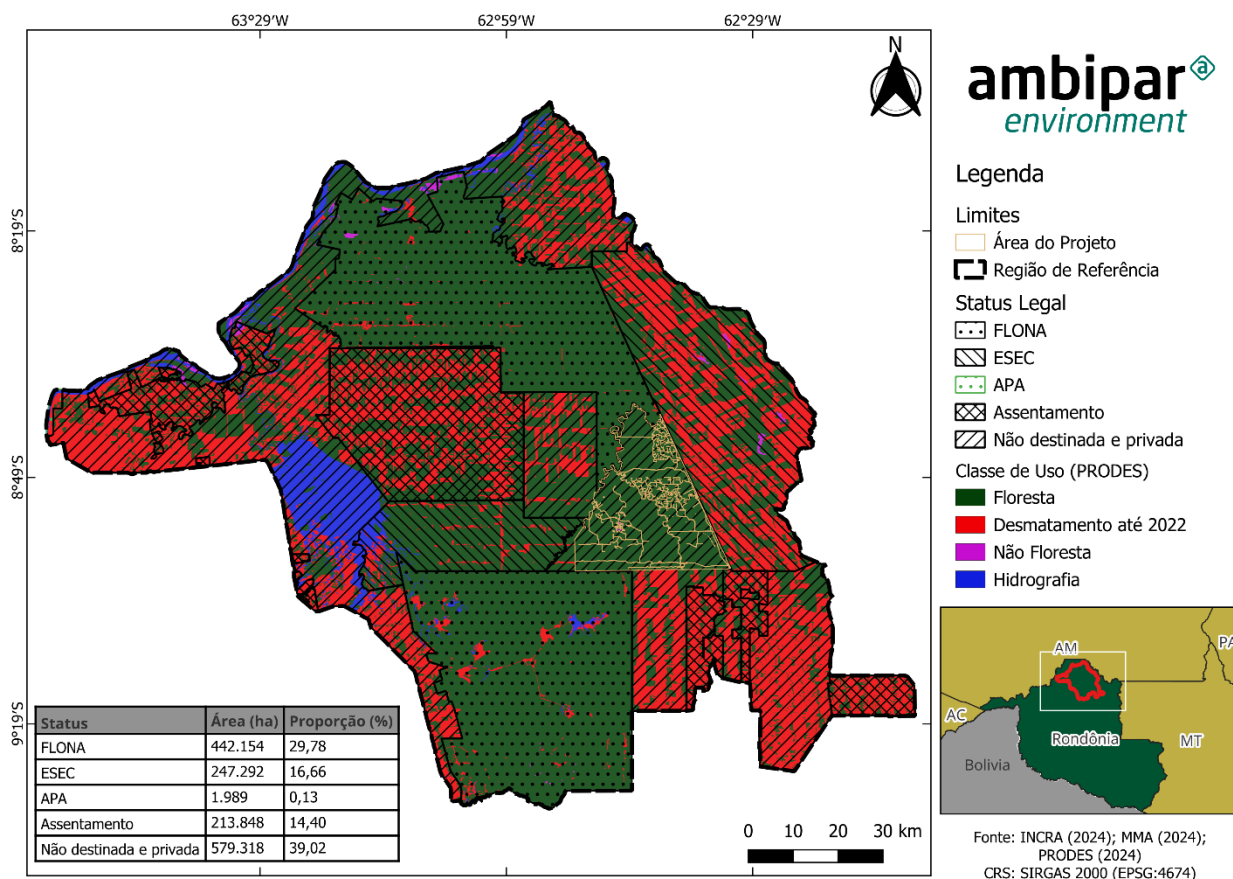


Figure 1 Location of project boundaries.

1.14 Conditions Prior to Project Initiation

The Manoa Farm has been managed sustainably since 1997 in accordance with the company's Sustainable Forest Management Plan. The management aims at timber production combined with the conservation of natural resources and, therefore, adopts low-impact harvesting techniques, complying with all current legislation and the principles of FSC and PEFC forest certification. Therefore, the project was not implemented with the objective of generating greenhouse gas (GHG) emissions for the purpose of subsequent reduction, removal or destruction.

The conditions encountered prior to the start of the Project are described below.

1. Biodiversity

Flora

The vegetation types present in the reference region are Open Ombrophilous Forest (OOM) in the categories of lowland forests with palm trees, submontane forests with palm trees and submontane forests with lianas. Small patches of Dense Ombrophilous Forest (OOM) in the classification of submontane with uniform canopy, as well as the typologies of forested savanna and alluvial forest with emergent canopy can also be observed. In the project area, the OOM typology with lowland formation with palm trees predominates, followed by submontane OOM with lianas and patches of submontane OOM with palm trees (Casa da Floresta, 2015).

2. Phytosociology

The phytosociological survey carried out in the project area revealed a total of 177 tree species belonging to 45 botanical families. The family with the greatest diversity of species is Fabaceae, with 50 species, followed by Arecaceae and Mavacea, with 9 species each, Moracea, Sapotaceae and Lecythidaceae, with 8, 7 and 6 species respectively.

Mammal fauna

The study carried out in the project area sampled 43 species of medium and large mammals, belonging to seven orders and 19 families. Carnivora and Primates are the most representative orders, with 12 and 11 species, respectively.

Birdlife

The presence of 273 bird species, belonging to 22 orders and 53 families, was recorded in the project area. This number, however, should increase considerably with greater sampling intensity. The literature indicates a number of 472 bird species for the reference region.

Herpetofauna

At Fazenda Manoa, 44 species of herpetofauna were recorded in the field, of which 30 are anuran amphibians and 14 are reptiles. The relatively low species richness may be linked to insufficient sampling effort, as well as the seasonality with which certain species are seen.

Ichthyofauna

Literature data indicate the presence of 234 species of fish belonging to nine orders and 38 families were recorded for the reference region. In the project area, 11 species of fishing fish were randomly recorded.

3. Physical parameters

Climatic Aspects

According to Alvares et al. (2013) apud Casa da Floresta Assessoria Ambiental Ltda. (2015), the climate of the state of Rondônia is classified as Am in the Köppen system, that is, a tropical monsoon climate, with the temperature of the coldest month above or equal to 18°C, the precipitation of the driest month below 60 mm and the total annual average above 1,500 mm. Figure 2 shows the average monthly temperatures and precipitation of the municipalities that make up the Reference Region of the Manoa REDD+ Project.

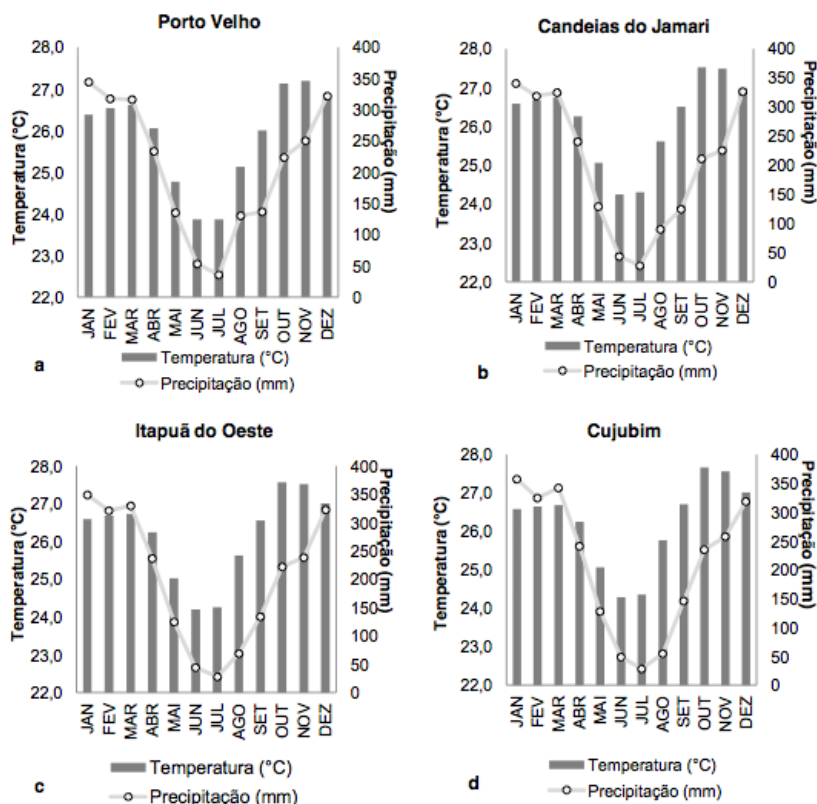


Figure 2 Climate graphs of the municipalities that make up the reference region. a) Average monthly temperature and precipitation of Porto Velho; b) Average monthly temperature and precipitation of Candeias do Jamari; c) Average monthly temperature and precipitation of Itapuã do Oeste; d) Average monthly temperature and precipitation of Cujubim. Source: Alvares et al. (2013) apud Casa da Floresta Assessoria Ambiental Ltda. (2015).

Hydrographic Aspects

The state of Rondônia is located in the Amazon Basin, in the Madeira River sub-basin, where all the state's rivers converge. The main rivers in the Madeira River sub-basin are the Jamari, Machado (or Ji-Paraná), Guaporé, Mamoré, Alto Madeira and Abunã.

The reference region is composed of part of the Jamari River basin, in the far west, the Machado River basin, in the central-eastern region, and part of the upper Madeira River basin, in the far north.

Pedological Aspect

As a result of prolonged weathering and leaching, the sedimentary rocks and crystalline basement present in the reference region during the Neogene resulted in deep soils, such as Latosols, Argisols and Spodosols, which predominate in the state of Rondônia (DANTAS; ADAMY, 2010 apud CASA DA FLORESTA ASSESSORIA AMBIENTAL LTDA, 2015).

In the reference region, on the plains of the Madeira and Machado rivers, there are Dystrophic Haplic Gleysols, Dystrophic Red-Yellow Latosols, Dystrophic Yellow Latosols and Fluvic Neosols (SHINZATO et al., 2010 apud CASA DA FLORESTA ASSESSORIA AMBIENTAL LTDA, 2015).

On the banks of the Madeira River and the lower Jamari River, in the Samuel HPP reservoir, Eutrophic and Dystrophic Gleysols are observed. Gleysols develop in saturated conditions, without the presence of dissolved oxygen, forming a gleysol horizon, with gray and greenish colors. Eutrophic Gleysols have a greater saturation of cations exchangeable with plants, and dystrophic ones have a lower base saturation.

To the east and far west of the reference region, Yellow Latosols are observed, characterized by a yellowish coloration due to the almost exclusive existence of goethite among the iron oxides in the clay fraction, an effect of the high humidity in the region (Casa da Floresta, 2015).

In the southern part of the reference region, in the center-south of Cujubim, Dark Red Latosols are present in the areas where the Santa Clara and Serra da Providência Formations occur (Casa da Floresta, 2015).

Quartzite Neosols are found among Yellow Latosols, on the banks of the Machado River, in the extreme east of the reference region. They have an essentially sandy texture in all horizons and high to moderate acidity, with low base saturation and low fertility (Casa da Floresta, 2015).

In the inselbergs of Serra da Providência, in the western part of the reference region, near the Samuel HPP, there are Dystrophic Concretionary soils, characterized by the presence of petroplinthite (although in insufficient quantities to define it as Plinthosol), originating from cycles of wetting and accentuated drying, with formation of nodules and ferruginous concretions (SANTOS et al., 2013 apud CASA DA FLORESTA ASSESSORIA AMBIENTAL LTDA, 2015). Small areas of Regolithic Neosols are present in the center-south of the reference region. Dystrophic Red-Yellow Argisols make up the southern end of the reference region. To the east of the reference region there is an area with occurrence of Dystrophic Haplic Cambisols.

Geological Aspects

The state of Rondônia is located in the western/southwestern portion of the Amazonian Craton, in the Central Brazil Shield. The Amazonian Craton is one of the largest Precambrian areas in the world, and represents one of the main tectonic units in South America. Within it, the Phanerozoic basins of Parnaíba, Xingu and Alto Tapajós, Parecis, Solimões, Tacutu and Amazonas can be observed.

4. Socioeconomical Parameters

The territory where the State of Rondônia is located today was initially explored as a result of the discovery of gold in the areas of the Guaporé Valley in the 18th century. After a cycle of extraction of this mineral, the region began to suffer from the lack of interest of the Metropolis, but the economic cycles were renewed and the region once again aroused interest in later moments. The municipalities of Porto Velho and Candeias do Jamari have their origins related to another period of exploration of the region's resources. In the 19th century, the extraction of rubber drove the occupation of rubber plantations in areas where latex gum was extracted (MACEDO, 2000). Candeias functioned as a support point for those who traveled towards the rubber plantations located in the Upper Candeias River, as well as a place where part of the rubber production was stored.

The occupation of what is now the Municipality of Porto Velho also began as a result of rubber extraction, as its urbanization occurred due to the installation of the construction site of the Madeira Mamoré Railroad, which was supposed to transport production from the Territorial Colonies (currently the Departments of Pando and Beni, in Bolivia) and the Amazon to supply the European and North American markets. This work was a Brazilian counterpart through the signing of the Treaty of Petrópolis, which established Brazil's responsibility to build a railroad that would facilitate the flow of Bolivian and upper Madeira latex production in exchange for an area that is now the State of Acre.

The occupation guided by the Brazilian State of the locations that are now the Municipalities of Cujubim and Itapuã do Oeste was related to the strategy of occupying the Amazon through agricultural colonization projects (FEARNSIDE, 1989). In the 1970s, the Military government drew up the 1st National Development Plan. During this period, actions were carried out through the discursive presence of a notion of the Amazon as an empty area, suitable for occupation by those who claimed land for production. These measures partly dissolved social tensions arising from those who claimed land for cultivation.

This period is marked by the famous phrase of former president Emílio Garrastazu Médici, 'I want to open a road that will take landless men to a land without men', showing the notion of the Amazon as an empty space that needed to be occupied. This ideology directed a large flow of migrants to the region, largely peasants from the northeast and south of Brazil. There were numerous bibliographies produced during the 1970s and 1980s showing the impact of the expansion fronts in the north of the country and the large influx of migrants who moved to this frontier without finding any infrastructure there (NASCIMENTO, 2007).

In Rondônia, following the national strategy for occupation and development of the Amazon, colonization projects initiated by the Brazilian government played a central role in changing the state's landscape (Fearnside, 1989; Alves et al., 1999). Two state programs financed by the World Bank facilitated the implementation of these projects: POLONOROESTE, between 1981 and 1985, which was also responsible for paving BR-364 (Cuiabá-Porto Velho), the main highway crossing the state; and PLANAFLORO, between 1992 and 1999, which concluded the ecological-economic zoning of Rondônia (Mahar & Ducrot, 1998).

Table 2. Socioeconomic data of the municipalities in the reference region of the Mano REDD+ Project.

Data	Candeias do Jamari	Cujubim	Porto Velho	Itapuã do Oeste
Estimated population 2014	23.573	20.204	494.013	9.831
Population 2010	19.779	15.854	428.527	8.566
Area of the territorial unit (km ²)	6.843,868	3.863,943	34.096,388	4.081,583
Population density (inhab./km ²)	2,89	4,10	12,57	2,10
Municipal Human Development Index - 2010 (IDHM 2010)	0,649	0,612	0,736	0,614
GDP per capita - 2012	R\$ 17.120,48	R\$ 12.813,19	R\$ 22.081,33	R\$ 14.141,45

Source: IBGE - Instituto Brasileiro de Geografia e Estatística

Until the mid-20th century, the region of the municipality of Cujubim was populated by several indigenous ethnic groups that fought over the territory, mainly through hunting and fishing activities. However, it is not known for sure how many ethnic groups inhabited the current municipal area, although the presence of the Arikem, Boca-Negras, among others, has been reported.

Historiography and other studies indicate that in the late 19th and early 20th centuries, the indigenous people underwent a process of drastic changes in their way of life, which resulted in ethnocides. The extraction of rubber (*Hevea brasiliensis*) to meet the needs of wars led to the introduction of capitalism and provided great wealth to rubber tappers and traders in general.

Thus, in the region, the presence of northeastern workers in the rubber plantations and explorers of unknown territories and rivers inevitably led to the “encounter of societies” with different values, and a series of confrontations resulted in the loss of indigenous territories.

In this tragic scenario, indigenous people and rubber tappers were victims of the occupation process in the Amazon. The indigenous people were expelled from their territories and suffered ethnocide, while the rubber tappers faced poverty, slavery, loneliness and death.

The 1950s were a new milestone for the region, resulting in population growth, since the entry of mining, with the extraction of cassiterite in Ariquemes and Vale do Rio Machadinho, attracted new social actors.

From the 1970s onwards, with improved access to the region, especially through BR364, the official colonization of the State began, first in the region of Ariquemes with the installation of two Directed Settlement Projects (PADs) of INCRA “Marechal Dutra” and “Burareiro”, and soon after in the following decade the Cujubim Settlement Project (PA) was implemented, which gave rise to the municipality. In the

1980s, with the creation of the Machadinho, Cujubim and Buritis Settlement Projects, all municipalities in this Territory were derived from these INCRA colonization and settlement projects, with the exception of Campo Novo de Rondônia, which originated from the exploitation of cassiterite, starting in the 1950s (TEIXEIRA & OLIVEIRA, 2001).

The PADs and PAs clearly reflect the Amazon occupation policy, as a geopolitical strategy adopted by the Brazilian state, which in this case, provided the region with some infrastructures that drove the creation of these municipalities. In parallel with the State's action, logging activity contributed significantly and directly to the expansion of deforestation, while offering “jobs” to a portion of the unemployed population without qualified labor. Cujubim has a territorial area of 3,864.07 km² (IBGE/2010), its northern border is the municipality of Porto Velho, to the south Rio Crespo, to the east Machadinho d'Oeste and to the west Itapuã do Oeste.

Its origins were as an Urban Support Center for Rural Development - NUAR of the Cujubim Settlement Project and adopted the same name as the Project. It has a density of 4.10 inhabitants/km² (IBGE/2010), and was created by State Law 568 of 22.06.1994, signed by Governor Oswaldo Piana Filho, with areas of Rio Crespo and Itapuã do Oeste.

Cujubim is economically sustained by agriculture, livestock and the timber industry. Currently, the major suppliers of raw materials for the timber industry are the Jamari National Forest and the MANOA Farm, which covers the municipality's territorial area, and are certified as forestry origins due to sustainable forest management plans.

In recent years, the timber sector has been going through a major crisis due to the reduction in the stocks of timber available in private forests, as well as the monitoring actions of public agencies that restrict the illegality of predatory activities in industries and, consequently, the closure of companies and the dismissal of workers.

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

The objective of the Manoa REDD+ Project is in accordance with the Federal Constitution, as well as current legislation on the protection of native forests and the climate change regime provided for in international regulations (UNFCCC) and the National Policy on Climate Change (Law 12,187). In addition, it recently (August 9, 2023) adopted the Belém Declaration, prepared by the Amazon Cooperation Treaty Organization (ACTO), whose main objective is sustainable development, conservation and sustainable use of biodiversity, forests and water, to avoid the point of no return in the Amazon, combating deforestation and illegal activities in the region, economic development with social inclusion and generation of income and employment, based on mechanisms of social participation, especially of indigenous peoples and local and traditional communities, and strengthening the ACTO.

The project is in accordance with all current national, state and international legislation. Since this is a project that takes place in a private area and involves forest management, it is primarily subject to legislation related to land issues and the Brazilian Forest Code. The main laws and decrees that regulate the project's activities are listed and detailed below.

Legislation: Brazilian Federal Constitution of 1988: Defines and regulates how laws should be created in the country, how the three branches of government (Executive, Legislative and Judiciary) should function and the bodies that work together with them. The Constitution has the following fundamental principles:

- I - sovereignty;
- II - citizenship;
- III - human dignity;
- IV - the social values of work and free enterprise;
- V - political pluralism.

Applicability to the project: Regulates and directs all national legislation that influences the project.
Subject: Land regulation

Related legislation:

Law 601/1850 - Law of Unoccupied Lands: Provides for unoccupied lands in the Empire, and for those that are owned by sesmaria title without fulfilling the legal conditions, as well as by simple title of quiet and peaceful possession; and determines that, once the former have been measured and demarcated, they are to be transferred for a fee, both to private companies and for the establishment of colonies of nationals and foreigners, authorizing the Government to promote foreign colonization in the manner stated.

Law 4,504/1964 - Land Statute: Provides for the land statute and contains other provisions. This Law regulates the rights and obligations concerning rural real estate, for the purposes of implementing Agrarian Reform and promoting Agricultural Policy.

Law 9,393/1996 - ITR Law - Tax on Rural Property: Provides for the ITR Tax, on the payment of debts represented by Agrarian Debt Bonds and other provisions.

Law 10,406/2002 - Brazilian Civil Code - On the rights and duties in private life, of people, assets and legal facts. Divided into two parts, (1) General Part, referring to people, assets and legal facts and (2) Special Part, referring to the law of obligations, companies, things, family and successions.

Applicability to the project: The project is in accordance with the listed laws, which guarantees the right to property that includes the Project Area and regularity with taxes related to rural properties.

Topic: Environment

Related legislation:

Law 12,651/2012 - Brazilian Forest Code: Establishes general rules on the protection of vegetation, Permanent Preservation areas and Legal Reserve areas; forest exploitation, the supply of forest raw materials, the control of the origin of forest products and the control and prevention of forest fires, and provides economic and financial instruments to achieve its objectives.

Law 9,605/1998 - Federal Law on environmental crimes: Provides for criminal and administrative sanctions arising from conduct and activities that are harmful to the environment, and contains other provisions.

MMA Ordinance No. 148, of June 7, 2022 - Recognizes the following official lists: "Official National List of Endangered Flora Species", "Official List of Endangered Brazilian Fauna Species" and "Official List of Extinct Brazilian Fauna Species". Law 7,347/1985 - Law on Public Civil Action: Regulates public civil action for liability for damages caused to the environment, consumers, and assets and rights of artistic, aesthetic, historical, and tourist value, among other provisions.

Applicability to the project: The project area includes Permanent Preservation areas, Legal Reserve areas, and endangered species of Brazilian fauna and flora, which leaves the owner of the area susceptible to legal consequences if he or she fails to fulfill his or her responsibilities. Throughout its duration, the project has always been in compliance with the law, without receiving any penalties or fines.

Topic: Forest Management

Related legislation:

Conama Resolution 406/2009 - Establishes technical parameters to be adopted in the preparation, presentation, technical evaluation and execution of the Sustainable Forest Management Plan - PMFS for timber purposes, for native forests and their forms of succession in the Amazon biome.

Federal Decree 5,975 and related laws - Regulates art. 12, final part, 15, 16, 19, 20 and 21 of Law No. 4,771, of September 15, 1965, art. 4, item III, of Law No. 6,938, of August 31, 1981, art. 2 of Law No. 10,650, of April 16, 2003, amends and adds provisions to Decrees No. 6,514/08 and 3,420/00, and contains other provisions. Regulates issues related to the Sustainable Forest Management Plan, suppression and clear-cutting of forests and successor formations, use of forest raw materials, license for transportation of native forest products and by-products, among others. Ordinance GAB/SEDAM No. 039/2010 - Establishes the procedures and criteria, within the scope of the Secretariat for Environmental Development - SEDAM, necessary for the technical analysis of requests related to services available in the DOF System, carried out at the Environmental Protection Coordination - COPAM, a regular procedure that guarantees the order of control over operations of products and by-products originating from forest management inside and outside the State, as well as preventing the commercialization of products and by-products of illegal origin, which will come into force with the following wording.

Applicability in the project: Since it includes sustainable forest management activities, the project must comply with the laws related to this practice (in addition to those already listed in the "environment" topic). The management carried out at Manoa has always been in accordance with the legislation and has FSC and PEFC certification.

1.16 Double Counting and Participation under Other GHG Programs

1.16.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.16.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

☐ Yes ☒ No

Is the project active under the other program?

☐ Yes ☒ No

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

1.17.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

☐ Yes ☒ No

1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

1.18 Sustainable Development Contributions

The Manoa REDD+ Project carries out activities that contribute to sustainable development and favor the achievement of 7 of the global goals established by the UN (United Nations). In 2023, the project began a process to obtain the SD VISta standard, developed by Verra, which aims to ensure quantifiable and effective actions to meet the SDGs, thus contributing to benefits for the planet, people and their prosperity.

According to the NDC (Nationally Determined Contribution) presented by Brazil in September 2015 to the United Nations Framework Convention on Climate Change, which has a global target of reducing Brazilian emissions in relation to 2005 levels of 37% by 2025, and a reduction of 43% by 2030 (BRAZIL, 2015), the Manoa REDD+ Project collaborates directly with this NDC by promoting the reduction of deforestation in the Project area and thus the reduction of greenhouse gases.

SDG 4 – Quality Education

- Training in Low-Impact Forest Management techniques
- Promoting socio-environmental education actions in the municipality of Cujubim
- Encouraging and enabling research conducted on the farm to improve and expand knowledge regarding local biodiversity and its dynamics

SDG 6 – Clean Water and Sanitation

- Preservation of Permanent Preservation Areas

SDG 8 – Decent Work and Economic Growth

- Generation of direct and indirect employment opportunities locally
- Ongoing training workshops for workers on REDD+ and Health and Safety
- Generation of decent jobs that meet all requirements regarding labor rights

SDG 12 – Sustainable Consumption and Production

- Implementation of certified low-impact forest management
- Encouraging and enabling research conducted on the farm to analyze the impacts of forest management practices in the long term

SDG 13 – Action Against Global Climate Change

- Monitoring deforestation using satellite images and generating annual reports (Biophilic and Manoa Monitoring)
- Asset Surveillance

- Campaigns to prevent forest fires
- Maintaining existing access to strategic points at risk of fire
- Implementing certified low-impact forest management

SDG 15 – Life on Land

- Monitoring biodiversity (fauna and flora) combined with encouraging and enabling scientific research by local institutions
- Preservation and monitoring of endangered species
- Preservation and monitoring of the “Saleiro” High Conservation Value Area (HCVA)
- Maintenance of an ecological corridor with Conservation Units in the state of Rondônia
- Limiting the volume of timber extracted annually, reducing the impacts of the activity
- Monitoring the impact of forest management (post-exploration report)

SDG 17 – Partnerships and Means of Implementation

- Institutional coordination with public bodies and private entities
- Execution of partnerships with institutions in Cujubim and local universities

1.19 Additional Information Relevant to the Project

1.19.1 Leakage Management

The leakage management activities carried out by the project at Fazenda Manoa, particularly at CEFLM, include environmental education aimed at raising awareness about the importance of forest conservation. These initiatives serve as a long-term strategy to address leakage by transferring knowledge to younger generations and also to adults. The goal is to foster an understanding of the importance of maintaining the forest, highlighting its essential contribution to preserving ecosystem services such as climate regulation, water quality, and biodiversity protection.

Moreover, leakage management is extended to neighboring communities through awareness-raising initiatives that emphasize the project's importance and encourage practices like fighting forest fires and promoting the sustainable use of land. These activities enhance community involvement in conservation efforts, strengthening the region's commitment to environmental protection.

This integrated approach ensures that leakage management practices are effective and aligned with the socio-environmental needs of the territory, promoting positive and lasting impacts in the region.

The location of the leakage management areas are described on item “Leakage Management Zones” of section 3.3.1.

1.19.2 Commercially Sensitive Information

The information below is considered commercially sensitive and will be made available only to validators/verifiers and will be treated confidentially and will not be made publicly available.

- Project budget;
- Financial projections;
- Financial statements of Manoa Sustentável, Exploração e Serviços Florestais Ltda;
- Financial statements of Biofílica Ambipar;
- Agreements and contracts signed between the parties involved

1.19.3 Further Information

Not applicable. There is no information other than that described in this document that could influence the project eligibility, net GHG reductions or removals, or the quantification of net GHG emission reductions or removals.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification	The first identification of stakeholders was carried out by Ecoporé – Ação Ecológica Guaporé, with a multidisciplinary team composed of biologists and sociologists, during the first socioeconomic diagnosis of the project. The diagnosis did not identify any communities living in the project area or dependent on resources from it. Furthermore, according to the report carried out by Ecoporé: <i>“No group that could be categorized as a traditional population was detected in either the secondary database or in field research in the municipality of Cujubim. These populations are defined by their specific cultural manifestations and differentiated relationship with environmental resources. Traditional populations include groups such as extractivists, indigenous people, rubber tappers, riverside dwellers, fishermen and quilombolas.”</i> There are also no disputes over the rights to the lands where the Manoa Farm is located. The following is a list of stakeholders identified by this diagnosis: • Manoa employees; • Residents of the municipality of Cujubim; • Environmental agencies • Institutions in the municipality of Cujubim; • Universities and researchers in the state of Rondônia.
Legal or customary tenure/access rights	There are no land conflicts in the Manoa area, since the farm is private property with all the supporting documentation within the premises of the law. All documents that attest to the legality of the area can be accessed by VVB. According to the social diagnostics carried out in 2015 and 2023, no communities were found in the surrounding area that use resources from the area or any type of dispute over titles or rights within the project area.

Stakeholder diversity and changes over time

None of the stakeholder groups are traditional and/or indigenous peoples, nor do they have disputes over resources in the project area or land tenure. In cultural terms, there are no significant differences between the stakeholders; the most relevant differences are related to socioeconomic aspects. Stakeholders living in Cujubim have lower rates of access to quality education, health care, and financial resources, among other aspects, as described in the socioeconomic diagnosis (Ecoporé, 2015 and Ecoporé, 2024), compared to other groups, such as representatives of environmental agencies, institutions, and universities. Below is a description of each stakeholder and their relationship with the project.

Manoa employees: They are interested in the project due to the employment opportunities, which generates a mutually beneficial influence for both parties. The employees make it possible to carry out several proposed activities, while benefiting from the jobs and training generated. The vast majority of these residents are residents of the municipality of Cujubim, and therefore are also part of the “Cujubim residents” group (below), which has a major local impact on job creation and training, in addition to ensuring the population’s permanence.

Cujubim residents: The residents of Cujubim play a crucial role in the project, and it is essential that they understand the importance of preserving the forest. The forest is responsible, among many other aspects, for the generation of direct and indirect jobs in the municipality. In addition, they are part of the target audience for the training activities and participate in and/or benefit from several of the project’s activities. This group is made up of residents of urban and rural areas (neighbors of the farm).

Environmental Agencies: The interest of environmental agencies in the project stems from the possibility of establishing a model to be followed by other private properties in Rondônia, including through the provision of training on good practices for the use of the forest. In addition, environmental agencies support the maintenance of forest management activities on the farm and actions to protect the forest.

Institutions in the municipality of Cujubim: Institutions in the municipality of Cujubim are interested in the project due to their additional contributions to environmental education and support for complementary demands. They are important because they can

	facilitate public policies aimed at conservation and contribute to the implementation of social and educational activities. Universities and researchers in the state of Rondônia: Universities and researchers in the state of Rondônia benefit from the rich biodiversity that the project helps to conserve to conduct research. In addition, they contribute to proposed courses and training and monitor the project's interventions, demonstrating their effective results. Their activities are included in the scope of the project. Over the course of the project's existence, there have been changes in some stakeholder groups. Initially, there was a group that included landowners from the surrounding area (mainly small producers), with proposals for specific activities. However, the composition of this group has undergone many changes over the years. Due to this, activities for small producers no longer made sense for the project. Therefore, producers who still live in the surrounding area began to incorporate the group “residents of Cujubim”. Thus, activities that include these actors are maintained, but the type of activity has changed. It was also decided to remove the sawmills as stakeholders, since it was observed that the relationship between them and the project was closely linked to the economic aspects of selling timber. Despite this, they also make up a large part of the group of “residents of Cujubim”, so it is understood that it makes more sense to look at the relationship with the sawmills from the perspective of residents and the direct benefits linked to this, rather than the indirect benefits related to timber. Furthermore, Manoa employees were added as interested parties, as it was understood that they not only directly benefit from the project but are also part of the composition of the activities carried out.
Expected changes in well-being	All ecosystem services provided by forests, such as air quality, temperature, water quality, biodiversity, among others, are considered benefits that will be provided to stakeholders. There are no stakeholders in this project that directly depend on the project's forest resources, for example, traditional populations that use the area for food extraction, etc. However, due to the intrinsic importance of the Amazon rainforest, it is understood that everyone benefits from its ecosystem services.

	Workers at the Manoa Farm: Through training, the project improves employees' professional skills, increases workplace safety, and promotes workers' health and well-being. Population of the municipality of Cujubim: Through its activities, the project increases employment opportunities in the region, mainly in the timber industry, and promotes improvements in the quality of life of the municipality's population. In addition, maintaining the forest in the project area contributes to mitigating the climate crisis and maintaining HCVAs. Environmental institutions: The project promotes the improvement of professional skills of employees of local environmental agencies (such as ICMBio and SEDAM) and contributes to the maintenance of the forest in the project area, which functions as an ecological corridor for two conservation units. Institutions in the municipality of Cujubim: Institutions in the municipality of Cujubim benefit from donations (e.g. donations of medical equipment to health units) and infrastructure improvements (e.g. construction of APAE). As a result, the population of Cujubim also benefits from the improvement and/or availability of services that would not be possible without the existence of the project. Universities and researchers in the state of Rondônia: The project provides logistical and financial support for research activities in the project area, facilitating the work of universities and researchers in the state.
Location of stakeholders	The stakeholders are mainly located in the municipality of Cujubim, represented by: Manoa employees, Cujubim residents and Cujubim institutions. There are also stakeholders located in Porto Velho, such as the university (UNIR) and state environmental agencies. The main impact outside the project area is in the municipality of Cujubim, as this is the municipality where most stakeholders come from and where educational activities, infrastructure improvements, among others, are carried out. The impacts of the project in the municipality of Cujubim are positive.

Location of resources	All territories and resources owned by the stakeholders are located outside the project area. And there is no customary use within the project area.
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2.1.2 Stakeholder Consultation and Ongoing Communication

Date of stakeholder consultation	First consultation for socioeconomic diagnosis: October-2014 Second consultation for socioeconomic diagnosis: September-2023
Stakeholder engagement process	In the Manoa REDD+ Project, it is important to highlight that stakeholder engagement/involvement is aimed at providing additional benefits to them, since no negative impacts have been identified on these stakeholders, as the project is located in a private area where there are no disputes over the Manoa territory and where there is no demand from local populations for the area's forest resources. Therefore, all activities aim to maintain the forest and bring social benefits. Before the project began, a face-to-face consultation was held with various stakeholders in the region to identify local stakeholders (Ecoporé, 2015). Subsequently, in 2023, a new assessment was carried out (Ecoporé, 2024), through which new communications were carried out with the stakeholders, with the aim of obtaining more up-to-date contexts of the region. In this process, face-to-face consultations were again carried out with various parties. In addition, since the first assessment, the project has been carrying out continuous communications with the parties involved, always seeking to improve this procedure. This culminated in the procedure described in the “Continuous Communication” section below. The diagnoses were based on literature data and information obtained from municipal administrations and government departments for all municipalities in the reference region, except for Cujubim, where primary data were also obtained. Primary data were collected through questionnaires with open and closed questions. The number of questionnaires applied refers to the sampling effort obtained during the time allocated for field research, during which the following activities were carried out: Interviews with residents of the urban perimeter of Cujubim and the rural area and with workers

	on the Manoa farm; in addition, during this period, the researchers' perceptions of the situation in the municipality were obtained and it was also possible to contact the municipal administration departments, with whom open interviews were conducted and audio recorded with the interviewees' authorization. According to the information contained in the Ecoporé diagnosis, secondary data were obtained from public information on official websites, as well as through requests through official letters from state public agencies in various socioeconomic areas. The choice to conduct a field survey of information in the municipality of Cujubim is justified by the fact that this municipality suffers direct social and economic impacts from Fazenda Manoa, since access, job creation and disposal of raw materials (wood) occur in this municipality. No traditional peoples or communities were located, according to the definition given by decree nº 6.040, of February 7, 2007, which instituted the National Policy for the Sustainable Development of Traditional Peoples and Communities, except for remaining rubber tappers located around the FLONA Jamari, near Itapuã do Oeste, as well as large riverside communities along the Madeira and Machado Rivers. Therefore, it is important to highlight that there are two main communication processes: those that occur at longer intervals to update the diagnosis (baseline) and identify possible new interested parties; and those that are done continuously throughout the project, allowing these parties to always have the opportunity to bring new elements to the project, ask questions, make complaints, report unforeseen impacts, in addition to enabling the project to always meet the real and current demands of the people involved. All communication was done in a way that involved the interested parties in a culturally appropriate manner.
Consultation outcome	In both the first communication (2015 socioeconomic assessment) and subsequent ones, none of the parties objected to the existence of the project. In all communications throughout the project's existence and through all channels provided, the project's existence and benefits have been mainly praised. Complaints are assessed and considered in order to improve the project, where relevant. Likewise, suggestions are analyzed and taken into consideration, assessing its viability and the real social and environmental benefits.

	All the risks, costs and benefits of the project were discussed with the stakeholders during the communications, particularly in the interviews conducted in 2015 and 2023. These communications emphasized the environmental and social benefits related to the protection of the area. Furthermore, the project is based on the laws and regulations relevant to the country where it is implemented, including workers' rights standards, as described in section 1.15. This includes compliance with labor and safety laws, ensuring that all workers involved in the project have their rights guaranteed and are protected against occupational hazards. Prior to any audit, communications are conducted with stakeholders to make them aware of the possibility of being interviewed and to increase their knowledge of the function of the process. These communications can take place through face-to-face presentations or through online communications (email, messages, etc.). This process also includes clarifying the VCS validation and verification process, reinforcing the importance of transparency and ongoing stakeholder participation.
Ongoing communication	The entire process of ongoing communication with stakeholders is described in the appendix CONTINUOUS COMMUNICATION (section 2.1.2) of this document. Deviations in the project description from the initial PD: Communication, complaints and dispute resolution procedures. Initially, the project's initial PDD described that conflict identification and related preventive measures were available in Manoa's procedures manual. However, during the last monitoring, the proponents assessed that the procedures described in this manual were not aligned with what was being done by the project in terms of conflict resolution and communication with stakeholders. As a result, the project's processes for receiving, listening to, responding to and attempting to resolve complaints within a reasonable timeframe were redesigned by the proponents, so that their current implementation is culturally aligned with the farm's activities. Thus, the communication procedure describes the day-to-day actions that have been improved by the REDD+ project in terms of recording and following up on complaints. The updated communication procedure for the Manoa Project that was applied is the one mentioned above

	and described in the appendix CONTINUOUS COMMUNICATION (section 2.1.2). The project has not undergone any changes at the request of stakeholders. This is probably because to date, no negative impacts of the project have been identified on any of the identified stakeholders.
Stakeholder input	The project has not undergone any changes due to stakeholder demand. This is probably because, to date, no negative impacts of the project have been identified on any of the identified stakeholders.

Date of stakeholder consultation	Feedback Process April 8-11, 2024
Stakeholder engagement process	The feedback process consisted of the presentation of five main topics: a brief explanation of what REDD+ and the carbon market are and their importance; a description of the Manoa REDD+ Project and its activities, including the roles of Manoa and Biofilica; the results and "big numbers" achieved by the project in its 10 years of existence; a notice about the validation and verification audits scheduled for 2024, in addition to the presentation of the communication channels currently available. After the presentation of this information, an attendance list and a questionnaire about impressions of the project were handed out (more details in the "consultation outcome" item below). To increase audience engagement and encourage participation, some stakeholders participated in dynamics before the presentation of the content. These activities consisted of making the audience reflect on the main words associated with REDD+. The result of the dynamics carried out with the employees can be verified by the VVB. Before the implementation of the feedback, all stakeholders were informed about it, in an appropriate manner, according to the needs of each group. For example, the institutions in Cujubim were notified in advance by representatives of Manoa, who are closer to this group. The Manoa employees, who had already gathered for an annual training session before the harvest (a key factor in choosing the date), were informed on that occasion that they would receive a

	visit from Biofilica to provide feedback. The residents of Cujubim, who live near the farm and are mainly rural producers, were notified via WhatsApp, which is currently the most effective tool for most of this group. The other institutions and environmental agencies received official letters. During the feedback process, all approaches were adapted so that each audience could be communicated with in the most appropriate way. PowerPoint presentations were made for the employees and institutions. For the neighbors and the selective collection association, an oral approach was used, with illustrative folders and conversations. The PowerPoint presentation was slightly adapted according to the target audience, as were the expressions and words used. The need to adapt the language proved crucial, as during the process it was discovered that some of the recipients, especially some employees and neighbors, were illiterate and/or had little education. Therefore, both the presentation of the content (avoiding only written information) and the way in which the questionnaires were answered had to be customized to the context. Some groups answered their own questionnaires, while for others the questions were asked orally and written by the Biofilica team.
Consultation outcome	The main result of the feedback process was the responses obtained through the questionnaires applied at the end of the communication process. The questionnaire included 5 closed questions and 3 open questions. First, participants were asked whether the impacts and benefits that the activities of the Manoa REDD+ Project could provide were presented. All responses were unanimous, with all interviewees answering "yes". This result shows that information about the impacts and benefits of the project was clearly communicated to everyone involved. Next, we asked participants to evaluate the communication channels presented. The response options ranged from "good" to "bad". All respondents classified the communication channels as "good". This positive feedback suggests that the means of communication used by the project are effective and well received by the public. We also checked the level of awareness of participants about the occurrence of an audit to be received in 2024, and the possibility of an auditor needing to speak with them. The majority answered "yes", indicating that they were aware of this information. However, three employees answered "no". To ensure that everyone was properly informed, this

question was reinforced later, ensuring that all involved were fully aware.

The questionnaire also included a question about the positive and negative aspects of the project. At this point, it became clear that some stakeholders had difficulty answering the questionnaire, indicating that this data should be collected in a different way in the future. Some responses included negative points that were completely opposite to the positive points, which suggests difficulty in interpreting the question.

Finally, participants were asked whether they were opposed to the existence of the Manoa project. All responded “no”. Those who answered “yes” did so incorrectly, confusing the meaning of the word “oppose”, as indicated by the positive responses to the other questions related to the project. For this reason, the word will be replaced in future questionnaires to avoid misunderstandings.

These results demonstrate a clear and positive understanding on the part of participants regarding the essential information on the Manoa REDD+ Project, as well as the effectiveness of the communication channels used.

It is important to clarify that none of the participants were required to answer the questionnaire. Therefore, some people chose to answer in groups (one questionnaire for more than one participant), while others chose to answer only a few questions. Therefore, the numbers presented in each question do not reflect the total number of people consulted.

Table below shows the main responses regarding the other open questions and the respective actions established.

Positive Impacts

Response Category	Number of Responses
Preservation and Conservation of the Environment	21
Benefits for Society and the Municipality	12
Sustainability and GHG Reduction	10
Awareness and Importance of Preservation	5

Negative Impacts

Response Category	Number of Responses	Actions Taken
Environmental degradation	3	Based on the analysis of these responses, it is understood that they referred to the forest management process, which, compared to no activity, can cause greater degradation. However, as already described in other items of this document (section 1.12 and 1.4), forest management is seen as a potentializer of conservation by giving economic value to the forest, providing the physical presence of people in the area, promoting forest protection, sustainable uses, etc. Furthermore, there are already several procedures in place to prevent management from causing environmental damage, as described in section 1.4. Therefore, it is understood that this statement does not require additional actions to be met.

	Dust from the road	1	This type of demand has already appeared in other consultation processes, and Manoa has taken measures to prevent this impact, such as wetting the road. Furthermore, a study presented in the second diagnosis revealed that most of the cars that use the dirt road do not belong to Manoa, making it unlikely that the company is responsible for the dust that generates these complaints. In any case, Manoa maintains constant communication with the neighborhood, and many understand that the company has no responsibility for this issue, so much so that among several neighbors, only one raised this point.
	Little publicity for the project	2	This type of demand was duly considered and recognized as extremely important and relevant. Thus, the project seeks to improve its actions to better publicize its activities among interested parties, with plans to

		implement increasingly efficient measures in the future. The feedback was an important step in this direction, and other actions will be implemented.
Action have private interest	1	This comment was considered specific and, after analysis, it was understood that it does not qualify as an improvement for the project. The actions/activities, although carried out by private companies (Manoa and Bioflica), aim at the interest of the community as a whole. Therefore, no additional actions to be carried out in relation to this were identified.

Sugestões/Críticas/Elogios/Dúvidas

Response Category	Number of Responses	Actions Taken
Creation of a park/zoo (suggestion)	1	The creation of a zoological park is not in line with the project's premises. However, it is understood that this suggestion is in line with the environmental education activities carried out by the project, which include the demonstration of local fauna through images and taxidermied animals. Thus, the

	actions already carried out are in line with this suggestion.	
	Projects with sport/exercise (suggestion)	1 It is understood that this suggestion is not aligned with the current premises of the project.
	Tourism, receiving visitors to the farm (suggestion)	2 It is understood that this suggestion is not aligned with the current premises of the project. Although there are already several actions to welcome schools and institutions in the region
	Expanding the dissemination of the project, including lectures and workshops (suggestion)	7 As mentioned previously, this suggestion was duly considered and recognized as being of extreme importance and relevance. Thus, the project seeks to improve its actions to better publicize its activities among interested parties, with plans to implement increasingly efficient measures in the future. The feedback was an important step in this direction, and other actions will be implemented.
	Criticism	0 -
	Compliments	18 -
	Questions	1 The only doubt raised was about the period of completion of the construction of the nursery, which was promptly clarified.
Ongoing communication	As described in the table above, the entire process of ongoing communication with stakeholders is described in Appendix: CONTINUOUS COMMUNICATION (section 2.1.2) of this document.	
Stakeholder input	The table above presents a compilation of the responses to the questionnaires. As described, some suggestions were identified as	

	not necessary for the objectives of the questionnaire, while others were considered and will serve as a basis for improvements. None of the demands will result in a significant change to the current design of the project.
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2.1.3 Free Prior and Informed Consent

There are no traditional peoples and communities, as defined by Decree No. 6.040 of February 7, 2007, which instituted the National Policy for the Sustainable Development of Traditional Peoples and Communities, in the project area. Nearby there are only rubber tapper remnants located around the Jamari FLONA, in Itapuã do Oeste, as well as large river communities along the Madeira and Machado rivers. These communities, although near the project area, have no link with it and don't rely on the project area in any way or form. Therefore, there are no measures or compensations necessary (Ecoporé, 2015, Ecoporé, 2024).

The project area belongs to one of the proponents, Manoa Sustentável, Exploração e Serviços Florestais Ltda, and all the corresponding documentation will be shared with the VVB. The project has not affected and will not affect the property rights of any of those involved or interested, so this section does not apply.

2.1.4 Grievance Redress Procedure

Development process	Manoa has a communication procedure used in its day-to-day operations to guide how relationships should be established with stakeholders present in the area surrounding the farm and employees. The Project uses this procedure and intends to improve it throughout its existence. To date, there have been no conflicts or disputes related to the project's activities. However, consultation and communication with these stakeholders allows for discussion about the progress of the activities carried out, whether in the form of complaints or suggestions. Even though there have been no conflicts related to the project's activities so far, if any arise, traditional conflict resolution methods used by local stakeholders will be respected and, where applicable, integrated into the process. This approach includes informal conversations and in-person meetings to directly address grievances, honoring cultural and local preferences for handling issues or disagreements. The Manoa REDD+ Project ensures that communities may choose these methods, offering informal and locally adapted alternatives before resorting to formal mediation and arbitration stages, if necessary.
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Contact with stakeholders occurs through three fronts: application of a questionnaire to survey positive and negative impacts, provision of an ombudsman channel, and development of a suggestion box (described in Appendix). These channels are monitored by the Financial Manager and, as of 2023, began to be recorded in a spreadsheet for monitoring.

Through these mechanisms, stakeholders were able to influence the implementation of project activities, adopting, when appropriate, suggestions for improvement or innovation, and taking corrective or compensatory measures in cases of complaints and damages.

Regarding courses, training, or actions carried out with schools and associations in the region, criticisms and suggestions are collected through emails and/or suggestions made in person after the action has been carried out.

Although the official communication channel is the ombudsman, verbal complaints or complaints made by other means are also considered and duly addressed according to their significance, as described in [Appendix: CONTINUOUS COMMUNICATION \(section 2.1.2\)](#). The procedure also describes how Manoa employees return the result of the complaint and/or request to the interested stakeholder according to the particularities of each case, always seeking the most appropriate form of communication for the interested parties (whether by email, telephone, meeting in person or others).

Furthermore, in the first half of 2024, a feedback process was carried out (further details in section 2.1.2) to ensure that all project stakeholders were fully aware of the project and felt comfortable expressing opinions, questions, and complaints. One of the main objectives of this process was to emphasize the existing complaint channels and receive suggestions from others, if necessary. During this period, participants were also informed about the audits scheduled for 2024. The first institutions consulted were those of the Municipality of Cujubim, which included state and municipal schools, departments, and associations. In addition, feedback was provided to Manoa employees and neighbors in the area where management takes place. For this dialogue, presentations were prepared with content about REDD+ and the Manoa REDD+ Project, including planned activities, details about audits, and information

	about communication channels. In some cases, only conversations were held, with the help of banners containing the most relevant information. In addition, all participants received a folder with a summary of the information. The other parts of the project were consulted online through explanatory e-mails.
Grievance redress procedure	Manoa has a communication procedure used in its day-to-day operations to guide how relationships should be established with stakeholders present in the area surrounding the farm and employees. The Project uses this procedure and, throughout its existence, intends to improve it. To date, there have been no conflicts or disputes related to the project's activities. However, consultation and communication with these stakeholders allows for discussion about the progress of the activities carried out, whether in the form of complaints or suggestions. Contact with stakeholders occurs through three fronts: application of a questionnaire to survey positive and negative impacts, provision of an ombudsman channel, and development of a suggestion box (Appendix: CONTINUOUS COMMUNICATION (section 2.1.2)). These channels are monitored by the Financial Manager and, as of 2023, they began to be recorded in a spreadsheet for monitoring. Through these mechanisms, it was possible for stakeholders to influence the implementation of project activities, adopting, when appropriate, some suggestion for improvement or innovation, and taking corrective or compensatory measures in cases of complaints and damages. Regarding courses, training or actions carried out with schools and associations in the region, criticisms and suggestions are collected via emails and/or suggestions made in person after the action has been carried out. In addition, during the first half of 2024, in-person visits and communications were carried out to improve the complaint channels, as described in the item "Development of the complaints process" above. Although the official communication channel is the ombudsman's office, verbal complaints or those made by other means are also considered and duly addressed according to their significance, as described in Appendix: CONTINUOUS COMMUNICATION (section 2.1.2). The procedure also describes how Manoa employees return the result of the complaint and/or request to the interested

stakeholder according to the particularities of each case, always seeking the most appropriate form of communication for the interested parties (whether by email, telephone, meeting in person or others).

2.1.5 Public Comments

Between December 20, 2024, and January 19, 2025, the public consultation period for the REDD+ Manoa Project was open. During this period, only one comment was submitted, on January 2, 2025, suggesting a collaboration between the Ministry of Agriculture and Livestock (MAPA), the Ministry of Environment and Climate Change (MMA), and the REDD+ Manoa Project. The proposal recommended integrating the project into the in situ conservation program established by Decree 12.097/2024, leveraging the project's low-impact forest management infrastructure to support agroforestry systems, sustainable forest management, and environmental education, as well as promoting the mapping and documentation of the genetic diversity of native species with agricultural, forestry, or non-timber potential.

The REDD+ Manoa Project values and actively seeks strategic partnerships that contribute to environmental conservation and sustainable development. It currently collaborates with institutions such as SEDAM and ICMBio and remains open to dialogue with other environmental entities, including the MMA.

The suggestion presented aligns with the mission of the REDD+ Manoa Project, particularly in promoting sustainable management and environmental education. However, at this time, there is limited publicly available information regarding the practical implementation of the program, its specific objectives, and operational methodologies (as indicated on the official website: <https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/recursos-geneticos/PNRGAA/programas-nacionais-de-conservacao>). This lack of clarity makes it difficult to assess how the REDD+ Manoa Project could concretely contribute to this initiative.

Additionally, since the comment was submitted anonymously, there is no direct channel to further discuss the matter and explore potential collaboration opportunities. However, the communication channels of the REDD+ Manoa Project remain available (as detailed in the Appendix) so that those responsible for the National in situ Conservation Program for Genetic Resources or other interested parties can establish contact. Should there be interest from the program's management, the REDD+ Manoa Project is open to evaluating potential synergies and cooperation opportunities that contribute both to the program's objectives and to strengthening the actions already developed within the project.

2.2 Risks to Stakeholders and the Environment

2.2.1 Management Experience

Ambipar Environmental Investments is a Brazilian company that promotes the management of forest areas in the Amazon and Atlantic Forest biomes. The company has a specialized team and is a reference

in the development of forest conservation projects, ensuring the quality and effectiveness of the REDD+ activities carried out, especially those associated with project management and carbon measurements. Below is a brief summary of the team's technical expertise:

Plínio Ribeiro (CEO)

Location: São Paulo, São Paulo – Brazil.

Plínio Ribeiro holds a degree in Business Administration from the INSPER Institute of Education and Research and a master's degree in Public Administration and the Environment from Columbia University and the Earth Institute (USA). He has participated in several conservation projects in the lower Rio Negro, through the Instituto de Pesquisas Ecológicas – IPÊ, since 2005, and was one of the producers of the documentary “Retorno à Amazônia”, by Jean Michel Cousteau. He has worked at Biofílica since 2008, where he has led Project Management, Operations and Business. He is currently the company's Executive Director and shareholder.

Paula Conde (Administrative Manager)

Location: São Paulo, São Paulo – Brazil.

Paula Conde holds a degree in Business Administration from São Luís - PUC and a postgraduate degree in Accounting and Financial Management from FAAP. She has extensive experience, much of it in one of the largest media and education groups in Latin America – Editora Abril, where she worked in Financial Control and Reporting, Treasury, Accounting and Financial Reconciliation, Accounts Payable and Receivable, and Royalties. At Biofílica, she is responsible for administrative and financial activities, as well as logistical support for the team and projects.

Soraya Dias Pires (Operations Director)

Location: Piracicaba, São Paulo – Brazil

Soraya Dias has a degree in agronomy from the University of São Paulo (USP), two MBAs from USP, one in agribusiness and the other in strategic management, and an MBA from Fundação Getúlio Vargas (FGV) in business administration. Has 15 years of experience in management and development of agro-industrial businesses, with a career developed in large multinationals in the sugar-energy sector: Adecoagro, BP Biocombustíveis and BP Bunge Bioenergia. Experience in agro-industries in activities associated with agro-industrial planning and control, agricultural operations and negotiations. At Biofílica, she works as Operations Director.

Caio Gallego (Intelligence Manager)

Location: São Paulo, São Paulo – Brazil.

Caio Gallego is a Forestry Engineer graduated from ESALQ-USP. Specialist in geoprocessing and remote sensing focused on the area of environmental conservation, mapping and analysis of changes in land use. Has knowledge focused on Sustainable Forest Management, environmental modeling and use of alternative GIS for forestry and agribusiness. Has advanced knowledge in the use of GIS software and

analysis of changes in land use and coverage such as ArcGIS, QuantumGIS and DinâmicaEGO. Currently, at Biofílica, he works as an intelligence manager.

Luana Cordeiro (Project Manager)

Location: São Paulo, São Paulo - Brazil

A forestry engineer graduated from the University of São Paulo, with a postgraduate degree in Project Management (PMI) from SENAC, and an environmental technician graduated from the São Paulo State Technical School. She has worked for over 5 years at Biofílica Ambipar, where she gained experience in the development, monitoring and management of projects, preparation of audited documentation, budget management, co-management with partners ranging from the private sector to the third sector, conducting the hiring and management of suppliers and participating in processes of consolidation of methodological intelligence and carbon standards.

Nayra Nicolau (Carbon Project Coordinator)

Location: Rio de Janeiro, Rio de Janeiro - Brazil

A forestry engineer graduated from the Federal Rural University of Rio de Janeiro (UFRRJ), with a postgraduate degree in Forestry Management from the Federal University of Paraná (UFPR). She is currently a student in the Professional Master's Degree course in Environmental Engineering at the Polytechnic School of the Federal University of Rio de Janeiro (Poli / UFRJ). She has extensive experience in designing, managing and executing projects and environmental studies, technical coordination of environmental programs, as well as in institutional management with federal and state environmental agencies in the process of prior licensing and installation of projects related to the infrastructure sector. She has been with Biofílica since November 2022, working on the development and detailed planning of carbon projects, from initial conception to full implementation, including the auditing stages for project certification and credit issuance, as well as ongoing monitoring to ensure compliance with established targets.

Maria Elisa Russo Mafra Machado (Carbon Project Analyst)

Location: Campinas, São Paulo - Brazil

Maria Elisa Mafra has a degree in Biological Sciences from USP/ESALQ, completed in 2016, and a master's degree in Forest Resources, with an emphasis on Forest Ecosystem Conservation, from the same institution, completed in 2020. During her master's degree, she developed research in the area of Sustainable Forest Management, focusing on the socioeconomic analysis of non-timber forest production. Between 2017 and 2018, she was part of the technical team to develop a methodology for creating a microclimate favorable to the establishment of biodiversity around hydroelectric reservoirs – R&D AES-ANEEL. From 2020 to 2023, she worked as an FSC and PEFC auditor, also acting as a lead auditor for the FSC and PEFC chain of custody. She currently works as a project analyst at Biofílica Ambipar, supporting the development, monitoring and management of projects.

Priscila Coutinho R. Ferreira (Carbon Project Analyst)

Location: São Paulo, São Paulo - Brazil

Priscila Coutinho has been a Biologist since 2010, with a Master's degree in Genetics, Biodiversity and Conservation (UESB, 2014) and a Master's degree in Biodiversity Conservation and Sustainable Development (IPÊ, 2022). She has worked mainly in primatology and fauna conservation, in research projects and environmental licensing. Her experience with carbon stock monitoring and carbon market began around 2019 and expanded during her master's degree in 2020-2022. At Biofílica, she works as a Project Analyst supporting project development, monitoring and management processes.

Franciane Almeida (Geoprocessing Analyst)**Location: São Paulo, São Paulo – Brazil**

Franciane Almeida is a Forestry Engineer, graduated from the Federal University of Lavras (UFLA). She has experience in geoprocessing and remote sensing applied to the areas of forest planning, silviculture and harvesting, recovery of degraded areas and land regularization. At Ambipar, she works as a Geoprocessing Analyst, supporting the preparation and organization of the geographic bases of Carbon Projects.

Project proponent: Manoa Sustentável, Exploração e Serviços Florestais Ltda

Manoa is a pioneering company in low-impact forest management since 1997, recognized by the FAO (Food and Agriculture Organization of the United Nations) as an “Exemplary Case of Forest Management in Latin America and the Caribbean” in 2010. In addition, the low-impact forest management carried out at Manoa has two certifications (FSC and PEFC), always guaranteeing management excellence. Below is a brief summary of the team’s technical expertise:

Murilo Granemann (CEO)**Location: Curitiba, Paraná – Brazil**

Murilo holds a degree in Economics and International Trade from FAE. Murilo also has extensive experience in construction, forestry business and maritime freight logistics in North America. He has several courses in sales and corporate governance. In the REDD+ Project, he is responsible for the marketing and sale of Carbon Credits and for supervising and directing the REDD+ project’s expenses.

Hermínio Fernandes Silva Neto (Forestry Manager)**Location: Cujubim, Rondônia – Brazil**

Graduated as an Agricultural Technician from the State Forestry Institute of Rondônia. He worked at the State Secretariat for Environmental Development of Rondônia as an Agricultural and Livestock Technician. He is currently the Forestry Manager at Fazenda Manoa, where he is responsible for planning and making decisions with the Board of Directors on activities to be carried out on the farm, both in forest management and in REDD+ projects, management of all field operations, monitoring activities related to forest management and REDD+, coordination and execution of the farm's monitoring plan, monitoring the recovery of infrastructure during and after exploration, monitoring visitors to the management area,

coordination of activities carried out on the farm by employees responsible for monitoring the area's perimeter, support to research teams, among others.

Hemerson de Sousa Pereira (Forestry Engineer)

Location: Cujubim, Rondônia – Brazil

He holds a degree in Forestry Engineering from the Faculty of Rondônia (FARO) and a postgraduate degree in Occupational Safety Engineering from the Faculty of Santo André. He has worked in the forestry sector for 4 years, with experience in the Coordination of Conservation Units of the State Secretariat for Environmental Development of Rondônia (SEDAM) and as an Environmental Agent at the Chico Mendes Institute for Biodiversity Conservation (ICMBio), where he worked mainly in process analysis, consent analysis, inspection and monitoring of biodiversity and map analysis and vectorization. In Manoa, he works as a Forestry Executive Engineer and in the REDD+ Project, he works in remote monitoring of deforested areas and forest fires, receiving visitors to the Forestry Education Center (CEFLON), developing educational activities with schools and supervising university researchers in areas within the Farm.

Hélcio Edson Pereira (Financial Manager)

Location: Cujubim, Rondônia – Brazil

Graduated in Economics from PUC-Paraná, he has worked at Grupo Triângulo since 1995 and at Manoa since 2001. In the REDD+ Project, he is responsible for the human resources area, ombudsman channel, monitoring of social actions, hiring and firing of employees and supervising the hiring of companies responsible for training employees.

2.2.2 Risk Assessment

	Risks identified	Mitigation or preventative measure(s) taken
Natural and human-induced risks to stakeholders' wellbeing	Risk of occupational accidents in Forest Management	The only project activity that may pose some type of risk to the well-being of the interested party (Manoa employees) is forest management. Regarding this point, it is worth noting that "Risk" is being treated here differently from "Impact". As mentioned in section 2.1.2, no negative impacts on the interested parties as a result of the project are identified. However, when it comes to forest management, the risk of the activity is independent of the project, therefore it is

		understood that it falls into the risk category, and not as a negative impact.
Risks to stakeholder participation	Risk of disengagement. There is a risk that stakeholders, including research bodies, governments, institutions and other stakeholders, will lose interest in participating in the project.	Integrate stakeholders into the Project's decision-making processes. Disseminate reports and results achieved in a transparent and accessible manner to different audiences. Maintain communication channels and spaces for dialogue. The integration of stakeholders into the Project's decision-making processes occurs through the dissemination of reports and results achieved in a transparent and accessible manner to different audiences. In addition, communication channels and spaces for dialogue are kept active and accessible, with regular information sessions.
Working conditions	Risk of occupational accidents in Forest Management	Occupational health and safety is an aspect considered of great importance by Manoa, and is part of the project's daily activities. For this reason, the company complies with the Occupational Health Medical Control Program (PCMSO), conducting medical evaluations of each employee upon admission, annually, upon the employee's return to work, in cases of absences of more than 30 days, and upon dismissal. It also complies with the Environmental Risk Prevention Program (PPRA), which monitors and proposes measures to reduce the risks arising from each work activity. In addition to the aforementioned documents, which are prepared by occupational physicians and occupational safety technicians in accordance with the general procedures manual, the risks of the activity and the actions necessary to avoid them are also addressed. The document describes the mandatory safety equipment for each function (PPE),

		procedures for the proper and safe execution of each activity, instructions on the proper disposal of waste, hygiene measures, and others. Forest management, despite the use of PPE and various techniques that provide greater safety to workers, is an activity that offers health and safety risks, especially in the felling area, loading yard, concentration yard and supply area. Therefore, annual training is of great importance for employees to absorb the two necessary precautions. In addition, verifications of the implementation of these practices in the field are carried out based on internal audits carried out every six months, which ensure compliance with the actions within the established deadlines. It is worth noting that all these training and internal audit activities cover both in-house and outsourced employees.
Safety of women and girls	Risk of occupational accidents in Forest Management. No other risk to the safety of women or girls is identified.	Although there are vacancies available for anyone of any gender, there is a cultural factor through which women do not apply for vacancies to work in forest management, but if they do, they will be provided with the same precautions against the risk of accidents mentioned above. Except for this aspect, the project activities do not pose any risk to the safety of women and girls. This fact is reinforced based on the Code of Conduct and Compliance⁶ and the Diversity and Inclusion Policy⁷ of the Ambipar Group and Manoa's internal policy.
Safety of minority and marginalized	No risk identified	The project activities do not pose any risk to the safety of minority and marginalized groups, including children.

⁶ Ambipar Group. Code of Conduct and Compliance, 2023. Available at: <<https://ambipar.com/site2020/wp-content/uploads/2023/09/Codigo-de-Conduto-e-Compliance-2023-Ingles.pdf>>.

⁷ Ambipar Group. Policy On Diversity and Inclusion, 2023. Available at: <<https://ambipar.com/site2020/wp-content/uploads/2023/09/Politica-de-Diversidade-e-Inclusao-portugues.pdf>>. Accessed on October, 26, 2023.

groups, including children		This fact is reinforced based on the Code of Conduct and Compliance ⁸ , the Diversity and Inclusion Policy ⁹ of the Ambipar Group and Manoa's internal policy.
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	No risk identified	The project activities do not include actions that would lead to the emission of pollutants. The forest management carried out in the area has certifications (FSC and PEFC) which, among several aspects, includes the mitigation of the emission of possible environmental risks.

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

	Risks identified ¹⁰	Mitigation or preventative measure(s) taken
Discrimination	No risk identified	The project activities do not pose any risk of discrimination, sexual harassment, wage and gender inequality, forced labor, child labor, or human trafficking.
Sexual harassment	No risk identified	
Equal pay for equal work	No risk identified	
Gender equity in labor and work	No risk identified	This fact is reinforced based on the Ambipar Group's Code of Conduct and Compliance (2023) and Diversity and Inclusion Policy (2023), which has as its basic premise respect for people, regardless of their hierarchical position, origin, color, ethnicity, culture, age, social level, physical ability, religion, and sexual orientation, and does not accept any practice of discrimination. Its commitments include encouraging an attitude of respect for people, their traditions, and values, as well as guiding relationships based on respect for laws
Forced labor	No risk identified	
Child labor	No risk identified	
Human trafficking	No risk identified	

⁸ Ambipar Group. Code of Conduct and Compliance, 2023. Available at: <<https://ambipar.com/site2020/wp-content/uploads/2023/09/Codigo-de-Conduita-e-Compliance-2023-Ingles.pdf>>.

⁹ Ambipar Group. Policy On Diversity and Inclusion, 2023. Available at: <<https://ambipar.com/site2020/wp-content/uploads/2023/09/Politica-de-Diversidade-e-Inclusao-portugues.pdf>>. Accessed on October, 26, 2023.

¹⁰ The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

		and conventions that address fundamental human rights. In addition, the Ambipar Group has a specific policy for relationships with suppliers¹¹ and, in its code of conduct, describes situations that may result in the termination of the employment contract or the breaking of business relations, ensuring that partner companies in the project will be subject to the same codes and principles. Situations that may result in termination include: (1) committing acts of rejection motivated by prejudice, violence or any discriminatory attitude towards people based on their sex, ethnicity, race, religion, social class, age, sexual orientation, physical disability or reduced mobility; (2) engaging in threats, blackmail, false testimony, moral harassment, sexual harassment or any other act contrary to the principles and commitments of this code; (3) exposing colleagues and/or subordinates to humiliating and embarrassing situations during the workday and in the exercise of their function, contaminating the organizational climate and destabilizing their relationship with the work environment and the Ambipar Group. The Ambipar Group's Diversity and Inclusion Policy is committed to actively working towards compliance with SDGs (Sustainable Development Goals) 5 – Gender Equality and 10 – Reduction of Inequalities, and best practices for human development. To monitor compliance with its policies, the group has an ombudsman channel to receive complaints about: interpersonal relationships; physical aggression; moral harassment; discrimination; sexual harassment; conflict of interest; violation of laws or non-compliance with
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¹¹ Política de Relacionamento com fornecedores, Available at <https://ambipar.com/site2020/wp-content/uploads/2023/09/Politica-de-Relacionamento-com-Fornecedores.pdf>. Acessado em 26 de outubro, 2023.

		policies/procedures; community relations, among other matters. All the Ambipar Group's policies are available in full on the page https://ambipar.com/politicas-estatuto/. Manoa has an internal policy that prohibits any form of discrimination based on gender, race, religion, sexual orientation or any other characteristic, and defines that any form of discrimination, harassment or unfair treatment is strictly prohibited. The document also states that "All decisions regarding employment, promotion, salary, training and other opportunities will be based exclusively on the merit and skills of employees". The policy is displayed on the company's walls in common areas, accessible to all employees and visitors. In addition, during training and activities carried out with employees, whenever appropriate, information about this document is passed on to employees. In addition, any Manoa employee who feels discriminated against or is a victim of harassment is encouraged to report it or use anonymous channels, such as the suggestion box created by Manoa. Many employees confirm that they feel safe raising these issues directly with those responsible so that they can take action if necessary.
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2.3.2 Human Rights

The area of Fazenda Manoa does not have traditional communities residing, as it is a private property, whose owner signed a long-term agreement with Biofílica Ambipar for the conservation of vegetation areas within the property. Thus, it is understood that the applicable international legislation on human rights and the United Nations Declaration on the Rights of Indigenous Peoples and ILO Convention No. 169 on Indigenous and Tribal Peoples do not apply in the context of the Project.

However, regardless of this fact, the Manoa REDD+ Project is guided by the Ambipar Group's Code of Conduct and is committed to the stakeholders located in its surroundings, acting on the following premises:

- To stimulate an attitude of respect for people, their traditions and values;

- Adopt and maintain a transparent process for defining social actions;
- Respect the interests and needs of the communities in which it operates;
- Collaborate with knowledge and technical information that can bring public benefits;
- Preserve and guarantee the political freedom and expression of employees;
- To guide the relationship with authorities, politicians and public agents by transparent, professional and correct attitudes, and any form of pressure or request by public agents, which does not correspond to this definition, must be immediately rejected and communicated to the management of Biofíllica Ambipar Environmental Investments;
- To guide the relationship by respect for laws and conventions that deal with fundamental human rights and the protection of sustainability. In all their relationships, representatives of the Project must observe ethical, health, safety standards and respect for human rights and socio-environmental responsibility.

Risks identified	Mitigation or preventative measure(s) taken
No risk identified	Regarding human rights risks, as previously mentioned in section 2.3.1, respect is ensured through the Ambipar Group's Code of Conduct and Compliance (2023) and Diversity and Inclusion Policy (2023), in addition to Manoa's internal policies. Additionally, section 1.15 demonstrates that the organization is in compliance with all treaties and national legislation that concern the rights of traditional populations. It is important to note that there are no traditional populations living in the project area or that depend on its resources.

2.3.3 Indigenous Peoples and Cultural Heritage

Risks identified	Mitigation(s) or preventative measure taken
No risk identified.	No risks related to indigenous populations, traditional communities or cultural heritage were identified in the project area, since there is no presence of such populations or cultural assets on site. Therefore, the project activities do not interfere with cultural rights or practices. Respect for human rights and diversity is ensured by the Ambipar Group's Code of Conduct and Compliance (2023) and Diversity and Inclusion Policy (2023), in addition to Manoa's internal policies, as previously mentioned in section 2.3.1. In addition, the project complies with all national standards and international treaties relevant to the rights of traditional populations, as presented in section 1.15.

2.3.4 Property Rights

Risks identified	Mitigation or preventative measure(s) taken
No risk identified	The project area is characterized as private property belonging to Manoa Sustentável Extração e Serviços Florestais Ltda. Ownership and use rights are demonstrated through documents shared with VVB. Section 1.8 provides more details on this subject.

2.3.5 Benefit Sharing

The project does not have any impact on property rights, so this section does not apply.

2.4 Ecosystem Health

	Risks identified	Mitigation or preventative measure(s) taken
Impacts on biodiversity and ecosystems	Risk from Forest Management	Forest management adopts measures to mitigate risks to biodiversity, focusing on employee training and operational procedures. Annual training is provided to update employees on best practices for reduced-impact management. Specific measures include the maintenance of trees for future felling, lower-class trees and seed-bearing trees, as well as the conservation of rare and legally protected species. To protect seed-bearing trees and other important species, preventive measures are taken during activity planning, such as directing tree felling and cutting vines in a controlled manner. Permanent preservation areas and riparian forests are protected, and trees near watercourses or in areas with steep slopes are not extracted. These measures also benefit fauna, ensuring the availability of food and temporary shelter. Other measures include the protection of bird nests and the installation of warning

		signs against hunting. Frequent surveillance is carried out to prevent invasions that could negatively impact the area's natural resources and biodiversity. Even though there is a risk, the impact of the forest management is positive , as it is also responsible for the conservation of biodiversity and ecosystems.
Soil degradation and soil erosion	No risk identified	The project activities do not cause soil degradation or erosion. The impacts resulting from the removal of trees through forest management are negligible.
Water consumption and stress	No risk identified	The project activities not only do not cause risks in terms of water consumption and stress, but they also contribute to their maintenance. No specific water consumption is required for forest management activities. The project area consists of native forest, so there is no introduction of plant species that could cause any type of water stress.

2.4.1 Rare, Threatened, and Endangered Species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

☒ Yes

☐ No

Species and habitat	The Manoa REDD+ Project is located in an area of forest cover with great environmental importance, since it forms, together with the surrounding conservation units — the Jamari and Jacundá National Forests — an ecological corridor essential for the maintenance of vegetation and the mobility of fauna through the connectivity between these remnants, which total a block of 480 thousand hectares. All project activities contribute to the preservation of the forest, which not only avoids negative impacts on habitats and areas necessary for the connectivity of rare, threatened or endangered species, but also promotes their continuity. Flora: Family: Bignoniaceae
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- Species: *Handroanthus serratifolius*
 - Common Name: ipê-amarelo
 - Threat Degree IUCN: EN
- Family: Fabaceae
 - Species: *Apuleia leiocarpa*
 - Common name: garapeira
 - Threat Degree BR: VU
- Family: Fabaceae
 - Species: *Dalbergia spruceana*
 - Common name: jacarandá
 - Threat Degree IUCN: VU (Vulnerável)
- Family: Fabaceae
 - Species: *Hymenolobium excelsum*
 - Common Name: angelim
 - Threat Degree BR: VU (Vulnerável)
- Family: Fabaceae
 - Species: *Peltogyne paradoxa*
 - Common Name: roxinho
 - Threat Degree IUCN and BR: VU (Vulnerável)
- Family: Lauraceae
 - Species: *Mezilaurus itauba*
 - Commons name: itaúba
 - Threat Degree BR: VU
- Family: Lecythidaceae
 - Species: *Bertholletia excelsa*
 - Common name: castanheira
 - Threat Degree IUCN e BR: VU

- Family: Meliaceae
 - Species: *Cedrela odorata*
 - Common name: cedro-rosa
 - Threat Degree IUCN and BR: VU
- Family: Sapotaceae
 - Species: *Manilkara elata*
 - Common Name: maçaranduba
 - Threat Degree IUCN: EN

Fauna:

- Threat Degree IUCN: Vulnerable (VU)
 - Name: Azulona - *Tinamus tao*
 - Name: Jacamin-de-costas-verdes - *Psophia viridis*
 - Name: Harpia - *Harpia harpyja*
 - Name: Marianinha-de-cabeça-amarela - *Pionites leucogaster*
 - Name: Cantador-ocráceo - *Hypocnemis ochrogyna*
 - Name: Arapaçu-uniforme - *Hylexetastes uniformis*
- Threat Degree IUCN: Vulnerable (VU)
 - Name: Queixada - *Tayassu pecari*
 - Name: Tatu-canastra - *Priodontes maximus*
 - Name: Anta - *Tapirus terrestris*
 - Name: Tamanduá-bandeira - *Myrmecophaga tridactyla*
 - Name: Sagui-de-rondônia - *Mico rondoni*
 - Name: Parauacu - *Pithecia mittermeieri*
 - Name: Zogue-zogue - *Plecturocebus brunneus*
- Threat Degree IUCN: Endangered (EN)
 - Name: Ariranha - *Pteronura brasiliensis*

	Name: Macaco-aranha-de-cara-preta - <i>Ateles chamek</i>
Areas needed for habitat connectivity	As mentioned above, the activities of the Manoa REDD+ Project promote habitat connectivity. The following Figure 3 illustrates the configuration of the project area together with other conservation units, demonstrating the importance of the project as an ecological corridor.

	Risks identified	Mitigation or preventative measure(s) taken
Habitats for rare, threatened, and endangered species	Risk arising from Forest management	The mitigating actions are described in the first table of section 2.4.
Areas for habitat connectivity	No risk identified	The Manoa REDD+ Project promotes the conservation of a forest area that is part of an ecological corridor, thus not only does it not pose any risks, but it also promotes the continuity of connectivity between areas. More details can be found in the table above.

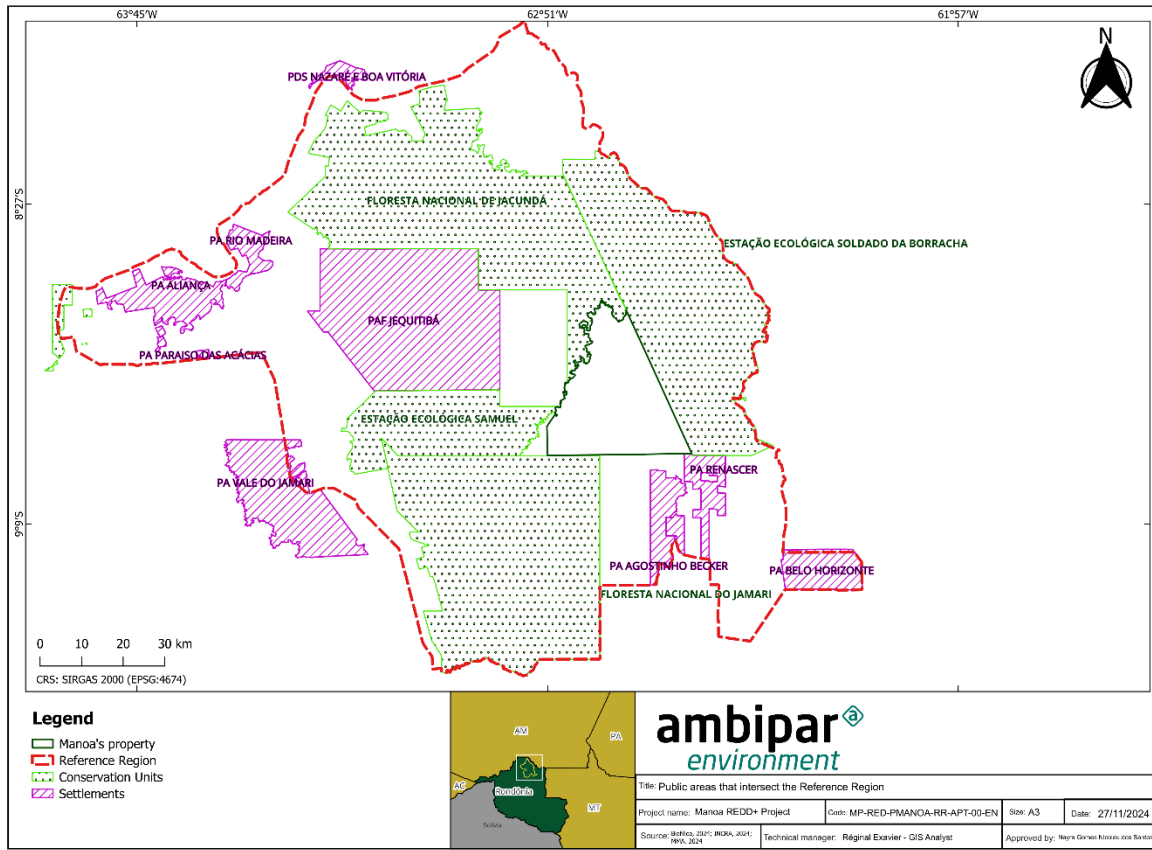


Figure 3 Map showing the proximity of the project area to other conservation units, forming a forest corridor

2.4.2 Introduction of Species

The project does not carry out any activities that include the use of invasive species, therefore this section does not apply.

2.4.3 Ecosystem Conversion

This is not an ARR, ALM, WRC or ACoGS project, so this section is not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	VM0015	VM0015 Methodology for Avoided Unplanned Deforestation	1.2

3.2 Applicability of Methodology

Methodology ID	Applicability condition	Justification of compliance
VM0015	1) Baseline activities may include planned or unplanned logging, firewood collection, charcoal production, agricultural and grazing activities, provided that the category is unplanned deforestation, according to the latest version of the VCS standard.	The baseline activities of the project include unplanned deforestation, according to the recent version of the VCS standard, as a result of agricultural and livestock activities.
VM0015	2) Project activities may be included in one or a combination of categories defined in the methodology scope description (Table 1 and Appendix 1 of VM0015).	The project activities include forest protection with controlled and selective logging, in accordance with the description of scope “D” of the methodology used (table 1).
VM0015	3) The Project area may include different types of forest, including, but not limited to, primary forests, degraded forests, secondary forests, planted forests and agroforestry systems, complying with the definition of “forest”.	The project area has different forest typologies, mainly primary forests that meet the definition of “forest”.

VM0015	4) At the start of the Project, the Project area must include only areas that have qualified as “forest” for a minimum of 10 years prior to the Project start date.	The project area includes only areas classified as “forest” for a minimum period of 10 years prior to the project start date.
VM0015	5) The Project area may include areas of wet forests in marshland areas (such as lowland forests, floodplain forests, mangroves), as long as they do not develop on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm.	The forest types found in the project area do not include forested wetlands and do not include peat swamp forests.
VM0015	6) If the Project area includes wet forests in marshland areas that develop on peat (e.g. peat forests), this methodology is not applicable.	The forest types found in the project area do not include forested wetlands and do not include peat swamp forests.

Tool	Applicability condition	Justification of compliance
VT0001	1) 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;	The activities carried out by the project are fully compliant with the law, as demonstrated in sections 1.8 and 1.15 of this PD.
VT0001	2) The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most	The most plausible baseline identification followed the process established by methodology VM0015 v1.2, which requires a stepwise approach to justify the

	plausible baseline scenario. Project proponent(s) proposing new baseline methodologies shall ensure consistency between the determination of a baseline scenario and the determination of additionality of a project activity.	selection of the most plausible baseline scenario. This process included the use of tool VT0001 to further support the scenario determination. The project did not propose a new baseline methodology and fully complies with the applicability condition for the use of VT0001.
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3.3 Project Boundary

3.3.1 Spatial Boundaries

Reference Region

According to the VCS VM0015 methodology, the reference region is the spatial boundary that contains the project area, the leakage belt, the leakage management areas and other relevant geographic areas to determine the project baseline (Figure 4).

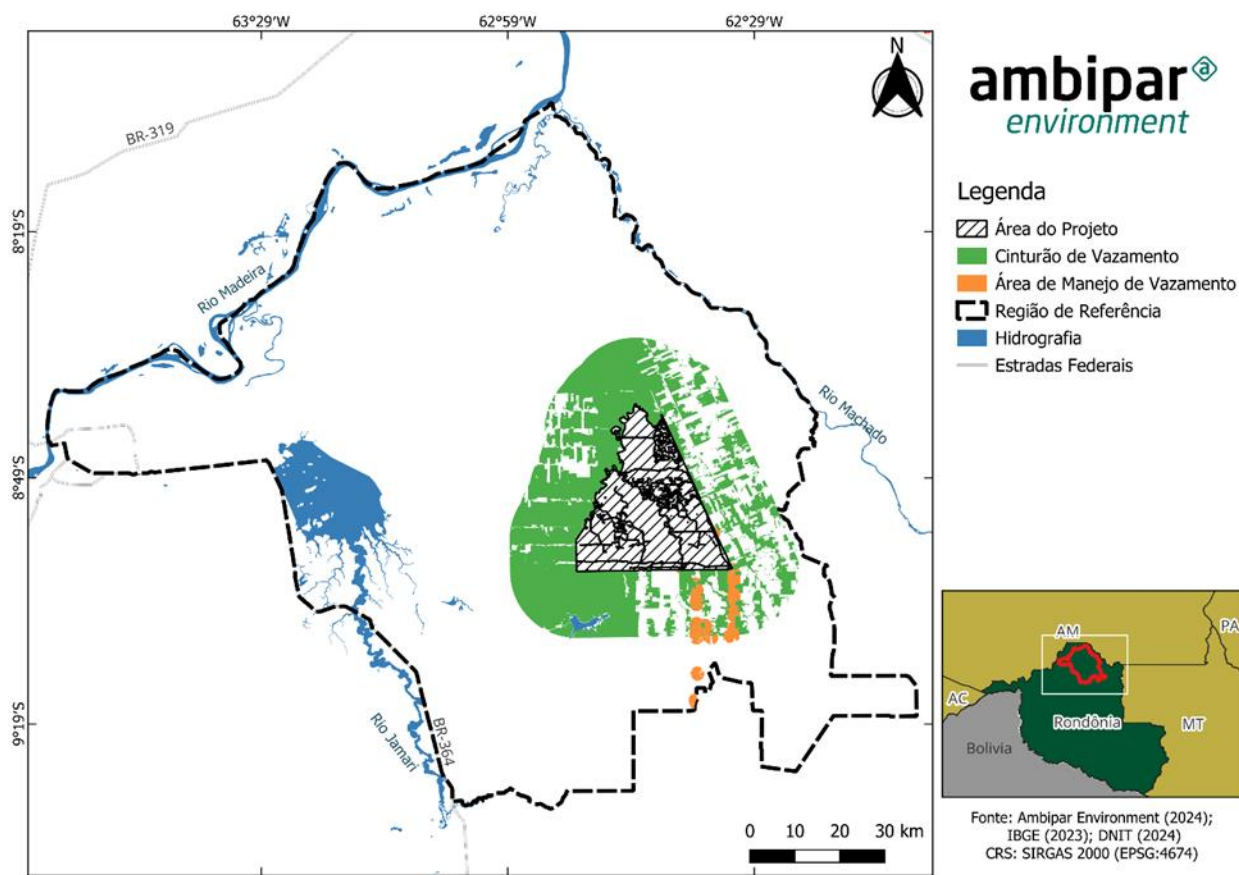


Figure 4 Boundaries of the Manoa REDD+ Project.

The proposed reference region corresponds to an area of 1,484,622 hectares, equivalent to 20 times the Project Area, and has a historical deforestation rate (between 2000 and 2022) of 17,630 hectare per year. It is delimited to the west by the Madeira River (in the Northwest) and by BR-364 (in the Southwest), to the east by the Jiparaná (or Machado) River, and to the south by the southern limit of Flona Jamari and the Renascer, Agostinho Becker, and Belo Horizonte settlements. Thus, the hydrographic context together with the land tenure situation of the areas surrounding Fazenda Manoa were the main elements used to determine the geographic limit of the Reference Region.

In addition to the context already mentioned, to demonstrate the similarity of the deforestation risk in the reference region and in the project area, the following criteria established by VM0015 version 1.2 (page 14) were analyzed:

a) Probable area of activity and influence of deforestation agents and vectors:

- **Agents and causes of deforestation: Group 1 - Cattle ranchers; Group 2 – Illegal loggers; Group 3 – Rural entrepreneurs; Group 4 - Land grabbers.**

These groups of deforestation agents were present in the reference region causing deforestation during the historical period. This can be confirmed by the socio-economic diagnosis made for the project, as well as newspaper reports and studies made of the region.

Group 1 - Cattle ranchers: The growth of the pasture area in Cujubim (an increase of 47.64% between 2013 and 2022¹²) reflects the expansion of cattle ranching, especially in the northern and eastern regions of the municipality, including the outskirts of Fazenda Manoa. The Socio-Economic Diagnosis carried out for the project points to cattle ranching as the main cause of deforestation in the region. Furthermore, since the 1970s, cattle ranching has been growing in Rondônia. According to IBGE data¹³, in 1970 the state had 41,030 cattle, in 1980 this figure was 250,286, it grew to 1,718,697 in 1990, jumping to 5,664,320 in 2000 and 14,804,398 cattle in 2020. It is possible to find several news stories about deforestation caused by the expansion of cattle ranching, such as Forest & Finance, which reports on the case of the "biggest deforester in the country" who operated in the region¹⁴.

Group 2 - Illegal loggers: In November 2019, the Union of Rural Property Owners of the Manoa Sector, Gleba Rio Preto and Jaquirana denounced deforestation in reserve areas in the municipalities of Porto Velho, Candeias do Jamari, Cujubim and Machadinho D'Oeste. The private properties, intended for sustainable extractivism, were being invaded and destroyed by invaders, with illegal logging and burning¹⁵. According to Imazon¹⁶, the municipalities of Porto Velho, Pimenteiras do Oeste and Cujubim are the hotbeds of illegal activity, responsible for 83% of unauthorized logging in the state. It is also common to find newspaper reports of illegal logging in the region¹⁷, which proves that this agent of deforestation was present in the region of reference during the historical period.

Group 3 - Rural entrepreneurs: The project's Socio-Economic Diagnosis indicates that forest areas in Cujubim have been converted into soybean crops. Small farmers often sell their land to agribusiness entrepreneurs, intensifying this process of converting forests into agricultural areas. In addition, in Rondônia, during the 2021/2022 agricultural year, the area destined for soybean cultivation covered a vast 460,119 hectares, in these areas cultivated with soybeans it was possible to observe the distribution of soybeans in areas of environmental preservation, as the Embrapa study showed¹⁸. Finally, the increase in soybean production in Rondônia is due to the replacement of degraded pasture areas. However, there

¹² MAPBIOMAS. Projeto MapBiomias – Coleção 8.0 da Série Anual de Mapas de Cobertura e Uso da Terra do Brasil.

¹³ IBGE. Available at: <https://www.ibge.gov.br/explica/producao-agropecuaria/bovinos/ro>. Accessed in March 2025.

¹⁴ Forest & Finance. Available at: <https://forestsandfinance.org/pt/news-pt/jbs-admite-ter-comprado-quase-9-mil-bois-ilegais-do-maior-desmatador-do-pais>. Accessed in March 2025.

¹⁵ Desmatamento em área de reserva de Rondônia é denunciado pela União dos Proprietários de Imóveis Rurais do Setor Manoa, Gleba Rio Preto e Jaquirana. Available at: <https://www.gentedeopinioao.com.br/meio-ambiente/desmatamento-em-area-de-reserva-de-rondonia-e-denunciado-pela-uniao-dos-proprietarios-de-imoveis-rurais-do-setor-manoa-gleba-rio-preto-e-jaquirana>. Accessed in March 2025.

¹⁶ Imazon. Available at: <https://imazon.org.br/imprensa/exploracao-madeireira-nao-autorizada-em-rondonia-aumenta-em-2023-cresce-pressao-sob-areas-protegidas>. Accessed in March 2025.

¹⁷ G1 News. Available at: <https://g1.globo.com/ro/rondonia/natureza/amazonia/noticia/2022/06/16/madeira-ilegal-levada-apos-grupo-barrar-acao-da-policia-e-localizada-em-serraria-de-cujubim-ro.ghtml>. Accessed in March 2025.

¹⁸ Dinâmica da expansão da soja e uso de agroquímicos em Rondônia. Available at: <https://www.alice.cnptia.embrapa.br/alice/bitstream/doc/1164944/1/Dinamica-da-expansao.pdf>. Accessed in March 2025.

has been a transformation of forest areas into pastures, which has boosted deforestation and fires in recent years¹⁹. This shows the presence of this agent of deforestation in the region.

Group 4 - Land grabbers: The region known as Soldado da Borracha, located between the Rondonian municipalities of Cujubim and Porto Velho, is the scene of an intense process of land grabbing, accompanied by numerous incidents of violence and conflict²⁰. In January 2020, the Rondoniagora portal released a video showing squatters continuing to illegally cut down the forest on the Soldado da Borracha branch in Cujubim, contributing to the increase in deforestation in 2020^{21,22}. This news shows the presence of this agent of deforestation in the region.

- **The density of settlements (settlements/km²) and the density of roads (m/km²) in the reference region**

A buffer area of 5km radius was created around the Project Area (as recommended by VM0015 v1.2 page 13). This area consists of 732.08 km² which is the basis for the similarity comparison with the Reference Region which is 14,846.22 km². Both criteria are met as required by the methodology, where the density of settlements and roads is lower in the Reference Region than in the buffer area surrounding the Project Area (Table 3).

Rural settlements were mapped based on official geospatial data provided by the National Institute for Colonization and Agrarian Reform (INCRA)²³, which was used as the reference source for the identification of settlements in both the Reference Region and the Project Area (Figure 5). This dataset was selected because it is institutional information produced by the federal agency responsible for land tenure management in Brazil, thereby ensuring traceability and institutional support for the information used. The data are provided in vector format, with polygon geometry, in the SIRGAS 2000 reference system (EPSG:4674), and are subject to continuous updates.

¹⁹ FEARNside, P.M. O desmatamento da Amazônia brasileira: 18 - A moratória da soja. 2021. Available at: <https://amazoniareal.com.br/o-desmatamento-da-amazonia-brasileira-18-a-moratoria-da-soja/>. Accessed in March 2025.

²⁰ Impunidade em Rondônia: Assassinatos no Campo seguem sem investigação. Available at: <https://www.cptnacional.org.br/publicacoes/noticias/conflitos-no-campo/6192-impunidade-em-rondonia-assassinatos-no-campo-seguem-sem-investigacao>. Accessed in March 2025.

²¹ Vídeo: Posseiros continuam derrubada ilegal em floresta de Cujubim. Available at: <https://www.rondoniagora.com/concursos-e-empregos/video-posseiros-continuem-derrubada-ilegal-em-floresta-de-cujubim>. Accessed in March 2025.

²² Prisão de maior desmatador do país piora crime ambiental na Amazônia. Available at: <https://noticias.r7.com/brasil/prisao-de-maior-desmatador-do-pais-piora-crime-ambiental-na-amazonia-12022020/>. Accessed in March 2025.

²³ National Institute for Colonization and Agrarian Reform (INCRA). *Acervo Fundiário*. Available at: <https://acervofundiario.incra.gov.br/acervo/login.php>. Accessed in March 2026.

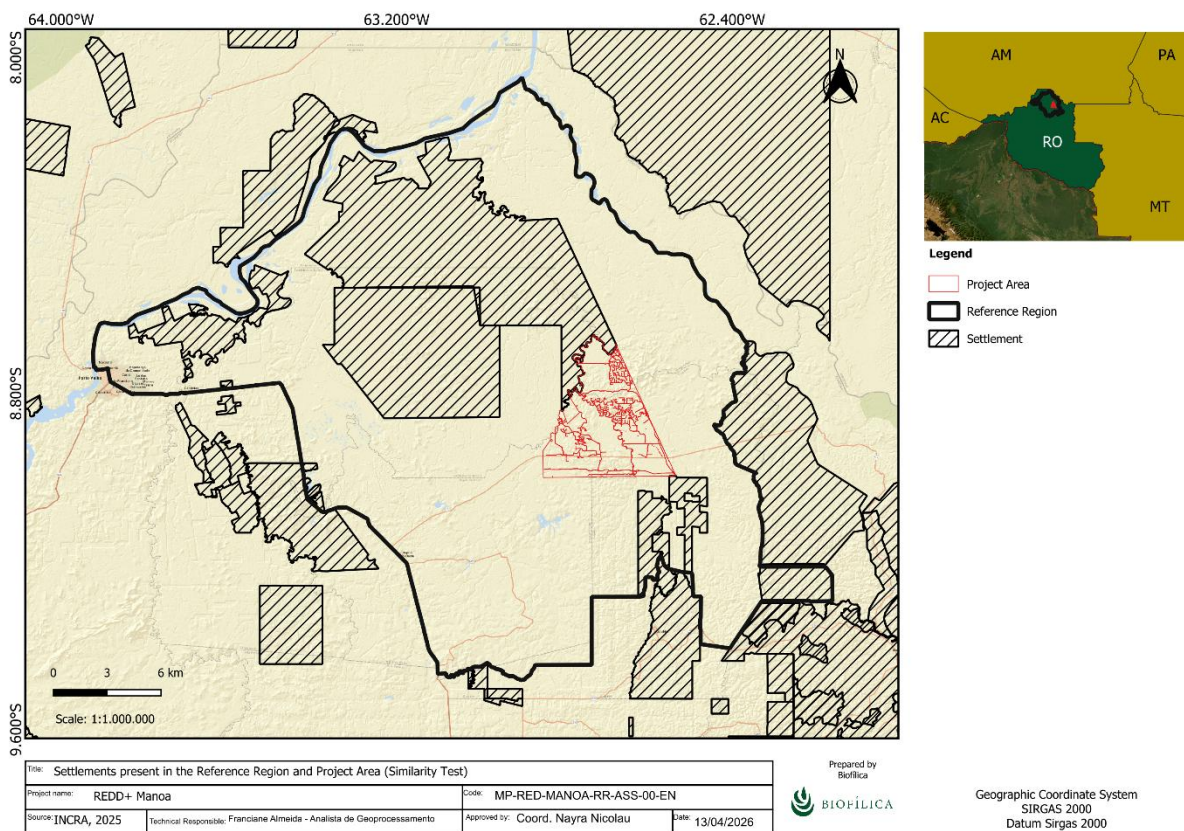


Figure 5 Spatial distribution of rural settlements in the Reference Region and Project Area (similarity assessment).

For road mapping in the Reference Region and Project Area (Figure 6), the Imazon road dataset was used²⁴, given its application in analyses of land occupation dynamics and anthropogenic pressure in the Amazon, especially with regard to the identification of unofficial roads and secondary access routes. Its use in this study is justified by the relevance of this type of information for understanding territorial access infrastructure and processes associated with land occupation and the advance of deforestation.

²⁴ Institute of Man and Environment of the Amazon (Imazon). Available at: [<https://imazongeo.org.br/>]. Accessed in March 2026.

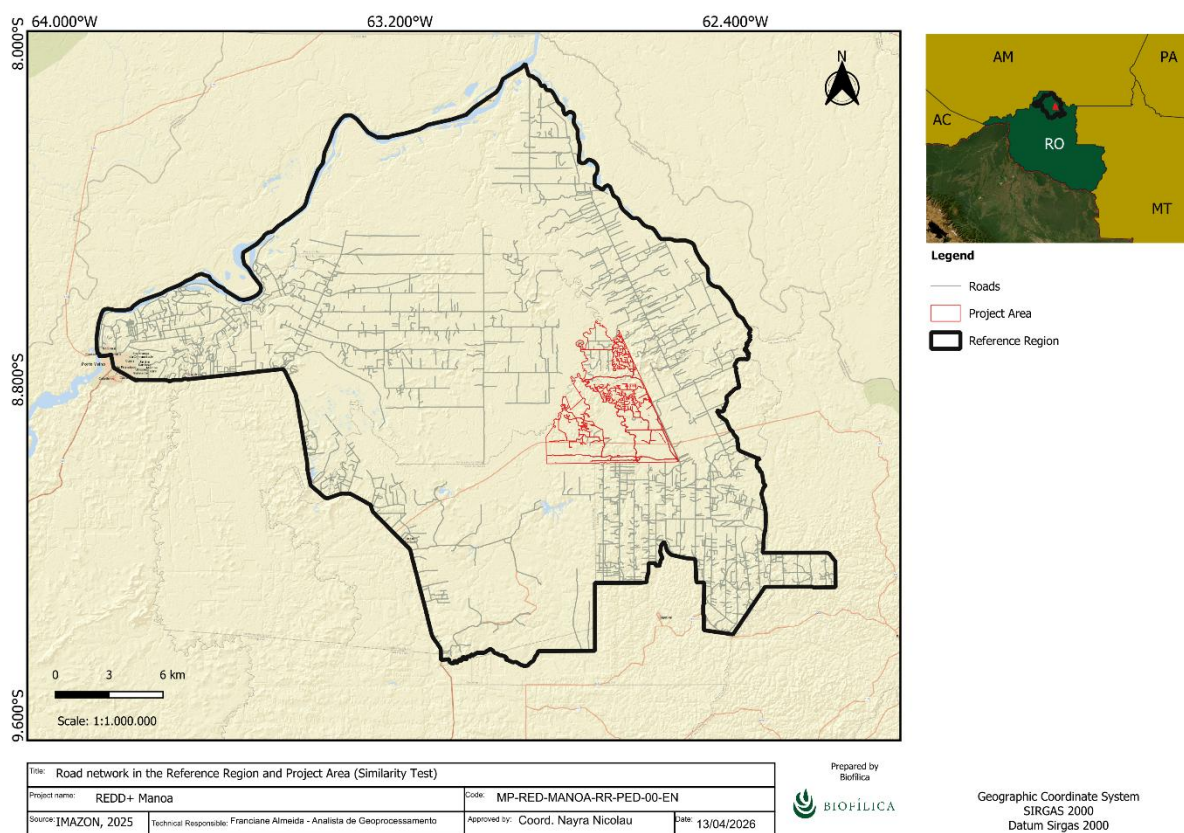


Figure 6 Spatial distribution of the road network in the Reference Region and Project Area (similarity assessment).

- Infrastructure vectors**

Public databases that include information on construction, planning and location of infrastructures^{25,26} were consulted and no infrastructure such as roads, hydroelectric dams, bridges etc. are expected to be implemented in the Project Area or near the Project Area (considering a buffer of 5km) during the baseline period.

Table 3 Similarity between the Reference Region and the 5km buffer of the project area.

²⁵ <https://sigel.aneel.gov.br/portal/home/index.html> - Georeferenced Information System for the Electricity Sector, includes information on the location and status of hydroelectric plants, wind farms, thermoelectric plants and other infrastructure related to the electric sector. The website has an interactive map for data consultation and download. Accessed on April 1st 2025.

²⁶ <https://servicos.dnit.gov.br/vgeo/> - Georeferenced data from the National Department of Transport Infrastructure that includes data on the status and location of state and federal highways and an interactive map, with the option to download data. Accessed on April 1st 2025.

Limit	Area km2	Settlements		Roads	
		Quantity	Density (qt/km ²)	Length (m)	Density (m/km ²)
RR	14,846.22	9	0.0006	5,190,670.00	349.63
5km buffer from PA	744.30	3	0.0040	364,239.00	489.37

b) Landscape configurations and ecological conditions

Condition 1: Forest/Vegetation Classes: At least 90% of the project area must have forest classes or vegetation types that exist in at least 90% of the rest of the reference region.

Outcome 1: 100% of the project area is composed of vegetation types that exist in 95% of the rest of the reference region (Table 4 and Figure 7)

Table 4 Similarity of vegetation types between the Project Area and the rest of the Reference Region.

Forest/Vegetation Classes	Rest of RR		PA		Total
legenda_2	Area (ha)	%	Area (ha)	%	Area (ha)
Lowland Open Rain Forest	481,913.36	56.27%	45,076.53	62.04%	526,989.89
Submontane Open Rain Forest	302,450.32	35.31%	26,957.68	37.10%	329,408.00
Alluvial Dense Rain Forest	33,188.32	3.88%	547.81	0.75%	33,736.13
Alluvial Open Rain Forest	21,623.16				21,623.16
Livestock (pastures)	6,792.65				6,792.65
Submontane Dense Rain Forest	4,536.63				4,536.63
Continental body of water	2,509.12				2,509.12
Pioneer Formation with fluvial and/or lacustrine influence	2,045.16				2,045.16
Secondary Vegetation	918.05				918.05
Forest Savanna	494.27	0.06%	79.14	0.11%	573.41
Total	856,471	95.51%	72,661	100%	929,132

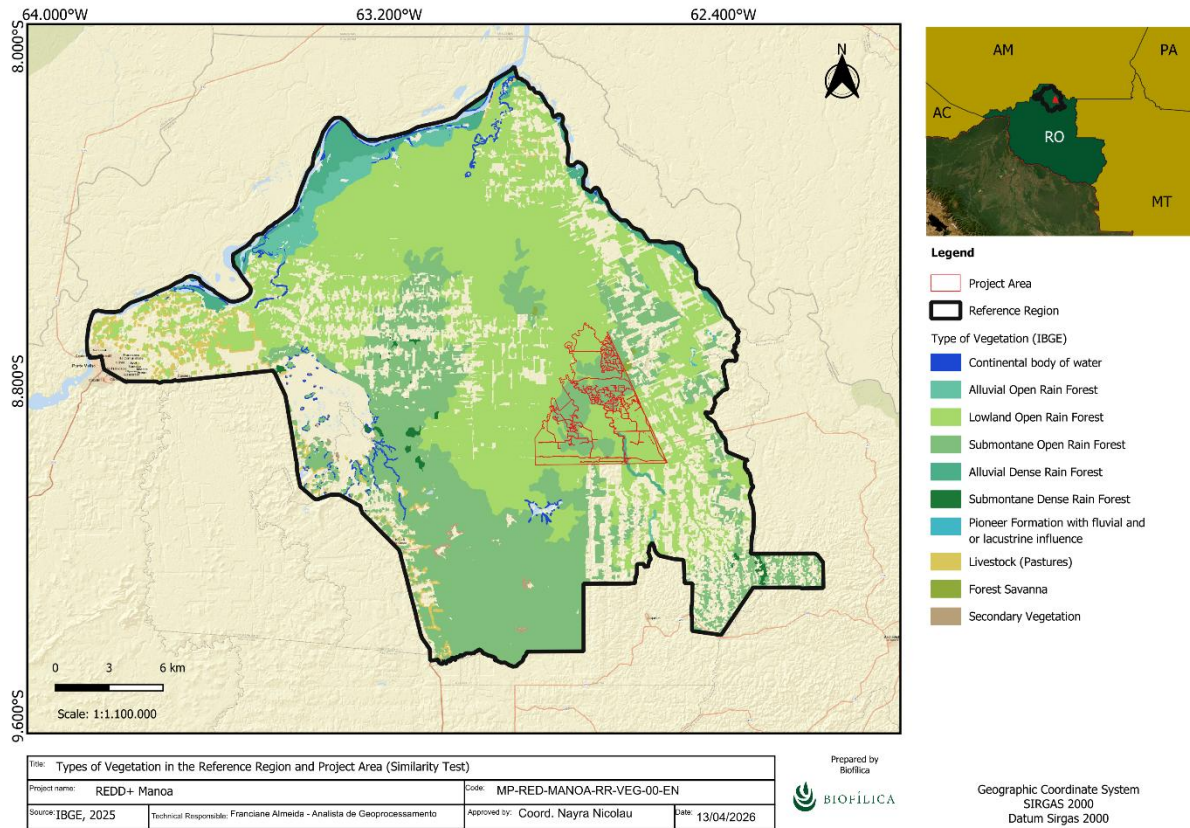


Figure 7 Spatial distribution of vegetation types in the Reference Region and Project Area (similarity assessment).

Condition 2: Slope: The average slope of at least 90% of the project area must be within +/- 10% of the average slope of at least 90% of the rest of the reference region.

Result 1: The average slope of 100% of the project area ($\leq 30.07^\circ$) is within the average slope of 100% of the rest of the reference region ($\leq 68.32^\circ$) (Figure 8, Table 5).

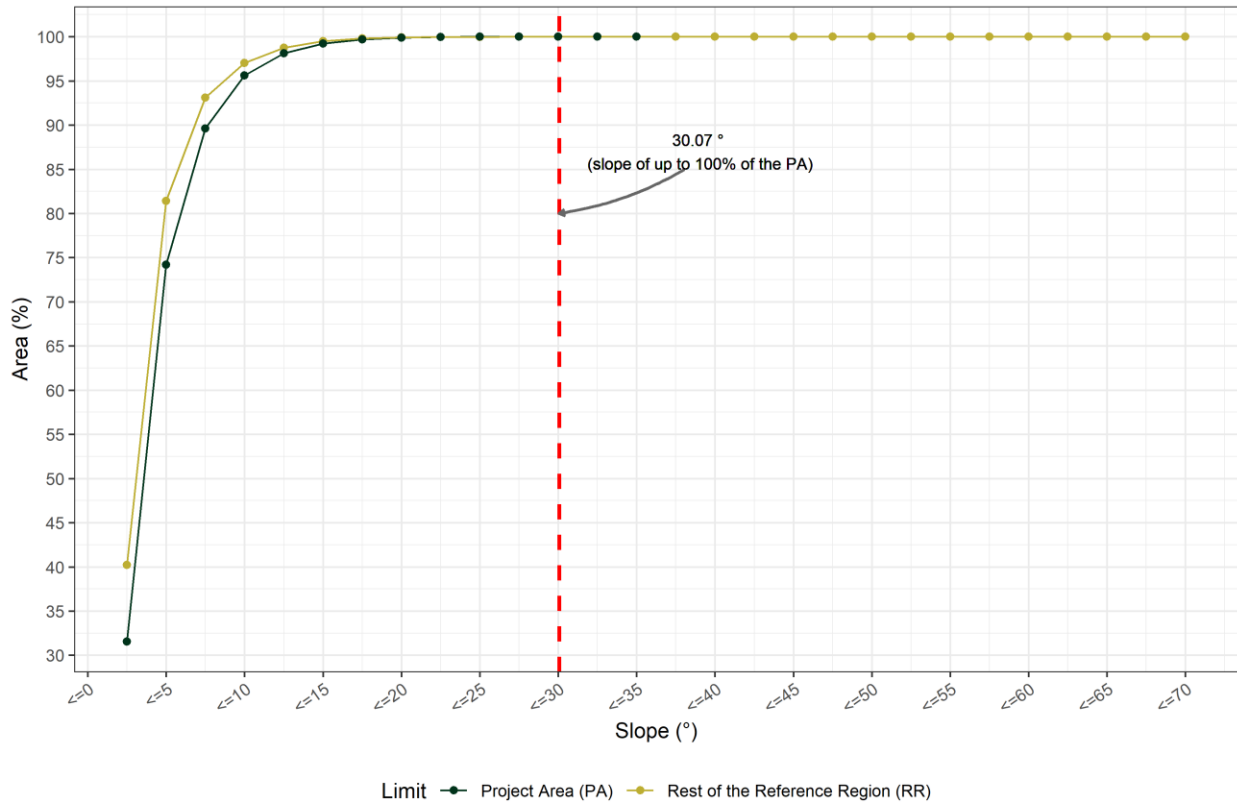


Figure 8 Mean slope similarity curves between the PA and the rest of the RR.

Condition 3: Elevation: At least 90% of the project area must be within the elevation range of at least 90% of the rest of the reference region.

Result 3: The elevation of 90% of the project area (≤ 124 m) is within the elevation range of 90% of the reference region (≤ 133 m) (Figure 9, Table 5).



Result 4: The average annual precipitation for 90% of the project area ($\leq 1,935.02$ mm) is within the range of the average annual precipitation for 90% of the reference region ($\leq 1,976.67$ mm) (Figure 10, Table 5).

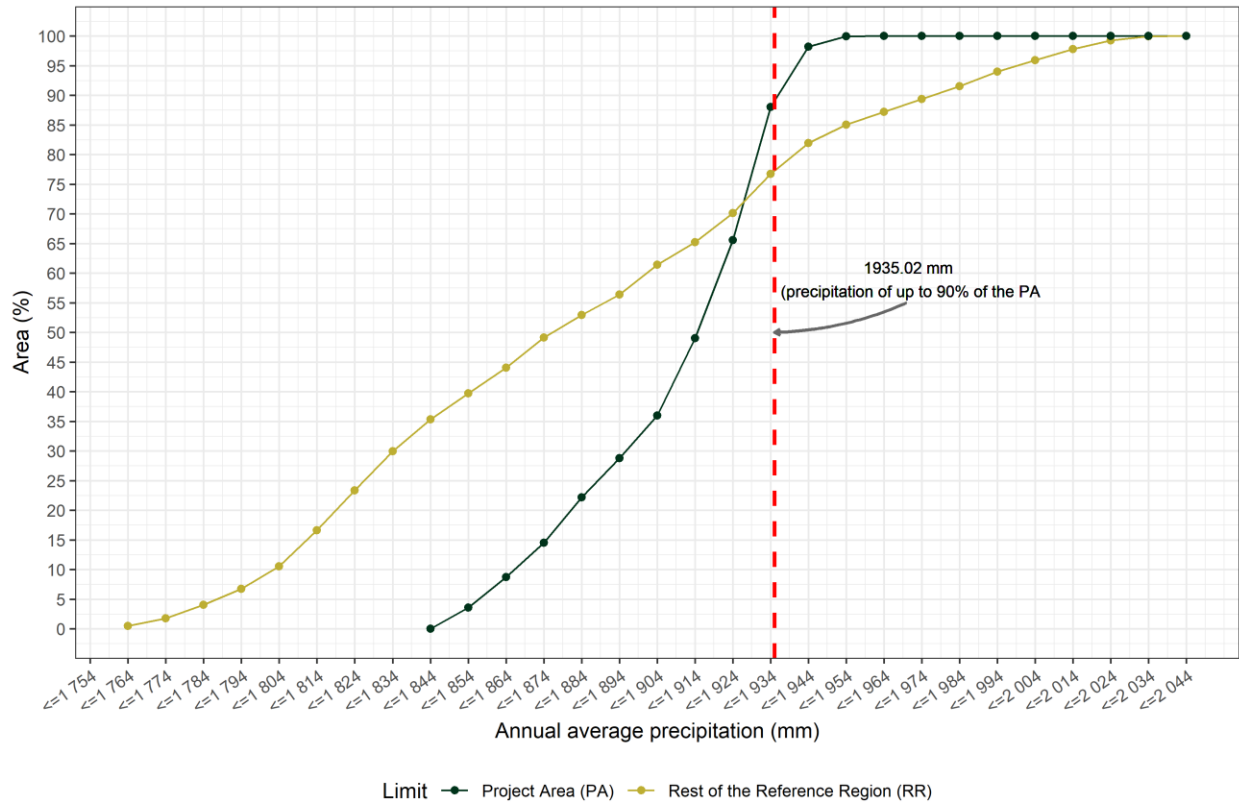


Figure 10 - Curves of similarity of average precipitation between PA and the rest of RR.

Table 5 Comparison of slope, elevation and precipitation variables between the Project Area and the rest of the Reference Region.

Percentile	Slope (°) ²⁷		Elevation (m) ²⁸		Precipitation (mm) ²⁹	
	RR*	PA	RR*	PA	RR*	PA
0	0.00	0.00	-138	56	1,754.11	1,843.79
5	0.93	0.93	68	87	1,787.75	1,856.90
10	0.94	1.32	79	94	1,802.81	1,866.35
15	1.32	1.32	84	97	1,811.62	1,874.73
20	1.32	1.88	88	99	1,819.35	1,881.66
25	1.87	2.08	92	100	1,826.46	1,888.38

²⁷ Tom G Farr and others, "The Shuttle Radar Topography Mission" (2007) 45 Reviews of Geophysics <<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2005RG000183>>.

²⁸ Same as note 1

²⁹ Chris Funk and others, 'The Climate Hazards Infrared Precipitation with Stations—a New Environmental Record for Monitoring Extremes' (2015) 2 Scientific Data 150066. <<https://www.nature.com/articles/sdata201566>>

30	2.08	2.09	94	102	1,834.10	1,895.92
35	2.09	2.64	96	103	1,843.24	1,903.00
40	2.10	2.93	98	104	1,854.73	1,907.26
45	2.78	2.96	99	105	1,865.63	1,911.15
50	2.93	3.37	101	106	1,876.32	1,914.65
55	2.96	3.75	103	107	1,889.89	1,917.84
60	3.37	3.86	104	108	1,901.25	1,920.87
65	3.82	4.18	107	109	1,913.38	1,923.66
70	3.95	4.68	110	111	1,923.80	1,925.98
75	4.63	5.03	113	113	1,931.28	1,927.71
80	4.77	5.69	118	116	1,939.76	1,929.79
85	5.61	6.54	124	120	1,953.84	1,932.31
90	6.57	7.52	133	124	1,976.67	1,935.02
95	8.49	9.55	147	132	1,999.14	1,937.55
100	68.32	30.07	278	222	2,037.02	1,954.68

* Reference Region without considering the Project Area

Condition 5: Soil types: At least 90 percent of the project area has soil types that exist in at least 90 percent of the reference region.

Result 4: The soil type of the entire project area is found in 92,87%percent of the reference region (Table 6 and Figure 11).

Table 6 Similarities in soil types between the Project Area and the Reference Region.

Soil types	RR		PA	
Legend	Area (ha)	%	Area (ha)	%
LAd - Dystrophic Yellow Latosol	986,014.53	0.66	35,461.79	0.49
LVAAd - Dystrophic Red-Yellow Latosol	306,048.54	0.21	35,693.67	0.49
Continental water body	64,072.56	0.04		
PVAAd - Dystrophic Red-Yellow Argisol	53,540.53	0.04	958.21	0.01
GXbd - Dystrophic Tb Haplic Gleysol	33,230.63	0.02	547.81	0.01
RYbd - Dystrophic Tb Fluvisol	32,825.31			
FTd - Dystrophic Argillic Plinthosol	2,899.27			
RQo - Orthic Quartzarenic Neosol	2,245.98			
ESKgu - Hydro-Hyperthick Ferri-Humiluvic Spodosol	2,017.82			
RLd - Dystrophic Lithic Neosol	1,724.72			
AR - Rock Outcrops	1.26			

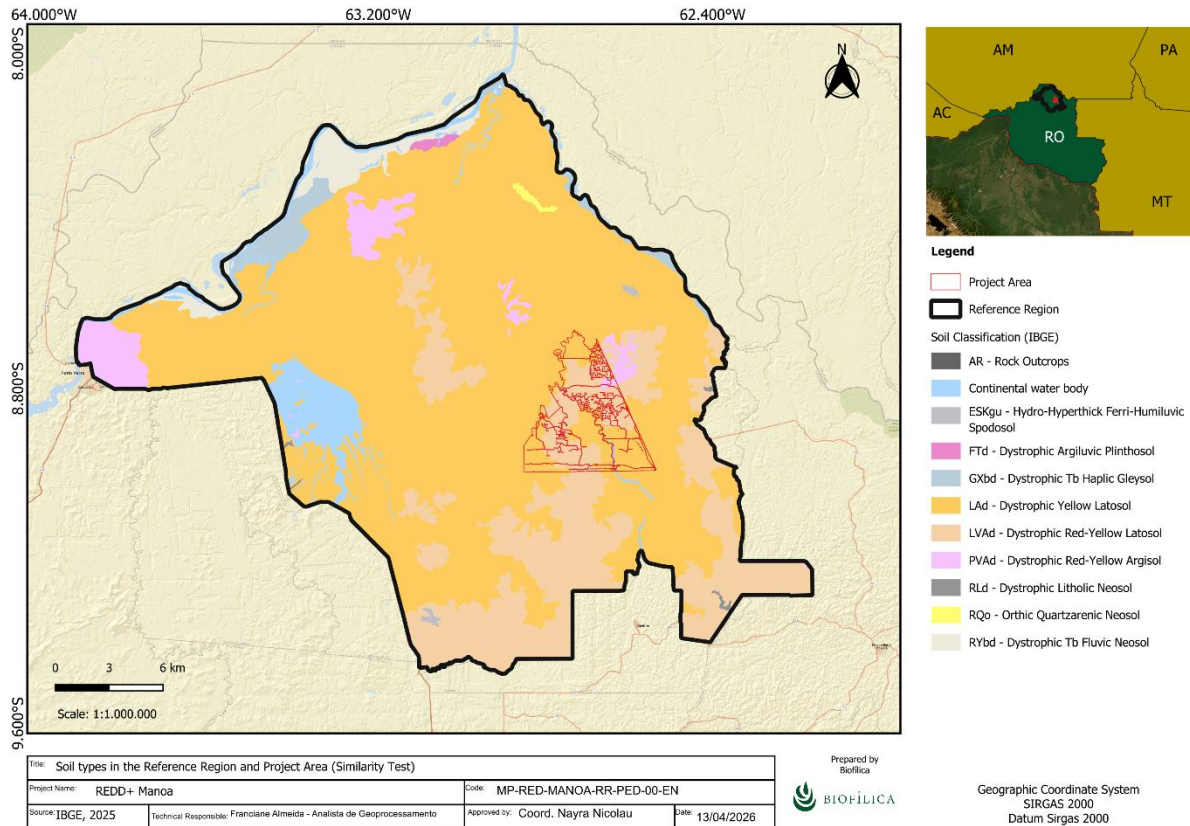


Figure 11 Soil types in the Reference Region and Project Area (similarity assessment).

c) Socioeconomical and cultural conditions

The legal status of the land within the project area in the baseline scenario can be observed in several locations in the reference region. The land status of the Project area is identified as private property, but based on the data obtained it is not possible to distinguish in the RR between private properties and non-designated areas, therefore these categories are considered together (Figure 15). Thus, the project area category occurs in 39% of the reference region.

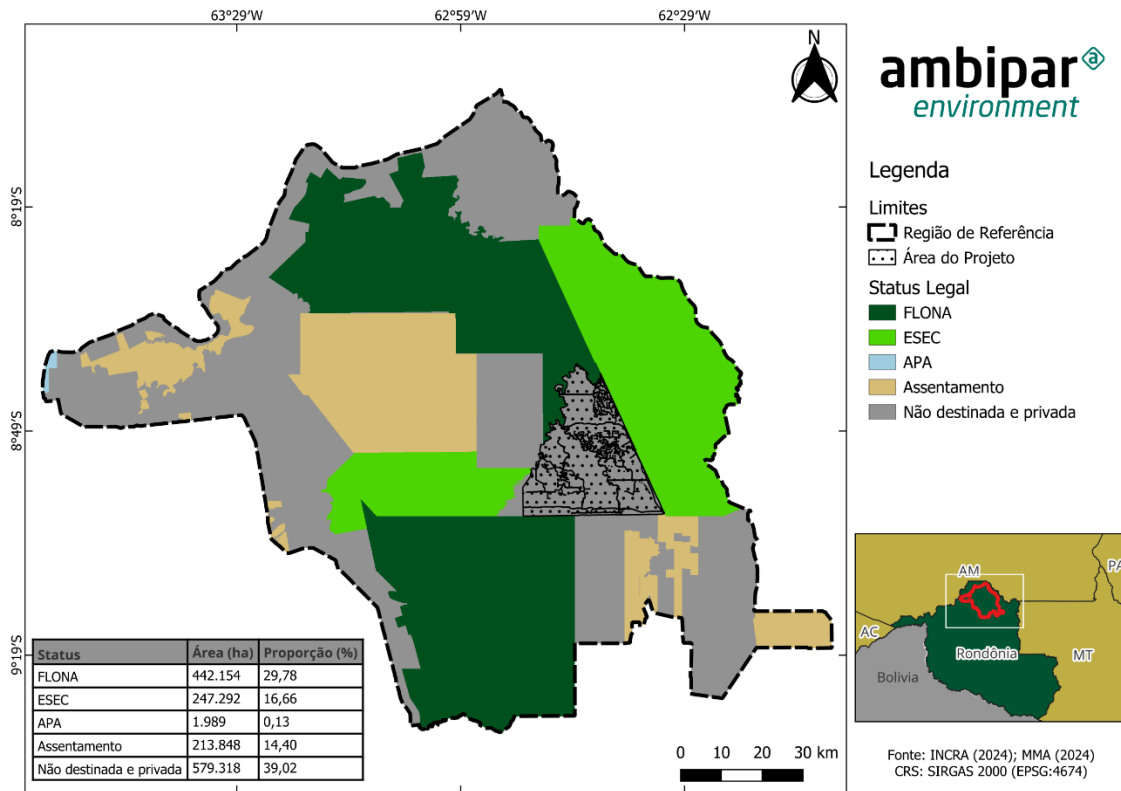


Figure 12 Status of the areas that make up the reference region

The entire Project Area is currently composed of forest, as identified through PRODES data consistent with the forest definition adopted in this PD. In the absence of the proposed project activities, the projected land use involves the conversion of these forested areas into non-forest areas due to deforestation processes, as modeled in the baseline scenario. Therefore, the two relevant land cover classes considered for the Project Area — forest and deforestation — are clearly present and well represented in the Reference Region. This can be observed in Figure 19, which illustrates the spatial distribution of both forest cover and historically deforested areas across the Reference Region. As such, the current and projected land use and land cover classes in the Project Area are consistent with those found throughout the Reference Region, in line with VM0015 v1.2, Section 5.1.1 (item 1.c).

The Project Area is governed by the same federal and state laws and regulations that apply throughout the Reference Region, as described in Section 1.15.

The proportion of urbanized population and agriculture-based population within the reference region was identified using IBGE data and georeferenced spatial data. There is a limitation to this public data, as it is broken down by municipality and the Manoa Project reference region covers only part of the area of the municipalities of Porto Velho, Itapuã do Oeste, Cujubim and Candeias do Jamari, which hampers analysis.

Even so, IBGE data divides the urban and rural population for these municipalities as follows:

Table 7: Population distribution

Municipality	Urban	Rural
Itapuã do Oeste (RO)	69%	31%
Cujubim (RO)	65%	35%
Porto Velho (RO)	93%	7%
Candeias do Jamari (RO)	77%	24%

Fonte: IBGE³⁰

As previously mentioned, the data in Table 7 refers to the total statistics for the municipalities and does not represent the reality of the reference region. Another limitation of this data is that it is not possible to identify in which part of the territory the populations are located, i.e. which portion is inside, and which is outside the reference region.

Analyzing the surroundings of the project area (5 km buffer), only rural communities are found (100%), these being settlements that are also present in the reference region, as shown in Table 3.

Although the ratio in number of urban versus rural populations of the municipalities that are part of the reference region is outside the 10% range in relation to the project area, the urban population within the reference region represents less than 1% in terms of extension. As most of the reference region is made up of non-urbanized areas, similar to what happens around the project area.

Looking at the figures, the reference region has an area of approximately 14,846 km², and the urbanized areas combined are less than 100 km². In addition, in comparison with the CAR (Rural Environmental Registry), within the reference region, according to the government's spatial base³¹, there are 7,902 rural property registrations, of which 7,224 are regularized with active status. This shows that most of the reference region is made up of rural properties. In addition, the high number of rural properties registered in the CAR, together with the presence of rural settlements in the buffer zone and throughout the reference region, confirms that the population in both areas is predominantly agriculture-based, as required by VM0015 v1.2. The figure below shows a map of the perimeters of rural properties within the reference region.

³⁰IBGE – SIDRA. Available at: <https://sidra.ibge.gov.br/tabela/9923>. Accessed in March 2025

³¹SICAR. Available at: <https://consultapublica.car.gov.br/publico/imoveis/index>. Accessed in March 2025

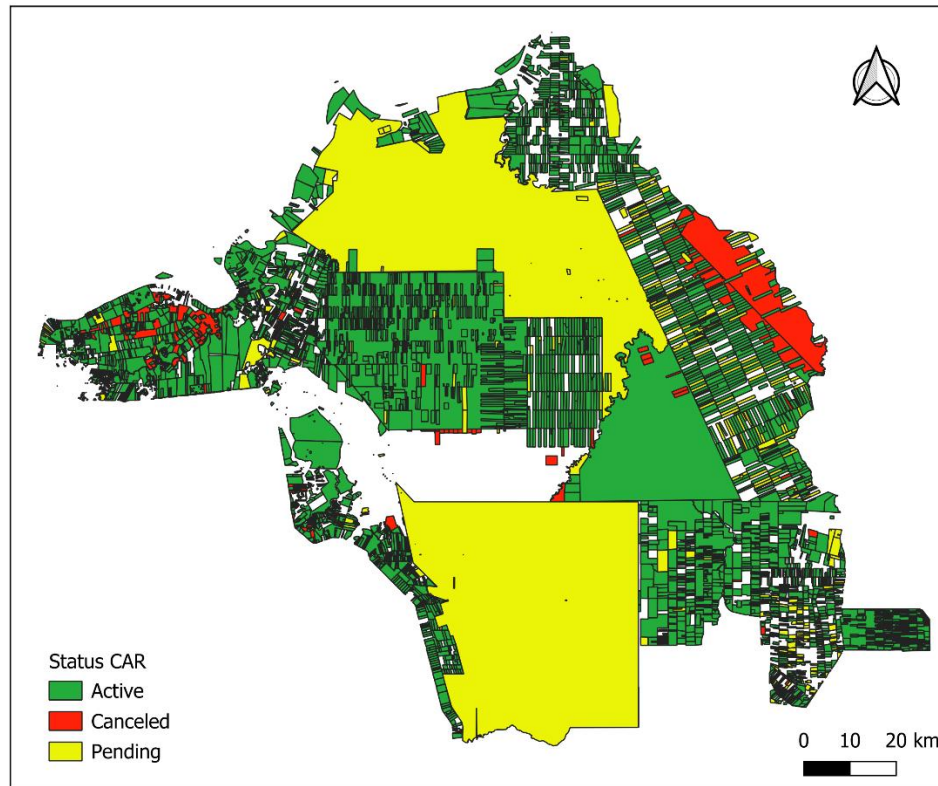


Figure 13: Perimeters of rural properties within the reference region

The VM0015 v1.2 methodology requires that the proportion of urbanized and agriculture-based population be similar between the reference region and the surrounding project area. Thus, if less than 1% of the areas in the reference region are classified as urban areas, and in the area surrounding the project the urbanized regions represent 0%, the spatial geographic data shows that the requirement of similarity of populations is not neglected.

These parameters are important to ensure that the reference region has similar socio-economic conditions to the project area. This helps to ensure that deforestation or degradation trends in the reference region can be validly compared with what would occur in the project area in the absence of REDD+.

Project Area

The Manoa REDD+ Project covers an area of 72,661 hectares of forest under the control of Manoa Sustentável, Exploração e Serviços Florestais Ltda, where the proposed conservation activities are carried out. The boundaries of the project area were defined considering the existing forest area within the boundaries of the Manoa Farm up to the start date of the project (January 1, 2023). The spatial boundaries of the project area are based on the coordinates of the property vertices according to the coordinates of the AV-15 endorsement, dated April 28, 2015, of the Full Content Certificate, registration

15,418 (Figure 14). Table 8 presents the coordinates used to delimit the physical boundaries of the project area.

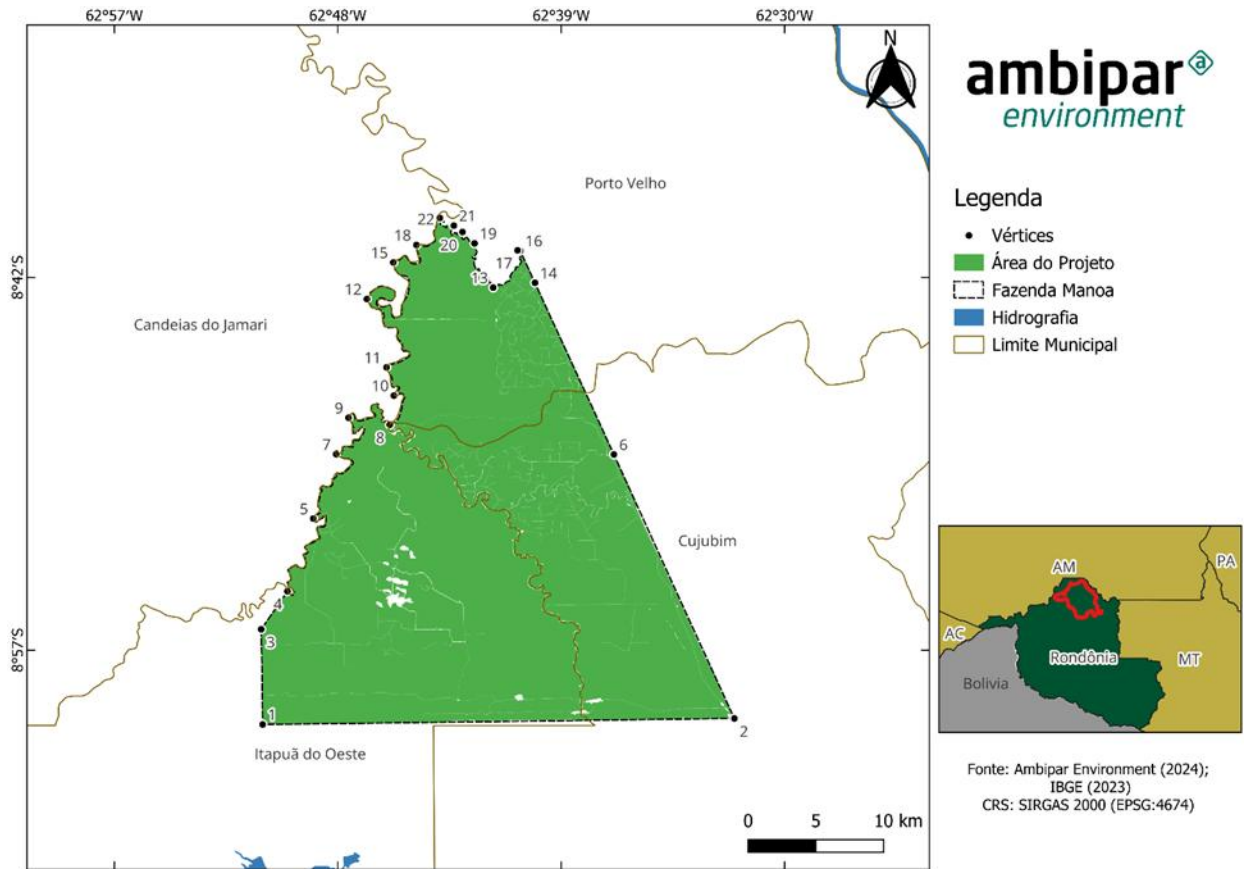


Figure 14 - Physical Boundary of the Project Area

Table 8 Vertices and coordinates of the Project Area (SIRGAS 2000 - EPSG:4674)

Vertex	Coordinate X	Coordinate Y
V 01	-62.8504	-8.9997
V 02	-62.5338	-8.9957
V 03	-62.8514	-8.9359
V 04	-62.8338	-8.9104
V 05	-62.8165	-8.8617
V 06	-62.6147	-8.8187
V 07	-62.8011	-8.8185
V 08	-62.7651	-8.7987
V 09	-62.7928	-8.7941

V 10	-62.7624	-8.7792
V 11	-62.7673	-8.7603
V 12	-62.7805	-8.7145
V 13	-62.6957	-8.7068
V 14	-62.6677	-8.7036
V 15	-62.7627	-8.6899
V 16	-62.6776	-8.6821
V 17	-62.6794	-8.6818
V 18	-62.7472	-8.6782
V 19	-62.7083	-8.6772
V 20	-62.7164	-8.6695
V 21	-62.7221	-8.6652
V 22	-62.7315	-8.6601

Leakage Belt

The limits of the leakage belt were determined using opportunity cost analysis, since more than 80% of the deforestation that occurred during the historical period in the reference region occurred in areas where post-deforestation activity is profitable, as demonstrated below.

To this end, the economic viability of agricultural production was spatialized in the project's Reference Region. Viability was defined as the difference between the sale price of cattle and soybeans (R\$/ha) (the main agricultural products in the region) and the average production costs (R\$/ha) and transportation costs (R\$/ha/km) to take the product to the nearest consumer center, whether a meatpacking plant, in the case of cattle, or a port in the case of soybeans. The sale and transportation prices and production costs of soybeans and cattle were collected from the most appropriate data sources for each type of product and for each type of information. The search was directed to the state of Rondônia or averages were calculated for several Brazilian states (Table 9). As a result, a unique profit map (R\$/ha) was generated for each activity (sale of cattle and soybeans) within the reference region.

Table 9 - Prices and costs raised for the Beef Cattle and Soybean activities.

Activity	Local	Sale Price (R\$/ha)	Production Cost (R\$/ha)	Transportation Cost (R\$/ha/km)
Beef Cattle ³²	State of Rondônia	R\$ 3.948,00	R\$ 3.360,00	R\$ 0,038

³² Fonte: Imazon - <https://imazongeo.org.br/#/>

Soybean ³³	Selling price = State of Rondônia. Production cost and transportation cost = average between different states	R\$ 6.254,15	R\$ 2.788,04	R\$ 0,91
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Subsequently, the following steps were taken:

- Two distance rasters were generated from each pixel to the nearest slaughterhouse and port (km), with pixels measuring 30m x 30m. The pixel distances to slaughterhouses within the Reference Region range from 2 to 160 km, while the distance to ports ranges from 0 to 129 km;
- The distance rasters were multiplied by the respective transportation cost data collected (R\$/km/ha), generating maps whose pixel values represent the transportation cost of each pixel to the nearest slaughterhouse or port (in R\$/ha);
- The fixed costs of cattle and soybean production (in R\$/ha) were added to the respective transportation cost maps above, transforming them into total cost maps (in R\$/ha);
- The fixed sales values of cattle and soybeans (in R\$/ha) were subtracted from the respective total cost maps to generate profit maps (in R\$/ha) for the sale of cattle and soybeans;
- The maximum profit value of the two activities was calculated for each pixel, generating a maximum profit map with post-deforestation activity in the reference region;
- The economic viability map of deforestation was obtained by filtering the pixels where the maximum profit > 0 (Figure 15);
- Finally, the leakage belt was obtained by selecting pixels with positive viability adjacent to the project area, up to a distance radius of 15 km that were of forest cover class at the start of the project (Figure 15).

³³ Fonte: **Informações Geográficas** — Agência Nacional de Transportes Aquaviários (ANTAQ) (www.gov.br);

APROSOJA Brasil. Custos de produção de soja: safra 2018/2019 e 2019/2020. Available at: https://aprosojabrasil.com.br/wp-content/uploads/2019/05/4-CUSTOS-18.19_19.20.pdf;

CONAB — Companhia Nacional de Abastecimento. Safras de Grãos. Available at: <https://www.conab.gov.br/info-agro/safras/graos>;

SIFRECA — Sistema de Informações de Fretes. Mercado de Soja. Available at: <https://sifreca.esalq.usp.br/mercado/soja>.

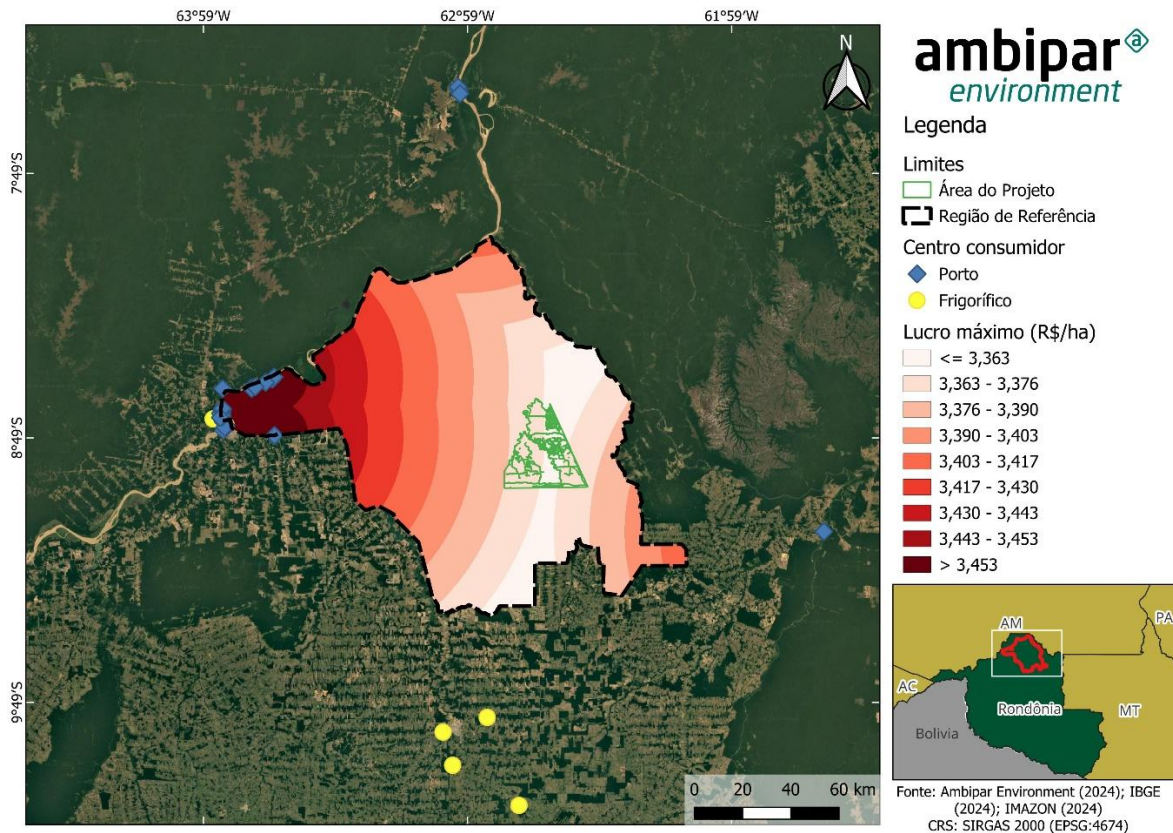


Figure 15 Spatialization of the maximum profit in relation to the Project Area.

Thus, the leakage belt is defined as the area of forest where post-deforestation activity would be economically viable, up to a radius of 15 km from the project area. This boundary potentially encompasses the most likely areas for mobility of deforestation agents in the event of leakage, and the regions with current deforestation. In addition, its size was chosen to accommodate at least the area of the baseline deforestation projections of the leakage belt and the project area, totaling 72,843 ha. This area is considered the final boundary of the Manoa REDD+ Project's leakage belt (Figure 16).

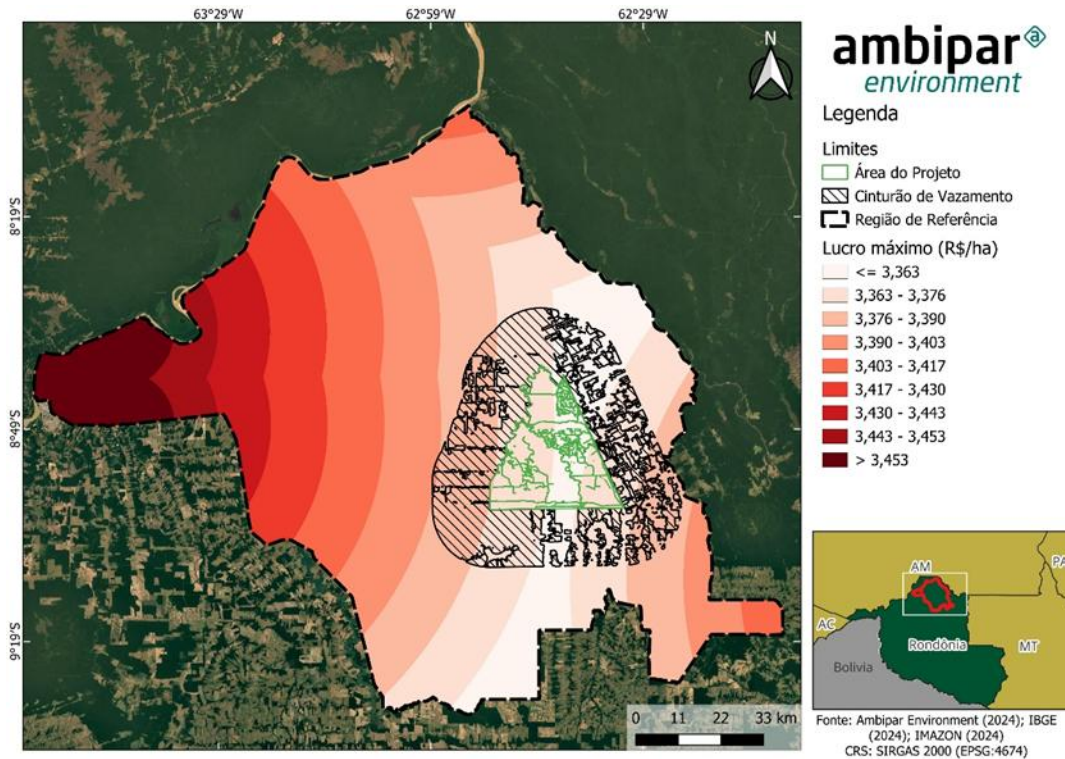


Figure 16 - Leakage Belt Boundary.

In accordance with Section 5.1.3.3 of the VM0015 v1.2 methodology, a spatial analysis was conducted to verify the existence of other registered VCS AFOLU projects near the Manoa REDD+ Project area. The analysis identified the REDD+ RESEX Jacundá project as the closest AFOLU initiative; however, there is no spatial overlap between its project area or leakage belt and the leakage belt defined for the Manoa Project. This confirms that there is no interference or double counting risk with other AFOLU projects. A map showing the location of the Manoa Project's leakage belt in relation to nearby AFOLU projects has been generated and is presented in Figure 17, below.

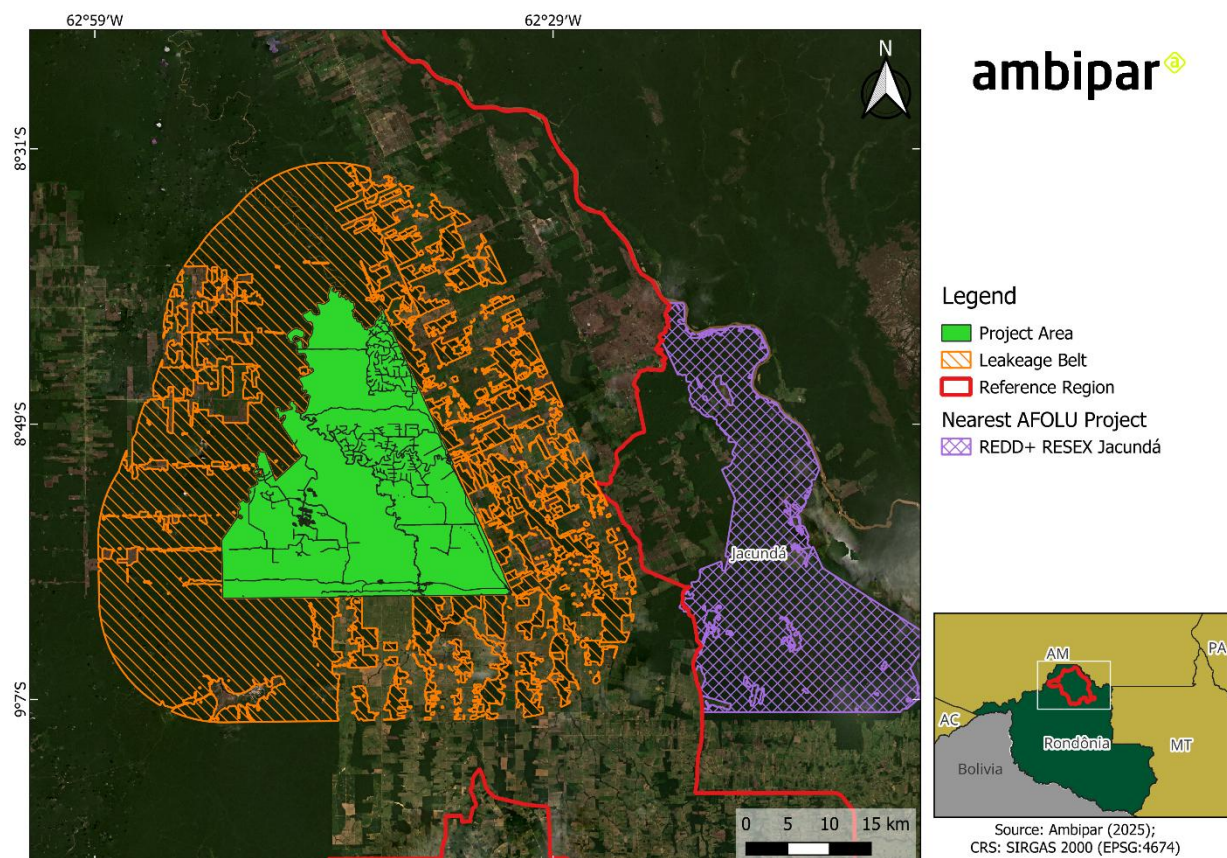


Figure 17 - Spatial relationship between the Manoa REDD+ Project Leakage Belt and nearby AFOLU Projects.

Leakage Management Zones

The Leakage Management areas were defined based on the following criteria:

- Areas that were deforested by the end of the historical period (December 2022);
- Areas located in a zone of influence of up to 1.5 kilometers around the interview points carried out by the socio-economic studies (Figure 18), where the project intends to carry out activities;
- Additionally, the area of the 2MANOA Forestry Education Center (CEFLM) was also included alongside the Leakage Management Areas, as it is not part of the Project Area and represents the location where most of the events held by the project will take place.

The LMA consists entirely of non-forest land as of the project start date, including areas of pasture and other anthropized land cover. The selection of the influence zone's location took into account that the predominant economic activity among respondents in the socioeconomic survey (47%) within the LMA

(Leakage Management Area) is beef cattle ranching³⁴. This places them in the category of the main deforestation agents in the reference region, as described in Section 3.4.3.

In addition to the mentioned criteria, the project's activity management plan (presented in Section 1.12 and in section 2.1.8 of the CCB PD) was also used to define leakage management areas, specifically for activities "Promotion of environmental education and encouragement of science"; and "Training of workforce", especially the training with environmental institutions. With those activities the Project intends address socioeconomic issues that lead to deforestation, preventing leakage. It is important to note that these same criteria were used in the first baseline, and much of the area already contains some management activity.

In total, the boundary of leakage management area covers 9.029 hectares.

The delineation of the Leakage Management Area (LMA) was not only based on spatial and socioeconomic criteria, but also explicitly guided by the Project's Activity Management Plan, which outlines where and how the proposed AUD activities will be implemented. This plan, which has been shared with the VVB at validation, includes detailed geographic targeting for actions such as annual technical visits to neighboring properties to raise awareness about fire prevention, environmental education programs with local schools held at the Manoa Forestry Education Center (CEFLM), training sessions for rural producers on sustainable alternatives to fire-based pasture preparation, and capacity-building in low-impact forest management for environmental institutions such as SEDAM and ICMBio. These activities were specifically designed to reduce the risk of activity-shifting leakage by addressing the drivers of deforestation identified in the reference region (particularly cattle ranching and the use of fire for land management).

These activities aim to mitigate the risk of activity-shifting leakage by directly engaging with stakeholders identified as primary deforestation agents—namely, small- and medium-scale cattle ranchers who rely on fire for pasture preparation. Among them, a key initiative is the presentation of firefighting techniques and the promotion of sustainable alternatives to fire-based pasture preparation, to be conducted at least once every two years. This activity specifically aims to strengthen the community's capacity for wildfire prevention and response. Its effectiveness will be monitored through the measurement of burned areas (in hectares) within the LMA, with the expectation that fire incidence will decline over time. By reducing fire-related impacts—a prominent driver of deforestation in the region—this activity is expected to have a direct impact on leakage mitigation. Educational campaigns, technical visits, and institutional training further support the transition toward low-impact practices, reinforcing local resilience and community commitment to forest conservation. The alignment of these interventions with the Project's Activity Management Plan and their implementation in strategically selected areas enhances their capacity to prevent leakage while generating co-benefits for both people and ecosystems.

The LMA boundaries were drawn to ensure consistency with the intervention zones defined in the Activity Management Plan. This alignment ensures that the zones selected are not arbitrary but are areas in

³⁴ Diagnóstico Socioeconômico e Ambiental da região do Projeto REDD+ Fazenda Manoa – Cujubim (Report version, page 14)

which concrete project activities are planned, managed, and monitored. Thus, the delineation complies with VM0015 v1.2, Section 5.1.4, which requires that leakage management zones be based on existing or planned project activity areas.

In line with VM0015 v1.2, the delineation of the leakage management area will be reassessed and validated at each baseline validity period.

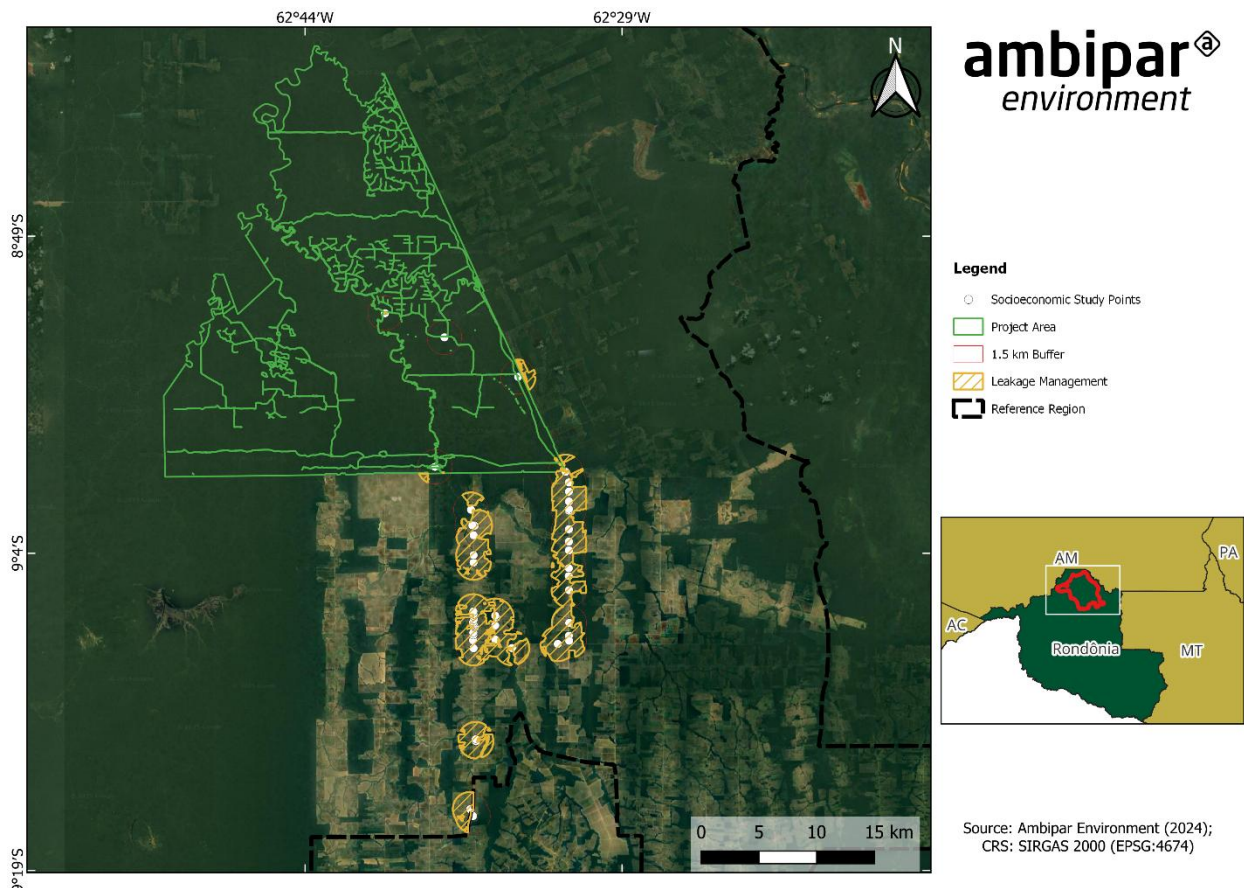


Figure 18 Leakage Management Area boundaries.

Forest

The forest area was identified based on the results of the Satellite Monitoring Project for Deforestation in the Legal Amazon (PRODES) of the National Institute for Space Research (INPE).

The forest area identified by PRODES in the Reference Region was 929,110 hectares as of December 31, 2022 (*end of the historical period*). In this analysis, the PRODES matrix data containing the record and quantification of deforested areas greater than or equal to 6.25³⁵ hectares was added with the annual

³⁵ Available at: <https://terrabrasilis.dpi.inpe.br/geonetwork/srv/eng/catalog.search#/metadata/507294db-a789-42dd-9158-9dea77d9293f>

increment vector data containing records of deforested areas between 1 and 6.25 hectares currently made available by PRODES³⁶.

This criterion is aligned with the definition required by VM0015 for the correct definition of forests (VM0015 Definitions v1.2, page 8). Furthermore, since PRODES has a resolution of 30m (0.9ha) and permanently excludes converted forests once deforestation is detected, forests mapped by PRODES comply with the FAO definition: *“Land with more than 0.5 hectares, with trees taller than 5 meters and a canopy cover of more than 10%, or trees capable of achieving these parameters in situ.”*

PRODES maps forest areas based on the forest classification of the Brazilian Institute of Geography and Statistics (IBGE). The IBGE definition of forests is based on the classes of life forms present. According to the Brazilian Vegetation Technical Manual, forests are defined as *“a set of synusia dominated by tall phanerophytes, with four well-defined strata (herbaceous, shrubby, small tree/low tree and tree)... presenting dominance of two phanerophyte life forms: macrophanerophytes, with heights varying between 30 and 50 m, and mesophanerophytes, whose size ranges between 20 and 30 m in height”*. The IBGE classification is precisely the definition used by Brazil's national communication periodically submitted to the UNFCCC³⁷.

³⁶ Available at: <https://terrabrasilis.dpi.inpe.br/geonetwork/srv/eng/catalog.search#/metadata/5f5cfb4c-e207-4932-9c93-2d51cea8adbc>

³⁷ Brazil, MCTI. 2020. “Fourth national communication of Brazil to the United Nations framework convention on climate change”. < https://antigo.mctic.gov.br/mctic/export/sites/institucional/arquivos/SIRENE/Comunicacoes-Nacionais-do-Brasil-a-UNFCCC/2020_12_22_4CN_v5_Ingles.pdf>

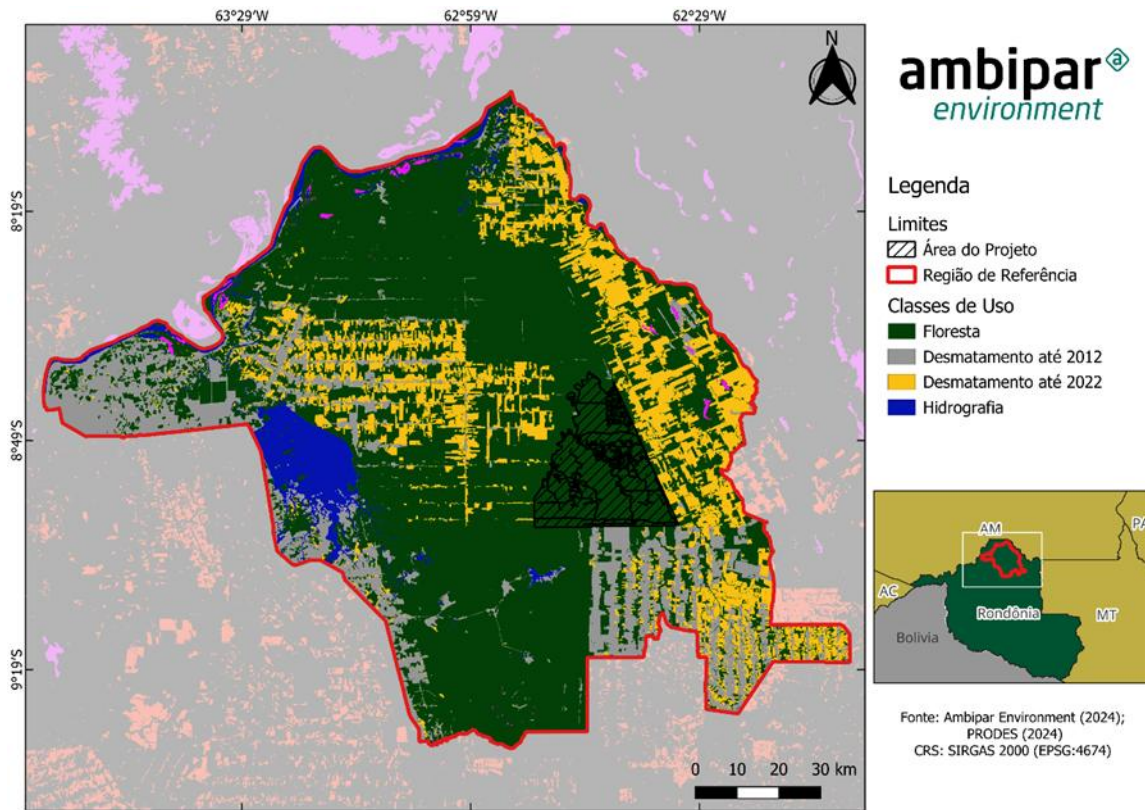


Figure 19– Forest in the Reference Region until December 2022.

3.3.2 Temporal Boundaries

Start and End Dates of the Historical Reference Period: The historical period of the Manoa REDD+ Project covers from 01/08/2012 to 31/12/2022.

Start Date of the AUD Project Activity Crediting Period: 01/01/2013

Start and End Dates of the First Baseline Validity Period: 01/01/2013 – 31/12/2022

3.3.3 Carbon Pools

Carbon Pools	Included/Excluded	Justifications/Explanation of Choice
Above Ground	Tree: included	Change in carbon stocks in this pool is always significant
	Not tree: excluded	Should be included in categories where the final land cover class is perennial crop. Pool was not inventoried for the

Carbon Pools	Included/ Excluded	Justifications/Explanation of Choice
		composition of the final forest carbon stock of the project area.
Below Ground	Included	Pool represents 15% of expected emissions in the baseline scenario
Dead wood	Included	Changes in carbon stocks for this pool are considered significant
Harvested Wood products	Excluded	Not included, the wood products pool in the baseline scenario is smaller than in the scenario with the project
Litter	Excluded	Excluded, as it does not lead to a significant overestimation of the net reduction of anthropogenic GHG emissions in the AUD project activity. This exclusion is conservative.
Organic carbon in soil	Excluded	Recommended when forests are converted to agricultural land. Should not be measured in conversions to pasture and perennial crops, according to VCS Methodology Requirements, 4.2

3.3.4 Sources of GHG Emissions

	Source	Gas	Included / Excluded	Justification / Explanation of choice
Baseline scenario	Burning of woody biomass	CO ₂	Excluded	Excluded as recommended by the applied methodology. Counted as carbon stock change.
		CH ₄	Included	Included as non-CO ₂ emissions from biomass burning in the baseline scenario, according to the methodology.
		N ₂ O	Included	Included as non-CO ₂ emissions from biomass burning in the baseline scenario, according to the methodology.
	Livestock emissions	CO ₂	Excluded	Not a significant source
		CH ₄	Excluded	Not a significant source
		N ₂ O	Excluded	Not a significant source
Project scenario	Burning of woody biomass	CO ₂	Included	Counted as emission ex-post due to forest degradation by fire
		CH ₄	Included	Included as non-CO ₂ emissions from biomass burning in the project scenario, according to the methodology.
		N ₂ O	Included	Included as non-CO ₂ emissions from biomass burning in the project scenario, according to the methodology.
	Livestock emissions	CO ₂	Excluded	Not a significant source

	CH ₄	Excluded	Not a significant source
	N ₂ O	Excluded	Not a significant source

Deviations in the project description in relation to the initial PD:

In section 4.4 “Project Boundaries” on page 79 of the initial Manoa REDD+ Project PDD, the end of the first fixed baseline period is set at 31-December-2023. However, the period from 01-January-2013 to 31-December-2023 results in 11 years and not 10 as required by the VCS Standard v4.4 (for projects registered before 19 January 2022, as is the case with Manoa). Therefore, all documents will refer to the first fixed baseline period as 01-January-2013 to 31-December-2022.

3.4 Baseline Scenario

3.4.1 Determination of the Most Plausible Baseline Scenario

The baseline scenario was established according to the VM0015 V1.2 methodology and the “VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, v3.0”. The additionality process, including the identification of alternative scenarios, investment analysis, barriers and common practices, was discussed in detail in the additionality section of this document (see section 3.5).

Step A: Reuse the plausible alternative land use scenarios to the REDD project activity that have been listed as an outcome of Sub-step 1b of the additionality tool VT0001.

Alternative plausible land use scenarios for the project's REDD activity were reused, as listed in Substep 1b of the VT0001 additionality tool. The following scenarios were considered:

Scenario I - Continuation of land use activities prior to the Project (baseline scenario):

The details of this scenario are described in section 3.5, which deals with Additionality.

The identification of the baseline scenario followed the guidelines established by the VT001 tool and other guidelines defined by the VM0015 V1.2 methodology, supplemented by updated information obtained from the socioeconomic diagnosis carried out by Ecoporé in 2023. This diagnosis provided new information on the actions of deforestation agents and drivers, which influence the baseline scenario and reinforce the understanding of the dynamics of deforestation in the region. Among the main updates, the growing role of livestock expansion stands out, with a 47.64% increase in pasture areas between 2013 and 2022, and the expansion of soybean monoculture, with a significant increase of 5,643.81% in cultivated areas. These vectors have become more relevant, increasing pressures on forest cover.

The two other alternative scenarios are:

Scenario II - Certified Forest Management with REDD+ activities without registration as a VCS AFOLU Project:

This scenario represents the implementation of sustainable forest management activities certified by the FSC or PEFC, together with complementary activities to contain and monitor deforestation caused by the agents of “scenario 1” and social and biodiversity activities described in Section 1.12.

Scenario III – Timber Forest Management without REDD+ activities and without registration as a VCS AFOLU Project:

In this scenario, there are sustainable and legalized timber forest management activities, but without additional initiatives and investments focused on communities and local biodiversity to contain and monitor deforestation caused by agents. Although management assists in maintaining carbon stocks, it is less effective against the pressure of deforestation in forests. Economic viability is low because it is a volatile market and a very costly activity, especially when compared to agriculture and illegal logging. Thus, additional investments and activities are required.

Step B: Determination of the Most Plausible Baseline Scenario

As the project generates financial benefits beyond carbon revenues through the commercialization of tropical timber, the comparative investment analysis (Option II) of the VT0001 tool was applied to determine the additionality of the project. Scenarios I, II and III were analyzed, considering only the revenue from the sale of wood (for more details on the economic model see section (3.4.1)).

The financial indicator chosen for the comparative analysis was the Net Present Value (NPV), as it allows for a comprehensive valuation by incorporating the value of money over time, summability, and exclusive dependence on cash flow and cost of capital.

A conservative analysis until the year 2042 revealed a NPV of R\$ 33,097,569 for scenario I, R\$ 3,303,378 for scenario III and a NPV of - R\$ 10,650,648 for scenario II, indicating that the additional costs of implementing the REDD+ project make the investment financially unfeasible without the additional revenue from the trading of carbon credits.

Thus, according to Option II of the VT0001 tool, the most plausible baseline scenario is the one that presents the most favorable financial indicator, that is, the "no REDD+" scenario, which corresponds to the continuity of certified logging without additional REDD+ activities.

The sensitivity analysis reinforces this conclusion by demonstrating that even in optimistic variations in the price of timber and REDD+ costs, the "with REDD+" scenario remains financially less attractive than the "without REDD+" scenario. Thus, the need for additional revenue through the commercialization of carbon credits is essential to make the project economically viable.

Based on the application of the above steps and the analysis of the alternative scenarios, it was determined that the most plausible baseline scenario for this project is the continuity of previous activities, with logging followed by conversion of areas to pasture or real estate speculation, motivated by the appreciation of land with agricultural activities. The quantification of GHG emissions under this scenario followed the applicable activity modules according to the methodology adopted.

3.4.2 Update information on agents, drivers and underlying causes of deforestation

According to the VM0015 V1.2 methodology in its section 6.3, baselines should be reviewed over time, as the agents, drivers and underlying causes of deforestation change dynamically. Therefore, the baseline should be revisited as established in the most recent version of the VCS Standard, which in this case followed the 10-year period.

Information on agents, drivers and underlying causes of deforestation in the reference region should be collected periodically, as it is essential to improve future deforestation projections and project activity planning.

Therefore, the following information is updated based on a socioeconomic diagnosis carried out in 2023 by Ecoporé.

3.4.3 Description of Baseline Scenario (Step 2): Analysis of Agents, Drivers and Underlying Causes of Deforestation and Their Likely Future Development

Identification of Deforestation Agents

Based on field interviews³⁸, consultation with residents and representatives of local institutions, the following groups of deforestation agents were identified:

Agents of deforestation in the reference region: Group 1 - Cattle ranchers; **Group 2** - Illegal loggers; **Group 3** - Rural entrepreneurs; **Group 4** - Land grabbers.

Following the requirements of Section 6.2.1 of VM0015, v1.2, Identification of deforestation agents, below is information on each of the agent groups.

1) Name: Cattle Ranchers.

- **Brief description:** Cattle ranchers have emerged as the main agent of deforestation, many of them migrants from other regions of Brazil, attracted by the availability of land. This sector, driven by both government policies and market demand, is responsible for converting vast areas of forest into pasture. This activity not only results in a loss of biodiversity but also contributes significantly to greenhouse gas emissions and changes in the hydrological and nutrient cycles. Livestock farming makes an important contribution to the municipality's GDP, as mentioned above. This activity offers producers the security of a consolidated supply chain, with internal and external markets, little influence on natural climatic conditions on production, well-established sanitary policies and easy access to credit and investment.

- **Brief assessment of the most likely changes in population size:** The growth of the pasture area in Cujubim to 72,632 hectares (an increase of 47.64% between 2013 and 2022) reflects the expansion of cattle ranching, especially in the northern and eastern regions of the municipality, including the outskirts of Fazenda Manoa.

³⁸ Data collected in September 2023 for the Socioeconomic Diagnosis carried out by Ecoporé (2024).

- **Statistics on historical deforestation:** According to researchers from the Emílio Goeldi Museum, it is estimated that cattle ranching is responsible for approximately 80% of deforestation in the Amazon³⁹.

2) Name: Illegal loggers.

- **Brief description:** These agents often operate in remote areas, with little enforcement, and may be associated with informal or illegal networks, seeking quick profits through the extraction and sale of timber of high commercial value, without considering sustainable practices. Illegal logging plays a significant role in creating the infrastructure for deforestation. This movement takes place through the opening of roads, sometimes clandestine, in the forest. These roads are used to transport illegally harvested timber, but they also facilitate access to the interior of the forest for other actors, such as farmers and cattle ranchers, thus increasing the risk of deforestation. In addition, the creation of camps and bases of operations, with minimal infrastructure, provides shelter and logistics for illegal loggers, allowing them to remain in the area for long periods and carry out deforestation activities more efficiently. These spaces can be used as a base for larger movements of people to demarcate land for subsequent deforestation.

- **Brief assessment of the most likely changes in population size:** The activity of illegal loggers has continued, with signs of an increase in certain areas due to the demand for wood and the lack of effective enforcement. The area of illegal logging in the Amazon grew by 19% in one year, from 106,000 hectares between August 2021 and July 2022 to 126,000 hectares between August 2022 and July 2023⁴⁰.

- **Statistics on historical deforestation:** Almost 30% of logging in the Amazon is illegal. More than 100,000 hectares of Amazon forests were illegally logged from August 2021 to July 2022. This data is contained in the document "Mapping logging in the Amazon", launched by the Simex Network (Imazon, Idesam, Imaflora and ICV) during COP-28 in Dubai. This rate of unauthorized logging is very high and represents serious socio-environmental damage to the Amazon, as well as economic damage, especially associated with the timber production chain. Another striking fact is that the majority (60.9%) of illegal logging was identified on private rural properties with a Rural Environmental Registry (CAR) and 25.6% was concentrated on indigenous lands and conservation units⁴¹.

3) Name: Rural entrepreneurs.

³⁹ Pecuária é responsável por 80% do desmatamento na Amazônia, afirma pesquisadora. Available at: <https://www.brasildefato.com.br/2019/09/05/pecuaria-e-responsavel-por-80-do-desmatamento-na-amazonia-afirma-pesquisadora/> Accessed in April 2025.

⁴⁰ Extração ilegal de madeira aumentou 19% na Amazônia. Available at: <https://imazon.org.br/imprensa/extracao-ilegal-de-madeira-aumentou-19-na-amazonia>. Accessed in April 2025.

⁴¹ COP 28: Quase 30% da exploração de madeira na Amazônia é ilegal — Imazon. Available at: <https://imazon.org.br/imprensa/cop28-quase-30-da-exploracao-de-madeira-na-amazonia-e-ilegal/>. Accessed in April 2025.

- **Brief description:** This deforestation agent is made up of large investors and agribusiness companies, with access to capital and advanced technology, focused on large-scale production for export, especially commodities such as soy. Agriculture, especially soy monoculture, is a secondary but crucial agent in the deforestation process. Government incentives and increased soy production are significant amplifiers of land use transformation.

- **Brief assessment of the most likely changes in population size:** The significant increase in the area cultivated with soybeans (a growth of 5,643.81% between 2013 and 2022) demonstrates the transition of the local economy, based on logging and livestock farming, to intensive agriculture, which displaces livestock farming to forest areas. The growth in soybean area from 210 to 12,062 hectares reflects the influence of policies that favor large-scale agriculture, often to the detriment of environmental sustainability. This expansion, concentrated mainly in the southern and western portions of the municipality, takes advantage of existing infrastructure, such as paved roads, to facilitate access and transportation, reinforcing the dynamics of land concentration and the intensification of agriculture.

- **Statistics on historical deforestation:** The soy moratorium, implemented in 2006, helped reduce deforestation associated with soy cultivation in the Amazon. However, there has been recent pressure to end it, which could have a negative impact on deforestation rates⁴². According to data from IBGE's Municipal Agricultural Survey (PAM), between 2022 and 2023, the area planted with soybeans in Rondônia increased by 20.5%, from 489,000 hectares to 589,000 hectares⁴³. According to the Soy Moratorium, implemented to monitor and reduce deforestation associated with soy cultivation in the Amazon, between 2008 and 2021, 8,954 hectares of soy were identified in Rondônia planted in areas deforested after 2008, which represents 4.6% of the soy detected in the monitoring and 0.7% of the total area deforested in the state during the Moratorium period⁴⁴.

4) Name: Land grabbers.

- **Description:** These agents act in a clandestine manner, often associated with fraudulent schemes and corruption, and aim to unduly appropriate and increase the value of public lands through false property titles, which are then sold or used for economic activities such as livestock and agriculture. The grabbing of public land increases real estate and land speculation and is a critical factor in deforestation in Cujubim. Although the occupation of public lands is the main activity of land grabbers, there are also cases of these criminals invading private property. This conversion of forest areas into land for sale or

⁴² Brazil farmer lobby asks to lift soybean ban from deforested Amazon rainforest | Reuters. Available at: <https://www.reuters.com/markets/commodities/brazil-farmer-lobby-asks-lift-soybean-ban-deforested-amazon-rainforest-2024-12-11/>. Accessed in April 2025.

⁴³ Expansão do agronegócio em Porto Velho amplia destruição ambiental. Available at? <https://www.vozdaterra.com/2024/09/expansao-da-soja-e-do-agronegocio-em.html>. Accessed in April 2025.

⁴⁴MORATÓRIA DA SOJA. Available at: https://reporterbrasil.org.br/wp-content/uploads/2024/05/Abiove_relatorio-moratoria-soja-safra21_22.pdf. Accessed in April 2025.

the development of agricultural activities intensifies the pressure on the land and contributes to the loss of natural habitats⁴⁵.

- **Brief assessment of the most likely changes in population size:** The population trend of land grabbers in Rondônia does not follow a traditional demographic pattern as in established social groups, since land grabbers do not constitute a formally registered population. However, it is possible to analyze the trend of growth or reduction of this group based on indirect indicators such as the increase in illegal occupations, records of deforestation on public lands, and land conflicts. It is therefore common to find old and current news stories about land grabbing in Rondônia, showing that this has been a common practice in the territory throughout its history^{46, 47, 48, 49}. In addition, the expansion of highways such as the BR-319 and BR-364 has made it easier for land grabbers to access remote areas of forest, and the presence of clandestine roads and branches allows for faster illegal subdivision and occupation.

- **Statistics on historical deforestation:** According to data from the Amazon Environmental Research Institute (IPAM), half of the deforestation in the Amazon region between 2019 and 2021 occurred on public lands through land grabbing⁵⁰. Also, according to IPAM, in 2022, there was record deforestation in the Amazon linked to land grabbing⁵¹.

Changes in relation to the first baseline: The second analysis of agents, carried out in 2023, brought updates on the growing influence of livestock farming, especially the expansion of pasture areas, and soybean monoculture, which has become a significant secondary agent in deforestation. The role of illegal loggers was maintained, but with a greater focus on the creation of access infrastructure, such as roads, to facilitate extraction and which ultimately influence deforestation. Finally, land grabbing of public lands was identified as a critical driver of deforestation, intensifying land pressure and contributing to the loss of natural habitats. These updates to the agents, however, do not change the fact that **illegal deforestation remains the dominant common practice**, as identified in the first baseline.

⁴⁵ O que é grilagem de terras e como combater esse crime na Amazônia. Available at: <https://ipam.org.br/grilagem/>. Accessed in April 2025.

⁴⁶ PF combate grilagem de terras na Terra Indígena Igarapé Lage em Rondônia -<https://www.gov.br/pf/pt-br/assuntos/noticias/2025/04/pf-combate-grilagem-de-terras-na-terra-indigena-igarape-lage-em-rondonia>. Accessed in April 2025.

⁴⁷ Rondônia é o terceiro estado da Amazônia Legal com mais conflitos no campo, aponta estudo. Available at: <https://g1.globo.com/ro/rondonia/noticia/2021/06/06/rondonia-e-o-terceiro-estado-da-amazonia-legal-com-mais-conflitos-no-campo-aponta-estudo.ghtml>. Accessed in April 2025.

⁴⁸ Caso de grilagem liga frigoríficos a rede de corrupção e lavagem de dinheiro. Available at: <https://reporterbrasil.org.br/2024/05/caso-grilagem-frigorificos-corrupcao-lavagem-dinheiro/>. Accessed in April 2025.

⁴⁹ A grilagem de terras e a reforma agrária no estado de Rondônia. Available at: <https://www.anpr.org.br/artigos/a-grilagem-de-terras-e-a-reforma-agraria-no-estado-de-rondonia>. Accessed in April 2025.

⁵⁰ O que é grilagem de terras e como combater esse crime na Amazônia. Available at: <https://ipam.org.br/grilagem/>. Accessed in April 2025.

⁵¹ Recorde de desmatamento na Amazônia está ligado à grilagem de terras públicas. Available at: <https://ipam.org.br/recordede-desmatamento-na-amazonia-esta-ligado-a-grilagem-de-terras-publicas>. Accessed in April 2025.

Identification of Deforestation Drivers

1) Variables that explain the amount (hectares) of deforestation

Identification of deforestation drivers

- Livestock farming
- Agriculture (mainly soybeans, but commodities in general)
- Illegal and predatory logging
- Real estate and land speculation/land appreciation

An analysis of the growth of the cattle herd between 2013 and 2023 reveals a scenario of considerable expansion in the area surrounding the Manoa REDD+ Project. The municipalities of Cujubim, Porto Velho, Itapuã do Oeste and Candeias do Jamari showed growth of 126.20%. Candeias do Jamari and Cujubim recorded significant increases of 103.68% and 98.87%, respectively. Itapuã do Oeste had a more modest growth of 51.11%. At the state level, Rondônia showed an increase of 46.64%, while the other municipalities in the state saw growth of 38.60%⁵².

This growth is associated with the growing number of rural properties registered with the agricultural defense agency; both the total number of properties and the properties with cattle experienced notable growth. Cujubim led the increase in the total number of rural properties with a jump of 191.52%, followed by Porto Velho with 149.76%. In the case of properties with cattle, Porto Velho again stood out with a growth of 113.29%, while Cujubim and neighboring municipalities showed increases of 77.80% and 81.83%, respectively. Interestingly, Candeias do Jamari showed a reduction of 3.72% in properties with cattle.

In addition, agricultural mechanization has expanded, the area planted with temporary crops increased from 1,420 ha in 2013 to 25,044 ha in 2022⁵³, represented by the significant increase in monoculture areas, especially soybeans, which are replacing degraded pastures, transforming the agricultural landscape of the region.

Several actions supported by public entities that took place in the region stimulated a change in the local context compared to the first baseline scenario described in the first VCS/CCB PDD of Manoa REDD+. Although livestock farming is one of the main direct causes of deforestation in the Amazon, since there is a significant correlation between the number of cattle and deforestation rates in the region's

⁵² IDARON. Informe semestral de campo referente a 1ª campanha de atualização cadastral-2023 < https://www.idaron.ro.gov.br/wp-content/uploads/2023/07/Reb_bubalino_2023.1.pdf>

IDARON. Informe semestral de campo referente a 34ª etapa de vacinação contra febre aftosa período 15/04/13 a 15/05/2013 < https://www.idaron.ro.gov.br/wp-content/uploads/2018/11/RELAT_34%C2%AA_2013_DE_VACINACAO_FA_Rebanho_geral.pdf>

⁵³ ECOPORÉ, 2024. Diagnóstico Socioeconômico do Projeto REDD+ Manoa, 2024. and MAPBIOMAS. Projeto MapBiomias – Coleção 8.0 da Série Anual de Mapas de Cobertura e Uso da Terra do Brasil. 2023.

municipalities, showing that the activity is closely linked to the loss of forest cover⁵⁴⁵⁵, there was an increase in commodities in northern Rondônia, validated by the replacement of pastures, land leasing and high price per hectare of agricultural land (SILVA and MICHALSKI, 2020). This point has been reflected since 2016, when Embrapa recorded a 70% increase in soybean planting in the nine municipalities that make up the Jamari Valley. According to data collected by the National Supply Company (Conab), soybeans are the main agricultural product in the state of Rondônia, and the Jamari Valley region in particular attracts many producers due to the favorable prices of its land on the market, in addition to its proximity to the capital's port. More recent data from IBGE show a 50% increase in soybean planting from 2019 to 2020 in Cujubim alone. In addition, the value of soybean production in Cujubim increased by approximately 149%⁵⁶ from 2019 to 2021, demonstrating a high financial incentive for the production of this grain, favoring the activities of **Group 3**.

In parallel with this context, in March 2018, the Soldado da Borracha Ecological Station (ESEC Soldado da Borracha) was created by Decree No. 22,690, of March 20, 2018. ESEC Soldado da Borracha was a fully protected area under state responsibility and was created with the aim of preserving nature and promoting the development of scientific research. This fact is configured with the cancellation of property registrations when the area became a Conservation Unit, according to Law 9,985/2000, Art. 9, § 1. Analyzing satellite images from the previous year (2017), it is possible to identify that where the ESEC was implemented, large areas were being deforested. With this, it was possible to conclude that, once the ESEC was established, there would be a reduction in the action of deforestation agents, which became more aggressive than that identified in previous years in the region; however, the unfolding of the situation in the area resulted in exactly the opposite scenario.

In September of the same year, the Soldado da Borracha ESEC, along with 10 other Conservation Units, which together totaled 537 thousand hectares, were considered extinct. In view of this, according to G1⁵⁷, there was, once again, a large advance in deforestation over the Conservation Units, especially in the Soldado da Borracha ESEC. Once the ESEC was considered extinct, the areas returned to private property and, later, in 2021, the Court of Justice of Rondônia considered the extinction of the ESEC and the other 10 Conservation Units unconstitutional, returning them to areas of public domain. The consequence of this entire process was the increase in real estate speculation, encouraging land invasions, mainly by agents of **Group 4**, due to poor governance.

⁵⁴ RIVERO, Sérgio; ALMEIDA, Oriana; ÁVILA, Saulo; OLIVEIRA, Wesley. Pecuária e desmatamento: uma análise das principais causas diretas do desmatamento na Amazônia. Nova econ., v. 19, n. 1, 2009. Available at: <https://www.scielo.br/j/neco/a/jZHjd9B8ZghY7tG9G7qchTk/>

⁵⁵ DAL MAGRO, T. R.; SANTOS, M. J. dos; GALVÃO JÚNIOR, L. da C.; SILVA, J. L. G. da; OLIVEIRA, E. A. de A. Q. Produção bovina e desmatamento: análise da distribuição espacial da atividade pecuária no estado de Rondônia. Informe GEPEC, [S. l.], v. 23, n. 1, p. 112–126, 2019. DOI: 10.48075/igepec.v23i1.21128. Available at: <https://e-revista.unioeste.br/index.php/gepec/article/view/21128>. Accessed on: 18 mar. 2024.

⁵⁶ Same as note above.

⁵⁷ G1. Globo. 2018. Available at < <https://g1.globo.com/ro/rondonia/noticia/2018/09/26/deputados-de-ro-aprovam-acabar-com-reserva-florestal-de-cujubim.ghtml> > Accessed on: 06 de outubro de 2021.

In conclusion, the analysis of the actions of the agents and drivers of deforestation in the Manoa REDD+ Project region reveals a panorama in which multiple forces interact and contribute to the dynamics of deforestation. The expansion of livestock farming, represented mainly by the significant increase in pasture areas, stands out as the main driver of deforestation, reflecting the direct influence of agricultural practices on the loss of forest cover. This scenario is amplified by illegal logging, which not only directly devastates forests but also paves the way for other forms of land use that are harmful to the environment.

Rural entrepreneurs, driven by the exponential growth of soybean monoculture, emerge as significant agents of change in land use, altering the landscape and putting pressure on forest frontiers. Land grabbing, on the other hand, acts as a driver of real estate speculation and agricultural expansion, contributing to the cycle of environmental degradation.

The determining drivers, both in terms of the amount and location of deforestation, highlight the complexity of the problem. Economic factors such as agricultural commodity prices and input costs, combined with population density and accessibility of forests, play crucial roles in driving deforestation.

The overall trend for future deforestation rates in the region is upward. This trend is driven by a combination of economic, political and environmental factors. Continued economic development based on agricultural expansion, coupled with uncontrolled logging and growing infrastructure, tends to accelerate deforestation. Additionally, climate change may exacerbate these effects through more severe droughts and more frequent forest fires⁵⁸.

Identification of Underlying Causes of Deforestation

There are many studies that suggest the existence of several direct and indirect causes for the deforestation of tropical forests, resulting from a complex set of relationships that contribute to the reduction of the forest (Rivero et al., 2009). They indicate that the underlying causes are related to the growth of markets and the increase in demand for products that necessarily generate changes in land use.

The characteristics and decisions of the agents are themselves determined by broader forces, the underlying causes of deforestation. Below is a list of the main **underlying causes** identified by the 2023 Ecoporé diagnosis.

1. Government Programs and Applicability of the Law

- National Integration Program (PIN)
- Settlement Project (PROTERRA)
- Government policies that favor agricultural and livestock expansion

58 MARENGO, J. A. et al. Changes in Climate and Land Use Over the Amazon Region: Current and Future Variability and Trends. *Frontiers in Earth ScienceFrontiers Media S.A.*, , 21 dez. 2018. <https://www.frontiersin.org/journals/earth-science/articles/10.3389/feart.2018.00228/full>

- Lack of rigor in the application of environmental laws and the concession of land for agricultural activities
- Reversal of Conservation Measures (Example: Soldado da Borracha Ecological Station)
- Land Conflicts (disputes between farmers, companies and the government)

2. Logging Activities

- Installation of logging industries in the region and subsequent decline of the activity, creating the need for other activities
- Absence of Policies to Incentivize Non-Timber Forest Products
- Illegal logging
- Opening of local lines and clandestine roads that facilitate deforestation

3. Expansion of Livestock and Agriculture

- Market demand that favors commodities and livestock
- Mechanization of agriculture and consequent exclusion of family farming
- Income concentration which can lead to intensive exploitation of land by large landowners

Brief Description of Underlying Causes:

- **Government Programs and Development Policies:** Cujubim, located in Rondônia, has a history closely linked to the expansion of agricultural activities in the region. Its origins are linked to the Cujubim Settlement Project (PA) ⁵⁹, an important milestone in the formation of the urban center and the establishment of a community with a significant focus on agriculture. This historical occupation dates back to the colonization encouraged in the Amazon during the second half of the 20th century⁶⁰. Government policies of the time, such as the National Integration Program (PIN) and the Land Redistribution and Agroindustry Incentive Program for the North and Northeast (PROTERRA), were instrumental in promoting the development and occupation of this region⁶¹.

Currently, government incentives for agricultural expansion are maintained, including easy credit and policies to encourage livestock farming, and have been one of the main causes of deforestation in the Cujubim region. The precarious implementation of environmental conservation policies and the encouragement of land use for livestock and agriculture have contributed to the conversion of large areas of forest into pasture⁶².

The cancellation of the Soldado da Borracha Ecological Station in Rondônia illustrates the fragility of conservation policies. Pressure from landowners and the lack of budget for compensation have resulted in political and economic challenges to environmental protection in the area. This fact,

⁵⁹ SILVA FILHO, G. A. da. Toponímia de lugares de Rondônia: Divisão Territorial de Rondônia: evolução cronológica. IBGE. Porto Velho. 53 p. 1995.

⁶⁰ AMARAL, J. Mata virgem: terra prostituta. 1a ed. São Paulo: Terceira Margem, 2004. https://www.teses.usp.br/teses/disponiveis/8/8136/tde-19062024-105716/publico/1994_JoseJanuarioDeOliveiraAmaral.pdf

⁶¹ FEARNSIDE, P. M. Settlement in Rondônia and the token role of science and technology in Brazil's Amazonian development planning. Interciência, v. 11, n. 5, p. 229-236, 1986. Available at: < <https://repositorio.inpa.gov.br/bitstream/1/20479/1/artigo-inpa.pdf> >. Accessed on 30 out. 2023.

⁶² MAPBIOMAS. Projeto MapBiomias – Coleção 8.0 da Série Anual de Mapas de Cobertura e Uso da Terra do Brasil < <https://brasil.mapbiomas.org/map/colecao-8/> >.

combined with political influence on land use, based on the direct involvement of local and state political agents in the acquisition of forest lands, ends up encouraging invasions. Proposals to extinguish forest reserves by state deputies highlight the impact of politics on land use decisions, often to the detriment of environmental preservation. Squatters invade land, deforest the forest and can later obtain official recognition with formal property titles⁶³.

- **Logging Activities:** The reduction in log production has impacts on both land use and the regional forest economy. Although timber production has fostered employment opportunities in the industrial sector and contributed significantly to the regional economy, the adoption of forest management practices with limited consideration for long-term sustainability, combined with illegal logging activities, has precipitated the exhaustion of the region's timber resources, culminating in its decline. However, as mentioned above, timber extraction activities are responsible for the construction of road infrastructure, promoting access to previously exploited forest areas. With the exhaustion of commercially valuable timber for industry, these areas, now devoid of economically viable timber resources, are often converted to the development of other economic activities with greater potential for profitability.
- **Expansion of Livestock and Agriculture:** The local economy, initially based on family farming, has evolved towards commodity production, with an emphasis on soybeans and corn, reflecting a significant transition in land use. Livestock farming, in turn, has become the main agent of deforestation, with a 47.64% increase in pasture area between 2013 and 2022⁶⁴, which not only impacted biodiversity but also contributed to greenhouse gas emissions. At the same time, soybean monoculture grew exponentially, rising from 210 to 12,062 hectares⁶⁵, revealing the growing priority given to intensive agriculture to the detriment of environmental sustainability.

How Underlying Causes Influence the Action of the Identified Vectors and Agents

- **Government Programs and Development Policies:** Government policies aimed at livestock and agriculture primarily favor the actions of **Group 1** and **Group 3** agents, directly encouraging land expansion. Easy access to credit for livestock farming increases the economic dependence of these sectors, leading to a continuous increase in pressure on forests.

The weakness in the application of environmental policies, in turn, directly impacts the actions of **Group 2** and **Group 4** agents, allowing their illegal activities to operate.

- **Logging Activities:** Logging not only generates immediate deforestation, but also creates the conditions for other sectors to expand into deforested areas. The creation of roads and camps makes the deforestation process more efficient, resulting in greater loss of forest cover. This is a direct cause for the actions of **Group 2**, but indirectly it allows the actions of **Group 4**, which, by taking advantage of the ease of access through the opening of illegal roads, will act to seek land grabbing.

63 ARAUJO, Claudio; ARAUJO BONJEAN, Catherine; COMBES, Jean-Louis; COMBES MOTEL, Pascale; REIS, Eustaquio J. Property rights and deforestation in the Brazilian Amazon. *Ecological economics*, v. 68, n. 8-9, p. 2461-2468, 2009. Available at: <<https://doi.org/10.1016/j.ecolecon.2008.12.015>>. Accessed on: 17 jan. 2024.

64 MAPBIOMAS. Projeto MapBiomas – Coleção 8.0 da Série Anual de Mapas de Cobertura e Uso da Terra do Brasil. < <https://brasil.mapbiomas.org/map/colecao-8/>>.

65 Projeto MapBiomas – Coleção 8 da Série Anual de Mapas de Cobertura e Uso da Terra do Brasil, acessado em 18.03.2024 através do link [oi.org/10.58053/MapBiomas/VJIJCL](https://brasil.mapbiomas.org/map/colecao-8/)

- **Expansion of Livestock and Agriculture:** The continuous need to increase livestock and agricultural production, motivated by both the market and incentive policies, causes landowners to deforest or seek new areas resulting from deforestation to expand their activities. The lack of more efficient agricultural and livestock practices contributes to the need for greater land use, contributing to the actions of agents in **Groups 1 and 3**.

Probable future development

- **Government Programs and Development Policies:** The future trend will depend on how the next public policies are designed, especially if they manage to balance economic development and environmental conservation. Without a significant change in this sense, the pressure on forests will remain high. Furthermore, it is essential that environmental laws are complied with for this scenario to change. However, there is no clear forecast for these changes to occur, which suggests that this situation will persist in the coming years.
- **Logging Activities:** With the depletion of timber resources and increased monitoring, there is a possible reduction in this activity, but the infrastructure left by the opened roads will continue to facilitate deforestation by other groups.
- **Expansion of Livestock and Agriculture:** The future trend is that the expansion of these activities will continue to be a major cause of deforestation, especially if more efficient land use practices are not implemented. The market exerts a significant influence, and there is no evidence of a trend towards a decrease in this pressure.

Measures to be implemented

Regarding the underlying causes that contribute to deforestation, the measures to be adopted by the project are aligned with the context of deforestation drivers and have been reflected in the project activities section. The proposed actions include strengthening local governance, fire prevention campaigns, environmental education initiatives, promoting scientific research, disseminating sustainable forest management as an alternative, training in this area and prioritizing job opportunities for the community and local stakeholders, among others. In this way, the project aims to foster a “green economy” that values the forest and its resources in a sustainable manner, in addition to offering alternatives for the socioeconomic development of local stakeholders.

Adjust the Land Use and Land Cover Change Component of the Baseline

Analysis of Chain of Events Leading to Deforestation

The chain of events that leads to deforestation in the Manoa REDD+ Project region is complex and interconnected, with economic, political and social factors intertwined.

Land appreciation in the region is largely driven by livestock farming and agriculture, which have become highly profitable activities due to government policies that favor these sectors over sustainable practices.

This increase in land value not only encourages real estate speculation, but also triggers a series of negative consequences, such as land grabbing.

Land grabbing, often facilitated by illegal logging activities, occurs when these operations open roads, allowing access to previously unexplored areas. This process of opening roads facilitates the undue occupation of land, contributing to environmental degradation. In addition, government policies, which prioritize livestock farming and soybean cultivation, make these activities more attractive and profitable than others that could contribute to forest conservation, leading to a vicious cycle of deforestation and degradation.

The appreciation of land through livestock farming and agriculture is therefore intrinsically linked to the expansion of land grabbing and real estate speculation, highlighting the urgent need for reformulations in land use policies, and the applicability of existing ones, so that they prioritize conservation and sustainability.

Other factors

Unplanned Deforestation: To verify whether the deforestation identified in the reference region falls into the category of "unplanned" and it is occurring illegally, a search was conducted to identify if legal deforestation in the RR was negligible during the Historical Reference Period. To demonstrate this, vegetation suppression authorizations were obtained from SEDAM/CODEF⁶⁶, institution responsible for issuing and monitoring authorizations for deforestation and timber logging in the Rondônia State, where the RR is located. The database had only four licenses registered for the reference region, totaling 36.5 ha of forest area authorized for suppression, which corresponds to only 0.015% of the total deforested area (246.334 ha) detected by PRODES in the RR during that period. These areas have been removed and did not factor in any of the analysis for deforestation estimation.

Sustainable Forest Management Projects (SFMP): to assess whether SFMPs had an effect on past deforestation in the reference region, and if a new stratum is needed in the RR, an analysis was performed based on licenses for sustainable forest management plans (SFMP) currently registered in SEDAM/CODEF. We compared deforestation rates in these areas with deforestation outside of these areas (Table 10).

Table 10: Estimated probability of deforestation inside and outside Sustainable Forest Management Projects in the reference region during the historical reference period

A SFMP is	Risk (deforestation to forest rate)
Absent	0.396
Present	0.392

⁶⁶ Coordenadoria de Desenvolvimento Florestal (CODEF), Secretaria de Estado do Desenvolvimento Ambiental (SEDAM). Available at: <https://geoportal.sedam.ro.gov.br/>. Downloaded in 04/22/2025.

Total	0.395
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The results were calculated by computing the zonal proportion statistics of forest areas lost during the HRP inside and outside of active SFMPs. The table above shows that the difference between estimated probabilities of deforestation inside and outside of areas registered in SFMPs is only 0.004 or 0.4%. Based on these results, we conclude that presence of a SFMP was not an effective barrier to deforestation in the RR during the historical reference period. Consequently, the creation a new stratum or inclusion of a new factor in the modeling procedure were not necessary.

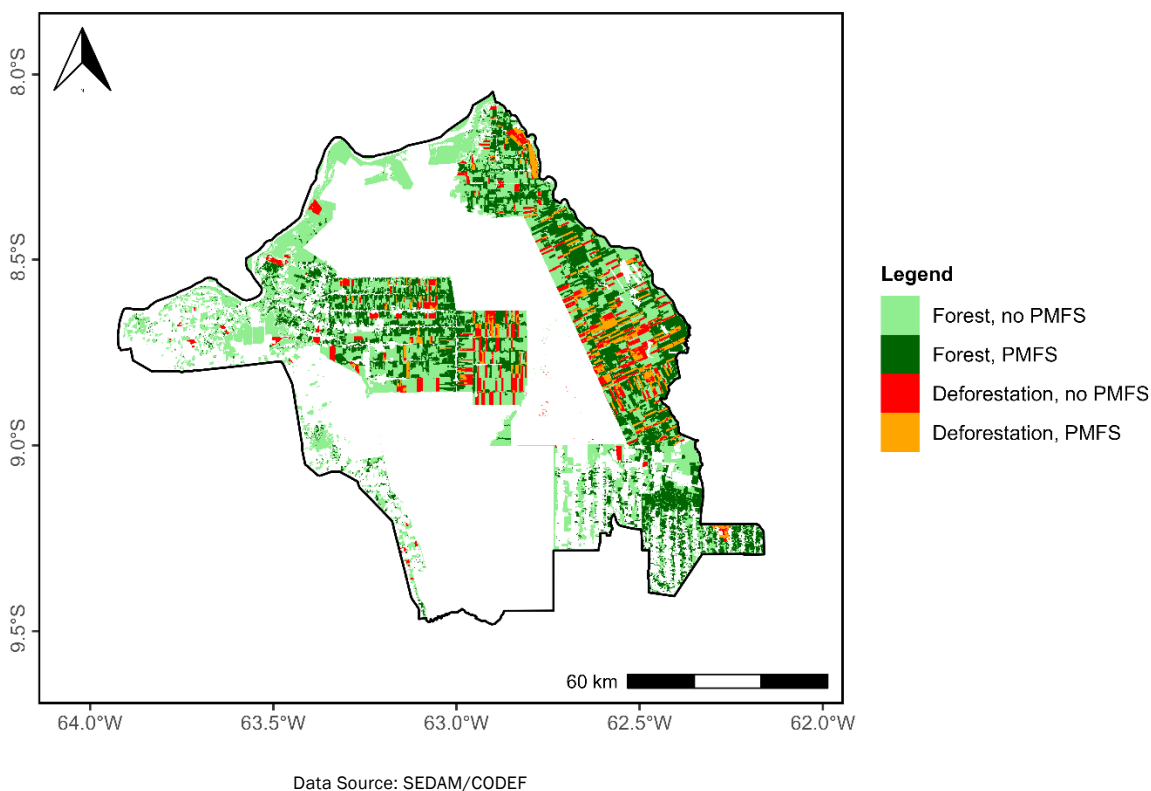


Figure 20: Deforestation occurred during the historical reference period, inside and outside Sustainable Forest Management Plan boundaries, in the Reference Region. Forests in protected areas and inside the project area were excluded for this analysis.

The quantitative analysis presented in Table 10, which compares the probabilities of deforestation inside and outside Sustainable Forest Management Plans (PMFS), was conducted for the period from 2013 to 2022. This interval was selected because it is consistent with the period used for baseline calibration and captures the most recent and relevant deforestation dynamics within the Reference Region. To ensure spatial robustness, the CODEF database (Cadastrado de Desenvolvimento Florestal de Rondônia) was used, as it provides the most comprehensive and spatially consistent representation of PMFS boundaries in the region.

Although the historical reference period spans from 2000 to 2022, it was decided not to extend this specific analysis using alternative datasets (such as IBAMA or other SEDAM records) due to significant technical and temporal limitations. These alternative datasets only contain consistent records from 2018 onwards and include a substantially smaller number of polygons compared to CODEF. The use of these incomplete datasets would introduce a downward bias in the risk estimation, as they would systematically exclude areas where PMFS existed prior to 2018 or were later canceled — often as a consequence of illegal deforestation — thereby artificially reducing the perceived level of risk within managed areas.

Therefore, the results obtained remain valid and representative for the baseline model. There is no evidence of structural changes in forest governance, law enforcement, or land-use dynamics within the Reference Region that would suggest a change in the relationship between the presence of forest management activities and the risk of deforestation. The baseline scenario confirms that the main drivers, such as land grabbing, illegal logging, and cattle ranching expansion, continue to operate actively across the landscape, including within areas registered under forest management plans, demonstrating that the presence of a PMFS did not constitute an effective barrier against unplanned deforestation during the analyzed period.

Legal Reserve (LR): A detailed analysis was conducted to evaluate the potential use of Legal Reserve (RL) areas, as declared in the Brazilian Rural Environmental Registry (CAR), as a variable in the spatial modeling of deforestation risk. Although areas currently declared as RL present, on average, slightly lower deforestation probability than non-RL areas, this result is heavily biased due to the self-declaratory nature of the CAR system.

Specifically, we observed that, in most cases, CAR registration or updates occurred after significant deforestation had already taken place in the respective properties. The analysis showed that most deforestation occurred before the CAR was registered, and that RLs, as declared, mainly reflect the remaining forest cover at the time of registration rather than areas preserved intentionally.

Furthermore, even when filtering the analysis to include only deforestation events occurring after CAR registration, the available data was limited and fragmented, making it difficult to define a consistent spatiotemporal factor for Legal Reserves. The situation is further complicated by the presence of overlapping CAR declarations in the reference region, which reduces the reliability of attributing deforestation events to specific RL polygons.

Based on these methodological limitations, we concluded that RL areas, as represented in the CAR, are not a reliable predictor of deforestation risk for the purposes of modeling or stratifying the reference region. Thus, RL was not included as a new factor variable or stratum in the deforestation risk modeling.

It is important to note that the exclusion of the RL variable does not imply an overestimation of projected emissions reductions, as Legal Reserves, as declared, do not appear to have effectively served as barriers against unauthorized deforestation within the reference region.

Conclusion

Based on the evidence presented in the socioeconomic diagnosis, data from MapBiomass, Prodes and bibliographical references, **it was possible to find conclusive evidence that explains the relationships between the agents, vectors, underlying causes and pressure of deforestation in the reference region.** The expansion of livestock and agriculture, combined with land grabbing and illegal logging, constitutes a clear and persistent trend of deforestation in the Cujubim region. Government incentives that favor

these activities, the lack of effective monitoring and the infrastructure created by illegal loggers reinforce this dynamic of environmental degradation, leading to the continuous conversion of forest areas for agricultural use and real estate speculation. This trend is evidenced not only by historical data on the increase in pasture and soybean cultivation areas, but also by the analysis of underlying factors, such as public policies that promote agricultural development to the detriment of forest conservation. The continuation of this pattern is reinforced by the absence of structural measures that encourage more sustainable agricultural practices or the rigorous enforcement of environmental laws, suggesting that deforestation will continue to be the predominant practice in the region.

3.4.4 Adjustment of Annual Areas of Baseline Deforestation

Adjustments to annual baseline deforestation areas were made according to the processes described in methodology VM0015 V1.2. Data obtained from monitoring land use/land cover change (LU/LC) in the reference region during the validity period of the previous baseline were used, as well as updated information on agents, drivers and underlying causes of deforestation. Updated variables included in the estimate of projected baseline deforestation areas were also considered, allowing for an accurate reassessment of deforestation levels.

For this assessment, the historical reference period was extended to encompass the original reference period and all subsequent monitoring periods up to the start of the current monitoring period. The adjusted baseline deforestation rates were then submitted to the validating/verifying body (VVB) for review and approval, ensuring compliance with methodological requirements.

3.4.5 Adjustment of Projected Baseline Deforestation Location

The adjusted projections of annual baseline deforestation areas, together with the enhanced spatial data for creating the factor maps in the spatial model, were used to re-evaluate the location of projected baseline deforestation, according to the methods described in this methodology.

In addition, all areas that had already been credited for avoided deforestation in previous baseline periods were excluded from the new projections, ensuring that these areas were not credited again.

3.4.6 Adjustment of the Carbon Component of the Baseline

In 2023, a new measurement of the carbon stock within the Manoa Farm was carried out to ensure more up-to-date and more accurate data. This update included, for the first time, the measurement of carbon present in dead wood, a component that had not been considered in the first measurement. This decision is in accordance with section 8.2.2.3 of the VM0015 V1.2 methodology, which allows the use of new, more accurate data to recalculate the baseline, if these data are validated by a VVB for the current validity period of the baseline.

The forest inventory to estimate the carbon stock contained in the Manoa Farm was carried out through sampling, with the installation of 40 conglomerates, with 4 subplots of 10 x 250 m each, totaling 160 samples, where all living and dead standing trees with DBH $\geq$ 10 cm were inventoried. Forty plots were

also installed to quantify dead wood on the ground using the interceptor line method. Initially, four strata were considered in the inventory planning, which considered the forest typologies and the managed and unmanaged areas of the Farm. In calculating the estimates, a probability level of 95% was considered for the confidence interval. Analysis of variance showed that there was no significant difference between the strata, so a single average was considered for the entire farm. The carbon stock found through statistical analysis was $116.5464 \pm 6.8395 \text{ MgC ha}^{-1}$, with a sampling error of 5.87% for the “live trees – above ground” reservoir. For the “live tree – below ground” reservoir, the stock was $20.4059 \pm 1.2353 \text{ MgC ha}^{-1}$, with a sampling error of 6.05%. The “standing dead trees” presented a stock of $1.0455 \pm 0.2346 \text{ MgC ha}^{-1}$, with a sampling error of 22.44%. For the “dead wood on the ground” reservoir, estimated through the interceptor lines, the average carbon stock was $11.9886 \pm 3.6864 \text{ MgC ha}^{-1}$, with a sampling error of 30.7%.

The unification of all reservoirs presented a stock of $149.9864 \pm 8.0265 \text{ MgC ha}^{-1}$, with a sampling error of 5.35%, below the 15% error at 95% probability. The unified dead wood component (standing dead trees and dead wood on the ground) contributed 8.7% of the stock, proving to be a significant reservoir within the sampling process. The calculation of reduced emissions, considering all unified reservoirs, was $549.4382 \text{ MgCO}_2\text{eq ha}^{-1}$.

All details about the methodology used to measure carbon stocks can be analyzed in “Final Report - Forest Inventory for Estimating Carbon Stocks in Biomass Above and Below Ground (Roots) and Dead Wood of the Manoa REDD+ Project”.

3.5 Additionality

3.5.1 Regulatory Surplus

Is the project located in an UNFCCC Annex 1 or Non-Annex 1 country?

☐ Annex 1 country ☒ Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

☐ Yes ☒ No

3.5.2 Additionality Methods

The additionality of the Project was analyzed according to the tool approved by VCS “VT0001 – Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities”, version 3.0, dated February 1, 2012. The method chosen to demonstrate additionality was investment analysis (Step 2). This method was selected to determine that the activity proposed by the VCS AFOLU project is financially less attractive without the revenue from the sale of GHG credits, when compared to the alternative land use scenarios identified.

Step 1. Identification of alternative land use scenarios for the activity proposed in the VCS AFOLU project.

Sub-step 1a. – Identify credible alternative land use scenarios for the activity proposed in the VCS AFOLU project

The scenarios described in this item were based on **updated** data collected by the socioeconomic study that was **redone in 2023** and which used secondary data (literature review) and primary data, resulting from interviews and reports from residents and representatives of local institutions.

Scenario I - Continuation of land use activities prior to the Project (baseline scenario):

In the last ten years, the sequence of events in land use exploration in the region has undergone some changes. Previously, logging predominated, followed by the abandonment of explored areas and their conversion to pasture by land grabbers who invaded abandoned, fragile or undefined areas. Currently, deforestation is more driven by real estate speculation, which has been strongly fueled by livestock farming and soybean planting. Furthermore, government policies to encourage livestock farming and the lack of support for other practices aimed at maintaining the forest have exacerbated pressure on forest cover. Another phenomenon is the expansion of occupation in a region known as ‘Soldado da Borracha’, bordering the Manoa farm. The temporary revocation of the Ecological Station title for this area has created the perception that conservation policies may be reversed or not applied, strongly driving deforestation in the region.

The growth of the agricultural sector, combined with the decline of the timber sector (detailed in scenario II), has led to a great appreciation of pasture areas to the detriment of forest areas, a fact that motivates owners of forest areas (Ecoporé, 2015; FNP, 2016) to deforest or sell their areas, since the implementation of management plans is extremely bureaucratic, costly and does not guarantee competitiveness with illegal timber. This context encourages deforestation throughout the region, as squatters also adopt the strategy of opening up new areas in order to increase their value in an attempt to sell them in the future.

In summary, the common practice scenario reflects a transformation in the land use pattern, with real estate speculation, expansion of livestock farming and soybean cultivation becoming the main drivers of deforestation, while inadequate public policies and failure to comply with decrees intensify these impacts. Therefore, as observed during the definition of additionality in the implementation of the first baseline, **illegal deforestation** remains the **dominant common practice**. In other words, the central scenario has not changed, but rather the different nuances of action.

Scenario II - Certified Forest Management with REDD+ activities without registration as a VCS AFOLU Project:

This scenario represents the implementation of sustainable forest management activities certified by the FSC or PEFC, together with complementary activities to contain and monitor deforestation caused by the agents of “scenario 1” and social and biodiversity activities described in Section 1.12.

Sustainable forest management, especially certified management, is recognized by several experts as a tool for forest conservation, maintenance of forest carbon stocks and reduction of deforestation rates (PORTER-BOLLAND et al., 2012; UNCED, 1992; VERÍSSIMO et al., 1992; SILVA et al., 1997; UHL et al.,

1997; BARRETO et al., 1998; HOLMES et al., 2002 apud SABOGAL et al., 2006; PUTZ et al., 2008; SPATHELF et al., 2004). This is mainly due to the application of low-impact logging techniques, continuous monitoring of the forest and the social and environmental impacts of the operation, physical presence, land organization and generation of economic value for forest areas.

However, as identified in the latest socioeconomic diagnosis prepared by Ecoporé in 2023, the timber industry in Rondônia has faced a significant decline, demonstrating that it is no longer as prosperous in the region. The shortage of commercial timber is a central factor, resulting in the closure of sawmills and the migration of companies to other sectors, such as agriculture. This movement, in addition to reducing the number of jobs, also reduced the representation of the timber sector in the regional economy. Between 2013 and 2021, the number of companies operating in the forestry sector fell from 21 to just nine, according to official data, evidence of this decline. Roundwood volume also suffered a sharp decline (Figure 21).

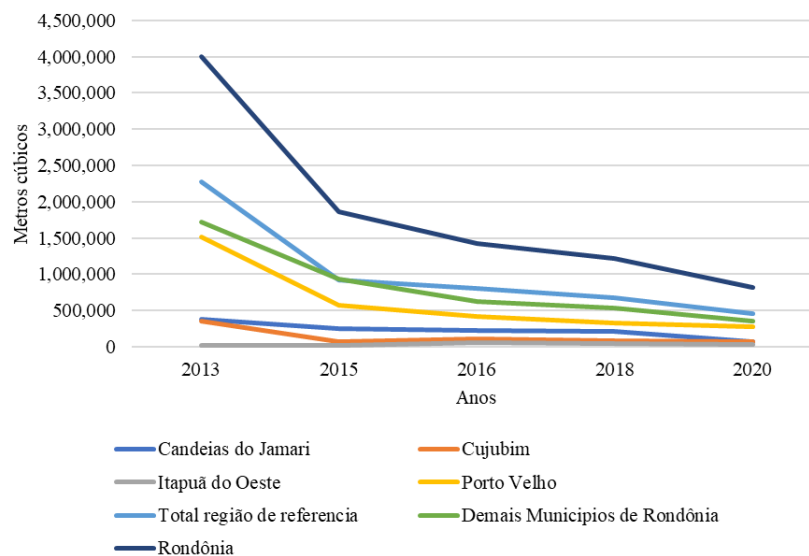


Figure 21 Production of timber in logs (cubic meters) in the period from 2013 to 2020 in the municipalities of the project reference region, total of other municipalities in the state of Rondônia and general total of the state ⁶⁷.

Therefore, returning to the context described in scenario (i), in the project region, Forest Management (when approved and certified) is not considered an economically advantageous practice, since there are several barriers for the owner who wishes to follow this path. The implementation of a certified management plan is bureaucratic and costly, where the owner must comply with several standards and make a large investment. Even so, the implementation of a certified management plan does not guarantee advantages in the market⁶⁸, where the product competes with the supply of wood of illegal

⁶⁷ IBGE – SIDRA. Produção da Extração Vegetal e da Silvicultura 2013 a 2022 Available at: <<https://sidra.ibge.gov.br/tabela/289>>. Acesso: 15 dez. 2023.

⁶⁸ FAGUNDES, Camila; SCHREIBER, Dusan; NUNES, Moema Pereira; FERNANDES, Maria Eduarda. Perception of Brazilian Companies on the Potential and Concrete Benefits Resulting from the FSC Certification. *Forests*, v. 12, n. 12, p. 1622, 2021. DOI: 10.3390/f12121622.

and/or dubious origin, forcing the responsible entrepreneur to reduce its price and profit margin⁶⁹. In addition, the forest owner must live with external pressure on the area every day, since at the first moment of fragility it will certainly be invaded.

In contrast to the reality of legalized timber management, opening up areas for the implementation of agricultural practices is much more advantageous, since monitoring is inefficient, the area increases in value by more than five times its initial value, and the costs of implementation and maintenance are generally substantially lower^{70,71}. Amid so many barriers and adversities, the owner often opts to sell his property, as he is unable to pay for management activities and deal with market uncertainty. In addition, times of financial crisis can lead to a weakened property security that would certainly lead to situations of invasion of the property.

In this context, for the Project to be effective in containing and monitoring deforestation that threatens the project area and activities that foster local socioeconomic development, specific investments are necessary (specialized professionals, acquisition of satellite images, technical studies specific to REDD, intensification of surveillance and property security, implementation of courses and seminars with social actors in the surrounding area, improvement of biodiversity monitoring). Since such investments are not mandatory and are generally not carried out by certified forest management, these activities could hardly be practiced in the regional scenario, making it difficult or impossible to generate positive net impacts in the region. Therefore, the economic viability of management is further reduced, without the addition of additional revenue resulting from the commercialization of credits registered in the VCS.

Scenario III - Timber Forest Management without REDD+ activities and without registration as a VCS AFOLU Project:

In this scenario, there are sustainable and legalized timber forest management activities, but without additional initiatives and investments focused on communities and local biodiversity to contain and monitor deforestation caused by agents. Although forest management contributes to maintaining carbon stocks, it is less effective in mitigating deforestation pressures. Economic viability is low because it is a volatile market and a very costly activity, especially when compared to agriculture and illegal logging. Thus, additional investments and activities are required. According to Putz et al. (2012), selectively logged tropical forests can still maintain conservation values, but their effectiveness depends on improved management practices and additional protection measures⁷².

69 SANTOS DE LIMA, Letícia; MERRY, Frank; SOARES-FILHO, Britaldo; OLIVEIRA RODRIGUES, Hermann; DOS SANTOS DAMACENO, Christiane; BAUCH, Marcos A. Illegal logging as a disincentive to the establishment of a sustainable forest sector in the Amazon. PLOS ONE, v. 13, n. 12, p. e0207855, 2018. Disponível em: <https://doi.org/10.1371/journal.pone.0207855>. Acesso em: 2 abr. 2025

70 MULLAN, Katrina; CAVIGLIA-HARRIS, Jill L.; SILLS, Erin. Sustainability of agricultural production following deforestation in the Brazilian Amazon. Land Use Policy, v. 105, p. 105660, 2021. Disponível em: <https://doi.org/10.1016/j.landusepol.2021.105660>. Acesso em: 2 abr. 2025. ScienceDirect+2

71 GARCÍA-ARIAS, José; CIBILS, Andrés; COSTANTINO, Agustina; FERNANDES, Vitor Bukvar; FERNÁNDEZ-HUERGA, Eduardo. When land meets finance in Latin America: some intersections between financialization and land grabbing in Argentina and Brazil. Sustainability, v. 13, n. 14, p. 8084, 2021. Disponível em: <https://doi.org/10.3390/su13148084>. Acesso em: 2 abr. 2025.

72 PUTZ, Francis E. et al. Sustaining conservation values in selectively logged tropical forests: the attained and the attainable. Conservation Letters, v. 5, n. 4, p. 296-303, 2012. DOI: 10.1111/j.1755-263X.2012.00242.x.

Furthermore, analyzing data made available by the State Secretariat for Environmental Development of Rondônia (SEDAM/RO), it was observed that **only 1.22% of the properties registered in the Rural Environmental Registry (CAR)⁷³ within the project's reference region (Candeias do Jamari, Cujubim, Itapuã do Oeste, and Porto Velho) obtained AUTEX (Authorization for Sustainable Forest Exploitation) between 2018 and 2024⁷⁴ (Table 9).** This suggests that sustainable forest management, despite being a legal alternative for native forest resource use, **is not a common practice in the region.** The low adoption rate further reinforces the challenges related to its economic feasibility and operational implementation.

Given these barriers, the likelihood of widespread sustainable forest management occurring in the project area without the incentives provided by VCS registration and REDD+ activities is extremely low.

Table 11 Number of Registered Properties (CAR) in the municipalities that make up the Project Reference Region and AUTEX Issued by Municipality (2018 - 2024).

Municipality	Number of registered properties (CAR)	AUTEX issued (2018 - 2024)	
		N	%
Candeias do Jamari	4,927	62	1.26%
Cujubim	3,070	12	0.39%
Itapuã do Oeste	1,800	9	0.50%
Porto Velho	21,146	295	1.40%
Total	30,943	378	1.22%

Result of Substage 1a:

Three scenarios were defined based on updated data from the 2023 socioeconomic diagnosis, including interviews with residents and representatives of local institutions:

- **Scenario I:** Continuation of previous activities (baseline), with logging followed by conversion of areas to pasture or real estate speculation, motivated by the appreciation of land with agricultural activities.
- **Scenario II:** Certified Forest Management with REDD+ activities without registration as a VCS AFOLU Project, where low-impact logging techniques and continuous monitoring would be applied, but without the additional financial resources of VCS credits.
- **Scenario III:** Sustainable and legalized timber forest management without additional investments in monitoring, biodiversity conservation, or community support. While it helps maintain carbon stocks, it struggles to mitigate deforestation pressures. Economic viability

73 GOVERNMENT OF THE STATE OF RONDÔNIA. Rural Environmental Registry System – SICAR/RO. Available at: <http://car.sedam.ro.gov.br/#/site/consultar>. Accessed on: February 24, 2025.

74 GOVERNMENT OF THE STATE OF RONDÔNIA. Environmental Development Coordination – CODEF. Available at: <https://transparencia.sedam.ro.gov.br/setor/codef>. Accessed on: February 24, 2025.

is low due to high costs, market volatility, and competition with illegal logging, making large-scale adoption unlikely without incentives from VCS registration and REDD+ activities.

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

Scenarios II and III comply with all applicable legal and regulatory requirements, while scenario I does not comply with mandatory laws and regulations.

However, illegal or unauthorized deforestation occurs systematically and widely in the legal Amazon and mainly in the project region, located in the “Arc of Deforestation”.

According to the 2023 socioeconomic diagnosis, based on data from IBGE and MapBiomas, between 2013 and 2022, the forest area in the municipality of Cujubim fell from 231,254 hectares to 145,845 hectares, a reduction of 85,409 hectares (36.93%). The most significant loss occurred in forest areas, mainly in the north and east regions, close to the Manoa farm. The Savanna Formation was also affected, with a reduction of 65.41%, from 425 to 147 hectares. The Flooded Forest shrank by 37.5%, from 56 to 35 hectares, largely due to agricultural expansion and the construction of dams.

Result of Sub-step 1b:

Scenarios II and II are in accordance with legal standards, while Scenario I includes illegal deforestation activities, which are common in the Amazon but not in accordance with regulations. Data from IBGE and MapBiomas from 2013-2022 show significant forest loss (36.93% coverage) in the project area, indicating the common practice of illegal deforestation.

Sub-step 1c. Selection of the baseline scenario

Described in Section 3 – Application of the Methodology, section 3.4 Baseline Scenario.

STEP 2: Investment analysis to determine that the proposed project activity is not the most attractive from an economic or financial point of view of the identified land use scenarios

Sub-step 2a. Determine the appropriate analysis method

Since the Project generates financial benefits beyond the revenue related to credits registered in the VCS, through the commercialization of tropical timber, a comparative investment analysis (Option II) of the alternative scenarios was applied to determine the additionality of the Project. Scenarios (ii) and (iii) were analyzed.

Sub-step 2b. Option II Application of the comparative investment analysis

The Net Present Value (NPV) was selected as a financial indicator for the comparative analysis of alternative scenarios. NPV is one of the methods most used by companies to evaluate projects and has the following advantages over other indicators: (i) it takes time into account in the value of money; (ii) NPV can be added; and (iii) depends only on cash flow and cost of capital (KUHN and LAMPERT, 2012).

Sub-step 2c. Calculation and comparison of financial indicators

Each cash flow scenario is composed of the sources described in Table 12. The summary of sources of income and expenditure considered in the analysis is presented in Section 1.12 of this document (Description of Project Activities), where the proposed activities to contain/monitor unplanned deforestation and generate net benefits to the climate, communities and biodiversity are described in detail.

Table 12 Summary of sources of revenues and expenses considered in the comparative analysis of Project investments.

Scenario	Incomes	Expenses
Continuation of land use activities prior to the Project (baseline scenario)	Costs and Expenses of illegal Forest Management.	(-) Illegal forest management activities.
Certified Forest Management with REDD+ activities without registration as a VCS AFOLU Project	Costs and Expenses of Forest Management, with complementary activities to contain and monitor deforestation	(-) Sustainable forest management activities (-) Additional activities to contain/monitor unplanned deforestation and climate, communities and biodiversity
Timber Forest Management without REDD+ activities and without registration as a VCS AFOLU Project	Project Costs and Expenses arising from Forest Management	(-) Sustainable forest management activities

The free cash flow scenarios and comparative NPV analysis considered the sources of income (Sale of tropical timber from Certified Forest Management) and expenses described in Table 9 and a discount rate of 25%. Such a discount rate has been applied for all project scenarios and is intended to reflect the investment risk at a present value in comparison to the scenarios analysed by the investor.

For this analysis, scenarios I, II and III were considered. Scenario I, corresponding to the continuation of land use activities prior to the project, was included as the baseline scenario, reflecting a situation with illegal forest management. Scenarios II and III were analyzed in detail for their financial viability – in other words, the "REDD+" scenario versus the "without REDD+" scenario – both excluding additional income beyond the timber commercialization already carried out by Manoa. In Scenario III ("without the project"), the only activity is Forest Management. In Scenario II ("with the project"), the same management activities are maintained but complemented by the additional efforts proposed under the REDD+ Project framework.

Input data for the financial economic model in scenario III include: Volume of timber harvested, average price of timber commercialization, operational expenses, operational investments, taxes, payroll, among others. In scenario II, the same expenses and cash flow of scenario III were considered. However, the

expected expenses for REDD+ Project activities were added as: Monitoring Avoided Deforestation and Emissions Reduction, Promoting environmental education and encouraging science, Prevention and mitigation of fires and respiratory diseases, Ensuring the continued high quality of forest management (Forest certification), Qualification of the workforce, Community Partnerships and Investments, Monitoring impacts on biodiversity and HCVAs and Supporting and encouraging scientific research. For scenario I the same conditions of scenario III were used, with correction of the activity cost. As scenario I reflects illegal timber extraction, the cost is estimated to be 10.5% lower than the legal activity⁷⁵. The cattle ranching activity was not included in scenario I as it can take from 12 to 15 years for the conversion of 100 to 150 hectares of forest to pasture⁷⁶. Therefore, converting forest to pasture across the approximately 72,000 ha project area would take longer than the crediting period, considered in the economic model. The detailed information and documents related to the financial economic model are considered commercially sensitive and were shared with the audit team on a confidential basis.

A conservative analysis until the year 2042 revealed a NPV of R\$ 33,097,569 for scenario I, R\$ 3,303,378 for scenario III, and a NPV of R\$ -10,650,648 for scenario II. In this way, it becomes evident that the complexity related to the implementation of such activities, added to the risks and barriers inherent in the forest management activity make the investment unfeasible. In addition, the analysis of scenario III don't take into account the risk of asset loss or deterioration (the forest) due to the influence of external agents. Thus, the evaluation demonstrates that additional forest management activities to contain/monitor deforestation and generate net positive benefits to climate, communities and biodiversity reduce the Project's financial viability if there is no additional revenue added, such as that resulting from commercialization of credits validated by VCS.

Considering the additional income from scenario IV (where the carbon revenues invested in the activities are taken into account), much more efficient and high-impact results are reflected in terms of financial results. This positive result points to the implementation of the project as highly viable and profitable. It far outweighs the other scenarios, indicating a huge potential for generating value. The proponents believe that the continued implementation of the REDD+ project will continue to guarantee the integrity of the forest cover in the area and will support the quality and longevity of the forest management activity in times of instability. Furthermore, from a financial point of view, the possibility of diversifying income brings greater security to the venture and reduces the risk for the investor. Therefore, considering the context described, scenario IV offers greater security to the investor than the other scenarios.

Given that Scenario II results in negative NPV and Scenario III results in positive but low NPV, and both scenarios are less financially attractive than Scenario IV (with carbon revenues), the baseline scenario was selected as Scenario I – Continuation of previous land use. This choice is consistent with Step B(2),

⁷⁵ Alessandra Maria Filippin dos Passos, Wylmor Constantino Tives Dalfovo e Michele Jackeline Andressa Rosa, Custo da legalidade na extração madeireira no estado de Mato Grosso: implantação de manejos florestais, 2020. DOI: <https://doi.org/10.4000/confins.29756>. Accessed on June 02 of 2025.

⁷⁶ Pecuaría na Amazônia: tendências e implicações para a conservação ambiental/ Eugênio Arima; Paulo Barreto; Marky Brito. Belém: Instituto do Homem e Meio Ambiente da Amazônia, 2005. Available at: <https://imazon.org.br/pecuaria-na-amazonia-tendencias-e-implicacoes-para-a-conservacao-ambiental/>. Accessed on June 06, 2025.

item 3 of VM0015 v1.2 and VT0001 Option III, since none of the alternative scenarios without carbon revenues are considered financially attractive under benchmark analysis.

Sub-step 2d. Sensitivity Analysis

Table 13 shows the critical assumptions of scenario (i) as well as its variations considered reasonable and used here in this sensitivity analysis (Perspective 1: pessimistic variations and Perspective 2: optimistic variations). The base values are those considered for the NPV found in sub-step 2c.

Table 13 Critical assumptions for scenario (i) and its variations used in the sensitivity analysis.

Scenario	Previous conditions	Perspective	
		1 - Pessimistic	2 - Optimistic
a. Continuation of land use activities prior to the Project (baseline scenario). Involving illegal Forest Management without certification and without REDD+ activities	Timber price	85% of the base value	115% of the base value
b. Forest Management with REDD+ activities, with sustainable forest management certification and complementary activities to contain/monitor unplanned deforestation and with additional activities to benefit the climate, communities and biodiversity.	Timber price	85% of the base value	115% of the base value
	Historical Costs of REDD+ Activities	85% of the base value	115% of the base value
c. Forest Management with REDD+ activities without sustainable forest management certification and complementary activities to contain/monitor unplanned deforestation and without additional activities to benefit the climate, communities and biodiversity.	Timber price	85% of the base value	115% of the base value

The result of the sensitivity analysis was that in none of the proposed perspectives, scenario (ii) obtained a higher NPV than scenario (i), demonstrating that from a financial perspective it is not financially

advantageous to maintain the forest standing and implement complementary containment, monitoring and social activities in the project area.

Results perspective 1 (pessimistic), R\$ 27,633,603, R\$ -16,114,613 and R\$ -2,160,588 for conditions a, b and c respectively. Results perspective 2 (optimistic), R\$ 38,561,534, R\$ - 5,186,682 and R\$ 8,767,343 for conditions a, b and c respectively.

Therefore, the conclusion of the sensitivity analysis is that the Manoa REDD+ Project is not considered to be financially attractive without registration as a VCS AFOLU project and the additional revenue derived from credit sales, the low perspective of an optimistic panorama regarding forest management activity reinforces the importance of the additional resource to finance the proposed activities. The financial models used in the analyzes of Sub-steps 2c and 2d are available to the validating/verifying bodies.

Step 3 – Barriers analysis

A VCS “VT0001 – Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities - requests investment analysis (Step 2) or Barrier Analysis (Step 3). In this case, the Investment Analysis was chosen, already described in Step 2.

Step 4 – Common Practices analysis

Scenario I, described as the baseline scenario or common practice scenario, indicates that there are not many results for forest management in the project region. As previously explained, the timber industry is declining in the region, a fact that has directly influenced the market and further devalued forest areas. In this scenario, there is no incentive for entrepreneurs to remain in the certified management business and continue preserving their area. The most common practice in these cases involves selling the property to acquire a license to deforest part of the property in order to increase the value of the property, or in invasions by third parties due to the fragility generated by the decline in forest management.

In the project region, there are numerous cases in which management plans are approved by the responsible agency and, after forest exploitation, the areas are completely invaded. Such invasions generally occur because the owner is unable to maintain the area after the management activity has ended. In some cases, the owner himself deforests the area, knowing that even if he receives a fine, the increase in the value of the deforested area compensates for the illegal deforestation.

For the analysis of common practice, an area southeast of Fazenda Manoa (Figure 22) called Seringal Urupá was chosen. The area was leased by the owner to a third party to carry out forest management. Of the total area of the property, 6,750 hectares were designated for the implementation of one of the management plans (Figure 22) that was divided into five Annual Production Units (UPA). Throughout the period that the area was exploited, the lessee suffered constant pressure from groups of settlers and squatters in the surrounding area. Without any resistance or governance after the completion of the management plan in 2012, the area was completely invaded.



Figure 22 Sign indicating the implementation of the Management Plan in the area.

The mapping carried out by PRODES clearly shows that after the management plan was finalized, the area began to be invaded and deforested (Figure 16). The shape of the identified deforestation shows the same pattern as other deforested areas in the surrounding area, configuring a classic spatial distribution of areas invaded by squatters and settlers.

The same invasion event could have occurred at Fazenda Manoa if the property had not adopted measures to strengthen security and governance. At the same time, forest management is faced with market uncertainties on a daily basis, which further weaken the management activity, reinforcing the additionality of the REDD+ project in the area.

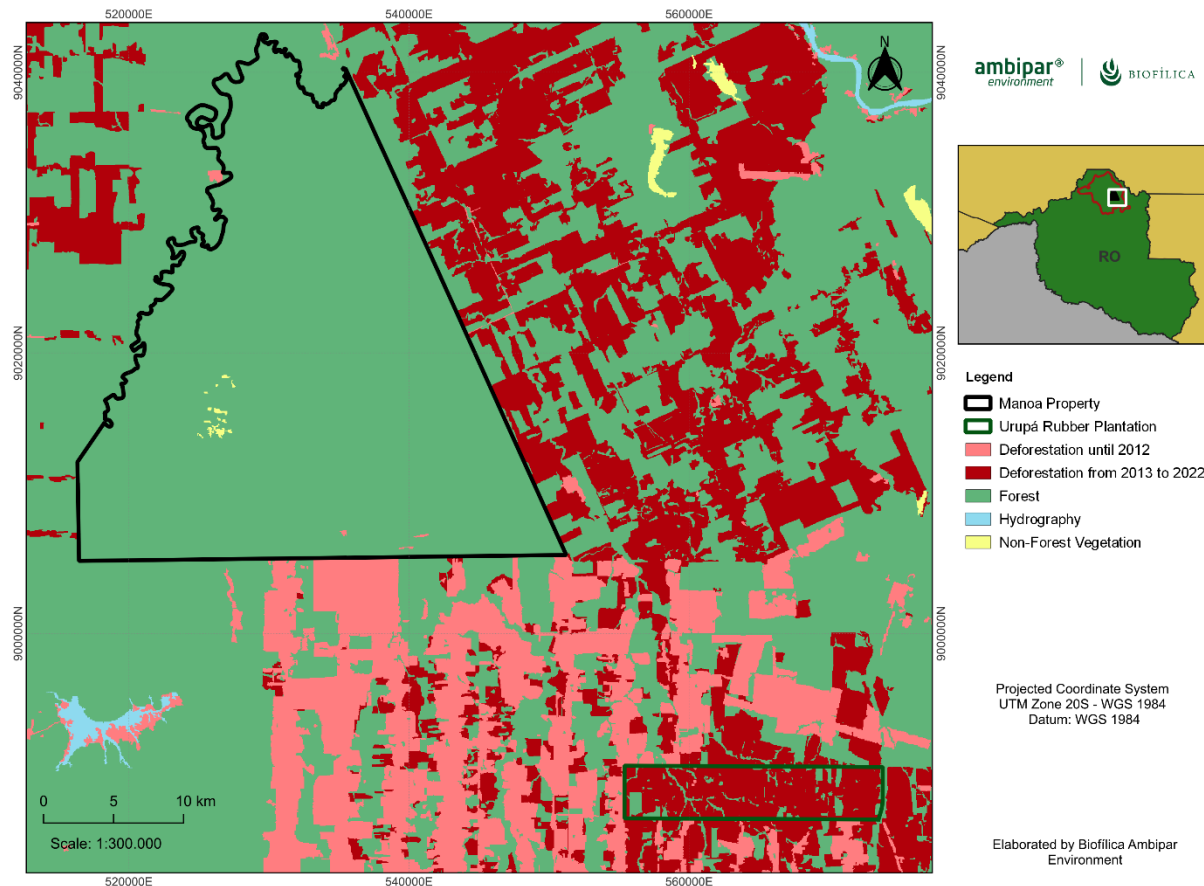


Figure 16 Deforestation around Seringal Urupá In Rondônia, the implementation of environmental conservation projects without some form of financial benefit is uncommon. An analysis of the projects developed in the region shows that most conservation initiatives are linked to direct or indirect economic incentives for local communities and rural landowners.

Evidence of the dependence on financial benefits in conservation projects in Rondônia:

- Projects within state Conservation Units (CUs) receive financial and material support, such as goods, construction, and contracted services, to enable sustainable management activities and integration with local communities. These resources are essential for managing protected areas and ensuring the participation of traditional populations, who rely on technically and economically viable proposals for the sustainable use of natural resources.⁷⁷
- The Amazon Protected Areas Program (Arpa), which operates in Rondônia, is funded by various international and national sources, including the World Bank, the German government, WWF, and the

⁷⁷ GENTE DE OPINIÃO. *Projects developed in Conservation Units in Rondônia promote the sustainable use of natural resources*. Gente de Opinião, Porto Velho, Jan. 30, 2022. Available at: <https://www.gentedeopinioao.com.br/meio-ambiente/projetos-desenvolvidos-em-unidades-de-conservacao-de-rondonia-promovem-uso-sustentavel-dos-recursos-naturais>. Accessed on: Apr. 15, 2025.

Amazon Fund. It provides financial resources for managing conservation units, including the acquisition of satellite images, enforcement, and infrastructure.⁷⁷

- REDD+ projects in the Rio Preto Jacundá Extractive Reserve, for example, generate carbon credits that are converted into financial value for local residents. These resources are used to improve infrastructure, establish agro-industries, and provide access to basic services, demonstrating that conservation is tied to economic benefits for communities.⁷⁷

- The Floresta+ Carbono program in Rondônia offers annual payments per hectare to rural landowners who maintain conservation areas or carry out environmental restoration, thus providing financial incentives for preserving and recovering legal reserves.⁷⁸

- In the Rio Cautário Extractive Reserve, a project provides a monthly “green allowance” to resident families, conditional upon compliance with the management plan, along with investments in jobs, vehicles, and infrastructure—highlighting that conservation is directly linked to financial incentives.⁷⁹

- Sustainable forest management projects also receive financial support that meets the basic needs of extractive families, such as housing, drinking water, energy, and transportation, reinforcing the idea that conservation depends on economic benefits to be feasible.⁷⁷

Conclusion for the Common Practice Analysis (Step 4):

The analysis of the spread of similar activities in the region shows that conservation projects in Rondônia are implemented almost exclusively when some form of financial benefit is associated—whether through subsidies, payments for environmental services, carbon credits, or investments in infrastructure and training. Projects that do not offer these financial incentives are not common, revealing a significant economic barrier to implementing conservation activities without financial returns.

Therefore, unlike common practices in the region, the project faces financial barriers that prevent its implementation without the support of economic benefits, reinforcing the need for the project to enable environmental conservation in Rondônia.

In conclusion, the analysis of common practices in the region reveals a clear dependence on financial incentives for the viability of forest conservation projects. The decline of the timber industry and the lack of sustainable management practices have created an environment where deforestation and invasions

⁷⁸ AMELICA. *[Payment for environmental services in Rondônia – Legislation and future perspective]*. AMELICA Portal. Available at: <https://portal.amelica.org/ameli/journal/274/2744715009/html/>. Accessed on: Apr. 15, 2025.

⁷⁹ PERMIAN BRASIL. *Forest Conservation Project of the Rio Cautário Extractive Reserve - RO*. Permian Brasil, Porto Velho. Available at: <https://permianbrasil.com/resex-estadual-do-rio-cautario/>. Accessed on: Apr. 15, 2025

by squatters are common outcomes. The case of Seringal Urupá exemplifies the risks faced by landowners who lack adequate governance and security measures. In contrast, projects that integrate financial support, such as REDD+ initiatives and other conservation programs, demonstrate that economic incentives are crucial for ensuring the successful implementation and continuity of sustainable forest management practices, underscoring the importance of financial support in fostering conservation efforts in Rondônia.

3.6 Methodology Deviations

3.6.1 Deviation #1: Leakage belt

The main procedural change occurred due to the update of the methodology from version VM0015 v1.1 to VM0015 v1.2, with the respective changes duly incorporated into the project.

In particular, VM0015 v1.2 does not specify a size limit for the leakage belt after identifying viable areas using the opportunity cost analysis method. Our analysis showed that the entire reference region is in areas where the profitability of post-deforestation activities in the historical period was high.

However, we restricted the area of the leakage belt to all forests adjacent to the project area, which are potential areas for access and relocation of deforestation agents, also following the historical dynamics that have been occurring in the region.

We also limited the size of the belt to the sum of the belt's own baseline deforestation plus the project's baseline deforestation, so that it can accommodate the (unlikely) worst-case scenario of 100% leakage.

These methodological adaptations respond to the FAR (Forward Action Request) required in the verification finalized in September 2024 of the project.

3.6.2 Deviation #2: Deforestation allocation

This affects section 4.1.2. Under VM0015 v1.2, the usual way to allocate baseline deforestation in the project area is to rank all pixels by their modeled probability of deforestation and then assign the total baseline amount to the pixels with the highest probabilities. This “rank-ordering” results with a pixel either fully counted as deforested or not, regardless of its modelled probability.

Although this method can help identify areas more likely to be deforested and can guide conservation planning, it brings some issues when we try to quantify deforestation across space:

First, this approach is similar to estimating land-cover areas directly from classification probabilities, which is known to frequently produce biased results⁸⁰. Second, deforestation shouldn't be quantified

⁸⁰ Sales, M. H., De Bruin, S., Souza, C., & Herold, M. (2021). Land use and land cover area estimates from class membership probability of a random forest classification. *IEEE Transactions on Geoscience and Remote Sensing*, 60, 1-11.

based on a single simulation. Even if probabilities are used correctly, the right approach is to rely on many simulations or, to allocate deforestation proportionally to the pixel probabilities.

For this project, we chose to allocate deforestation proportionally to each pixel's modeled probability instead of using strict rank-ordering. With this method, each pixel receives a share of the total baseline deforestation based on its probability weight. The total amount of deforestation stays exactly the same as required by VM0015; what changes is only how it gets distributed.

A simple example helps showing why this is a better approach. Imagine a reference region made of two homogeneous areas, A and B, with probabilities all equal of 0.51 and 0.49. If we allocate 100 deforestation pixels using rank-ordering, all of them would go to region A. But with probabilities so close, we would expect something much closer to a 50–50 split.

Our analysis also showed that the proportional-allocation method performs better. The Figure of Merit (FOM) for the full model using rank-ordering was 0.10, while the proportional approach reached 0.22 showing a clear improvement in accuracy.

3.6.3 Deviation #3: FOM

This affects section 4.1.2. The calculation of the FOM values was adjusted to match the probability-allocation approach. The equation itself did not change, and neither did the meaning of its components. What changed was only the way each quantity was computed, since the original equation is based on discrete events and our approach quantifies deforestation based on continuous probabilities.

3.6.4 Deviation #4: Sampling for reference data collection

This affects Section 4.1.1. We used a stratified random point sampling approach for data collection, defining strata based on PRODES data for land use change categories, and adding *additional strata* composed of buffers around both older and recently deforested areas. This constitutes a small deviation in relation to the methodology, which does not originally include such strata.

Due to the spatial autocorrelation⁸¹, deforestation is more likely to occur in clusters rather than spread apart. Therefore, areas classified as forests near areas classified as deforestation detected by PRODES are also where missed deforestation is most likely to occur. Because these areas have higher probability of deforestation, they also have higher variance. Thus, the inclusion of additional strata to account for this effect reduces the variance of estimate and improves the sampling efficiency.

Since calculations remain the same, it does not bias estimates and thus, do not compromise the conservativeness of emissions reductions estimates.

⁸¹ Chakir, R., & Le Gallo, J. (2021). Spatial autocorrelation in econometric land use models: an overview. *Advances in contemporary statistics and econometrics: festschrift in honor of Christine Thomas-Agnan*, 339-362.

4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

4.1.1 Analysis of Historical Land Use and Land Cover Change

Collection of Suitable Data

To map land use and land cover classes, data from the PRODES program, provided by the National Institute for Space Research, were used. The PRODES program uses images from the Landsat series of satellites and others to map annual deforestation and monitor forest remnants.

PRODES data in raster format, provided by the Terra Brasilis system, was analyzed in the following thematic classes: forest, non-forest vegetation, hydrography and anthropized vegetation (deforestation) for the years of 2000 and 2023. Satellite images used by PRODES cover the years of 2000 (representing the beginning of the HRP), and 2022/2023 (representing the end of the HRF) and can be located using three Landsat orbit/scene points: (i) 231/66; (ii) 231/67; and (iii) 232/66. (Table 14). The maps produced by PRODES have a methodology and estimated accuracy in mapping classes recognized nationally⁸² and internationally⁸³.

Table 14 Satellite images used to map land cover in the reference region.

⁸² KINTISCH, Eli. Improved Monitoring of Rainforests Helps Pierce Haze of Deforestation. Science. 27 Apr 2007. Vol 316, Issue 5824. pp. 536-537. DOI: 10.1126/science.316.5824.536 <
http://www.dpi.inpe.br/gilberto/press/science_monitoring27apr2007.pdf>

⁸³ MAURANO, L.E.P.; ESCADA, M.I.S.; RENNO, C.D. Spatial patterns of deforestation and the estimation of the accuracy of PRODES maps for the Brazilian Legal Amazon. Ciência Florestal, Santa Maria, v. 29, n. 4, pp. 1763-1775 <
https://www.researchgate.net/publication/339842256_Spatial_deforestation_patterns_and_the_accuracy_of_deforestation_mapping_for_the_Brazilian_Legal_Amazon>

Vector (Satellite or airplane)	Sensor	Resolution		Coverage (km ²)	Acquisition date (DD/MM/YY)	Scene ID	
		Spatial (m)	Spectral			Path/ Latitude	Row/ Longitude
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/6/2000	232	65
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/15/2000	231	66
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/4/2000	232	65
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/22/2000	232	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/13/2000	231	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/5/2000	231	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/14/2000	232	65
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/12/2000	232	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/28/2000	232	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/6/2000	232	66
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/6/2000	232	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/28/2000	232	66
Landsat	TM	30	0,45 – 2,35 µm	34.225	7/15/2000	231	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/29/2000	231	67
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/29/2000	231	66
Landsat	TM	30	0,45 – 2,35 µm	34.225	6/13/2000	231	66
Landsat	OLI	30	0,45 – 2,35 µm	34.225	21/08/2022	231	66
Landsat	OLI	30	0,45 – 2,35 µm	34.225	28/07/2022	231	67
Landsat	OLI	30	0,45 – 2,35 µm	34.225	27/07/2022	232	66
Landsat	OLI	30	0,45 – 2,35 µm	34.225	16/08/2023	231	66
Landsat	OLI	30	0,45 – 2,35 µm	34.225	31/07/2023	231	67
Landsat	OLI	30	0,45 – 2,35 µm	34.225	22/07/2023	232	66

Definition of Classes of Land Use and Land Cover

The land use and land cover classes used in this project are shown in Table 15. The description of each class and the area existing before the year in which the Project's baseline review period began is presented below:

- **Anthropized Vegetation in Balance:** areas of deforested Ombrophilous Forest converted to other land uses (mosaic of different types of vegetation that includes pastures, clearings, plantations and secondary vegetation).
- **Forest:** area of remaining forest belonging to different phytophysognomies of the Ombrophilous Forest.
- **Hydrography:** bodies of water (rivers, lakes, streams, among others).
- **Non-forest vegetation:** area composed of natural vegetation with a physiognomy different from the forest, such as arboreal and tree-dwelling savanna (cerrado), herbaceous savanna (clear cerrado field), Campinarana, among others.

Table 15- Existing land use and cover classes in the Reference Region.

Class identification		Carbon Stock Trend	Present in ¹	Baseline activity ²			Description
IDcl	Name			LG	FW	CP	
1	Anthropogenic Vegetation in Balance	Constant	RR, LM.	yes	yes	no	Forest areas deforested by clear-cutting and with a type of vegetation different from that of the Ombrophilous Forest.
2	Forest	Constant	RR, PA, LK.	yes	yes	yes	Remaining forest
3	Hydrography		RR	no	no	no	Bodies of water
4	Non-Forest Vegetation	Constant	RR	no	no	no	Natural cover of non-forest vegetation

¹- RR: Região de Referência; PA: Área do Projeto; LK: Cinturão de Vazamento; LM: Áreas de Manejo de Vazamento

²- LG: Logging. FW = Fuel-wood collection; CP = Charcoal Production (yes/no)

Definition of Land Use and Land Cover Change Categories

The project presents two categories of land use and land use change that are expected to occur within the project area and the leakage belt: the change from forested areas to areas with anthropogenic vegetation in balance (Table 16 and Table 17).

Table 16 Potential land use and land cover change matrix

			Initial LU/LC class				
			Forest	Deforestation	Non forest vegetation	Hydrography	
			I1	I2	I3	I4	
Final Class	F1	Forest	947,923	0	0	0	947,923
	F2	Deforestation (Anthropized Vegetation in Balance)	372,400	88,031	0	0	460,430
	F3	Non forest vegetation	0	0	5,412	0	5,412
	F4	Hydrography	0	0	0	70,856	70,856
Total (ha)			1,320,323	88,031	5,412	70,856	1,484,622

Table 17 Definition of land use categories and land cover changes

IDcl	Name	Carbon Stock Trend	Present in	Baseline activity			Name	Carbon Stock Trend	Present in	Baseline activity		
				LG	FW	CP				LG	FW	CP
I1/F1	Forest	Constant	PA	No	No	No	Antropic Vegetation	Constant	RR, LM	No	No	No
I1/F1	Forest	Constant	LB	Yes	Yes	No	Antropic Vegetation	Constant	RR, LM	No	No	No

Analysis of Historical Land-Use and Land-Cover Change

Deforestation mapping data provided by PRODES were used to analyze the history of land use changes. The main methodological steps taken by PRODES to map deforestation in the Brazilian Amazon are presented below:

Data sources and pre-processing:

PRODES is one of the three programs of the PAMZ+ "Programa de Monitoramento da Amazônia e Demais Biomas", a program for monitoring land use and land cover in Brazilian biomes, developed by INPE (Instituto Nacional de Pesquisas Espaciais), the Brazilian Institute for Space Research. PRODES monitors primary forest loss annually using satellite imagery, with the aim of estimating annual deforestation rates for the Brazilian Legal Amazon. These data are used by Brazilian authorities for land use planning, but are also open to the public. The PRODES program uses "Landsat Class Images", defined as Landsat-8 and Landsat-9 (USA), SENTINEL-2 (European Union) or CBERS-4/4A from INPE/CRESDA (Brazil/China). The SENTINEL-2, CBERS-4/4A and INPE/CRESDA images are used complementarily for regions with high cloud cover. These images have a spatial resolution in the range of 20-30m.

According to INPE⁸⁴, these images are acquired from their ready-to-use sources, that is, already pre-processed with refined geometric corrections using ground control points and digital elevation models,

⁸⁴ Almeida, Claudio Aparecido de, Luís Eduardo Pinheiro Maurano, Dalton de Morisson Valeriano, Gilberto Câmara, and Lúbia Vinas. 2022. "Methodology used in PRODES and DETER systems - 2nd edition (updated)", 50. Available at: <http://mtc-m21d.sid.inpe.br/col/sid.inpe.br/mtc-m21d/2022/08.25.11.46/doc/thisInformationItemHomePage.html>

which corresponds to the highest level of geometric correction. An assessment of the geometric quality in the Reference Region revealed an RMS of less than 1 pixel (30m).

Data classification and post-processing:

PRODES selects images with sufficiently low cloud cover from the pool of images available for the monitoring year. After this selection, they are used to create a single composite per scene, of the 6R/5G/4B type (Landsat-8 or 9), corresponding to the mid-infrared (1.57 - 1.65 μm), near-infrared (0.85 - 0.88 μm) and red (0.64 - 0.67 μm) bands, respectively, used as a basis for mapping. This composite is then contrast-enhanced to help reveal the deforested areas. The deforested polygons are drawn through photointerpretation of this composite with contrast based on their tone, shape, texture and spatial context.

The deforestation mapped by experts is compared with images used in the previous monitoring period to detect new deforestation. To ensure that only new deforestation fragments are mapped, all deforestation detected in the time series is masked, along with regions classified as non-forested.

The PRODES mapping procedure can detect deforestation increments of 1ha or larger. However, for consistency with previous versions of the monitoring procedure, only deforestation increments of 6.25ha or larger are included in each year in the matrix version. Smaller deforestation increments found by experts are stored in a database for tracking and are made available in vector format separately from 2024 onwards. The raster data available in the 30m pixel size together with deforestation vectors smaller than 6.25ha were used in our analysis.

The PRODES raster data classifies the pixels into the following classes: Forest, Deforestation, Non-Forest Vegetation and Hydrography. For the Reference Region, the forest class corresponds to forests belonging to the Ombrophilous Forest and Forested Savanna phytophysognomic formation (Brazilian Institute of Geography and Statistics 2012). PRODES land cover rasters identify deforestation that occurred each year with a different code, along with constant codes for the other classes. We extracted and separated the data into a land cover raster per year, resulting in a time series of land cover classifications. All GIS procedures were performed in R 4.4.1⁸⁵ and the terra⁸⁶, and sf packages⁸⁷, and in QGIS 3.34.9-Prizren⁸⁸.

⁸⁵ R Core Team (2024). *_R: A Language and Environment for Statistical Computing_*. R Foundation for Statistical Computing, Vienna, Austria. <<https://www.R-project.org/>>.

⁸⁶ Hijmans R (2024). *_terra: Spatial Data Analysis_*. R package version 1.7-78, <<https://CRAN.R-project.org/package=terra>>.

⁸⁷ Pebesma, E., & Bivand, R. (2023). *Spatial Data Science: With Applications in R*. Chapman and Hall/CRC. <https://doi.org/10.1201/9780429459016>

⁸⁸ QGIS.org, 2024. QGIS Geographic Information System. QGIS Association. <http://www.qgis.org>

Map Accuracy Assessment

The deforestation maps made by PRODES have an overall accuracy of more than 90%⁸⁹. However, we conducted an accuracy assessment of 2022 PRODES classification map specifically for the Manoa REDD+ Project Reference Region. This was done by comparing the mapped classifications to reference data collected using a stratified random point sample, which was visually evaluated by interpreters on Landsat and PLANET images. Refer to next section “*Estimation of Land Cover and Land Cover Change Areas*” for a detailed explanation on how the sampling was collected. Accuracy was assessed as the user’s, producer’s and total accuracy from the confusion matrix shown in **Table 18** below:

Table 18. Confusion matrix and accuracy assessment of the land cover classification map of PRODES for 2022.

		Planet 2022 (reference)						
		Forest	Deforestation	Other	Total (ha)	Samples	UA	CE
PRODES 2022 (class)	Forest	910,793	33,524	23,497	967,814	234	94.11%	5.89%
	Deforestation	58,891	398,838	8,524	466,253	602	85.54%	14.46%
	Other	1,124	0	24,351	25,475	3	95.59%	4.41%
	Total (ha)	970,807	432,361	56,373	1,459,542			
	Samples	258	571	10		839		
	PA	93.82%	92.25%	43.20%			91.32%	
	OE	6.18%	7.75%	56.80%				8.68%

Cells of the table contain estimated areas in the intersection between Mapped and Reference LULC classes for the year 2022. These were calculated as:

$$\hat{S}_{i,j} = \frac{n_{i,j}}{n_{i,.}} \cdot \frac{S_{i,.}}{S}$$

Where

$\hat{S}_{i,j}$: estimated area of mapped class i , that is actually class j ;

$n_{i,j}$: samples allocated in mapped class i , that were class j in the reference evaluation;

$n_{i,.}$: total samples in mapped class i ;

$S_{i,.}$: area of mapped class i ;

⁸⁹ OLIVEIRA, LP; ESCADA, MS; Renno, CD Spatial patterns of deforestation and estimation of the accuracy of PRODES maps for the Brazilian Legal Amazon. Forest Sciences, Santa Maria, v. 29, n. 4, pp. 1763-1775. Available at: <https://www.scielo.br/j/cflo/a/hLKygNRzYwPxh7j5yzbpzkM/?format=pdf&lang=pt>

S : total area

User's and producer's accuracy were estimated as:

$$UA_i = \hat{S}_{i,i}/S_{i..}$$

$$CE_i = 1 - UA_i$$

$$PA_j = \frac{\hat{S}_{i,i}}{\sum_i \hat{S}_{i,j}}$$

$$OE_i = 1 - PA_j$$

UA_i , CE_i : User's Accuracy and Commission Error for mapped class i , respectively;

PA_j , OE_i : Producer's Accuracy and Omission Error for reference class j , respectively;

The analysis indicates that the overall accuracy (considering only forest and deforestation) is 91.32%, while the user (UA) and producer (PA) accuracies for forest are 94% a.c. each. For deforestation, the values are 85.5% and 92.25%, respectively. The errors of commission (CE) and omission (OE) are indicated in the red column/row.

Estimation of Land Cover and Land Cover Change Areas

Data Collection

The following sub-sections describe the procedures for reference data collection and subsequent area estimation. The procedure generally follows the document "GFOI Methods and Guidance document, v2.0, page 136, Box 24 or v3.0, page 185, Box 32", saving small differences described in section "Methodology Deviations".

The procedure followed the steps:

- RS Imagery used for reference data collection
- Sampling design
- Response design
- Estimation of land cover and land cover change areas
- Estimation of the uncertainty in LU/LC change areas and calculation of the uncertainty penalty factor
- Application of the penalty factor to obtain final estimates of total historical deforestation area and annual rate

RS Imagery used for reference data collection

Reference LU/LC and LU/LC change data were collected by visual interpretation of Planet and Landsat 5 and 7 image mosaics. For 2022, monthly Planet satellite mosaics with a spatial resolution of 4.77 meters were used, with dates ranging between November 2022 and February 2023. Due to the lack of higher

resolution data for 2000, the best available dataset was the 30-meter spatial resolution images from the Landsat 5 and Landsat 7 (June to July 2000). The scenes/orbits/points used are all included in Table 19 below. The mosaic was processed in Google Earth Engine. The GEE database was filtered to include only images with no more than 10% cloud coverage.

Table 19: Landsat scenes used for reference data collection for 2000

Date	WRS Path	WRS Row	Satellite	Sensor
06/04/2000	232	65	LANDSAT 5	TM
06/05/2000	231	67	LANDSAT 7	TM
06/12/2000	232	67	LANDSAT 7	TM
6/13/2000	231	67	LANDSAT 5	TM
6/13/2000	231	66	LANDSAT 5	TM
6/28/2000	232	67	LANDSAT 7	TM
6/28/2000	232	66	LANDSAT 7	TM
6/29/2000	231	67	LANDSAT 5	TM
6/29/2000	231	66	LANDSAT 5	TM
07/06/2000	232	65	LANDSAT 5	TM
07/06/2000	232	66	LANDSAT 5	TM
07/06/2000	232	67	LANDSAT 5	TM
7/14/2000	232	65	LANDSAT 7	TM
7/15/2000	231	66	LANDSAT 5	TM
7/15/2000	231	67	LANDSAT 5	TM
7/22/2000	232	67	LANDSAT 5	TM

Sample design

A stratified **random points** sample of locations was used for reference data collection. The sampling unit was the geographic coordinate point, the sampling frame was the boundary of the project's reference region.

The stratification was defined using PRODES LU/LC change map for the project's reference region (Figure 23). The strata were defined as the change classes (deforestation increment, stable forest and stable deforestation), generated from classification maps of the beginning and end of the historical period. Two additional strata, defined as 2km buffers over the stable deforestation class and 500m on deforestation increment class (Table 18, Figure 30), were added to the stratification to reduce the size of the bigger stable deforestation and forest strata, which helps reducing the standard error of deforestation increment area estimates and increase sampling efficiency. These classes were added based on the hypothesis that deforestation potentially missed by PRODES are more likely to be located close to old deforestation and even closer to recent deforestation. The resulting stratification is detailed in the table below:

Table 20 Definition of strata in the reference data collection sample

Strata	Area (ha)	Proportion (%)	Definition
Stable forest	517,192	34.8%	Composed of all 30m x 30m pixels that remained as “Forest” between the beginning and end of the historical period, according to PRODES.
Stable deforestation	18,468	1.2%	Composed of all 30m x 30m pixels that remained as “Deforestation” between the beginning and end of the historical period, according to PRODES.
Increment	390,936	26.3%	Composed of all 30m x 30m pixels that transitioned from “Forest” to “Deforestation” between the beginning and end of the historical period, according to PRODES.
Buffer over deforestation	122,747	8.3%	2km buffer from the edge of the “Stable deforestation” class.
Buffer over increment	408,136	27.5%	500m buffer from the edge of the “Increment” class. This class has priority over the “Buffer over deforestation” class, since deforestation omitted by PRODES is more likely to occur close to recent deforestation.
Other	27,125	1.8%	Formatted by pixels of water and non-forest vegetation.
Total	1,484,604.47	100.00%	

The “other” class represents the classes in PRODES data (non-forest vegetation and water and clouds) that were excluded from the sampling.

Sample size: 839 points were randomly allocated to the 5 strata (**Table 22**), with the following distribution based on previous pilot sampling: 18 samples in the “Stable forest” class, 51 samples in “Stable deforestation”, 470 samples in “Increment”, 267 samples in “Buffer on increment” and 33 samples “Buffer on deforestation”.

Response design

The sample points were evaluated for their land cover change classes during the historical period using Landsat and Planet images as described above. The response classes were:

Table 21: Response classes

Class	Description
Stable Forest	Forest in 2000 remaining as forest in 2022
Stable Deforestation	Non-forest in 2000 remaining as non-forest in 2020
Deforestation	Forest in 2000 changed to non-forest in 2022
Regeneration	Non-forest in 2000 changed to forest in 2022

The samples were distributed to 3 trained interpreters, who carried out the visual interpretation of the images in two periods, 2000 and 2022.

All interpreters possess formal training and experience in visual interpretation of land use and land cover characteristics from satellite imagery of different resolutions. In addition, an initial assessment of interpreter’s agreement was carried out using a fraction of the samples from each class, to improve the

confidence of the interpretations. The initial level of agreement was assessed, and any cases of disagreement were examined and assimilated by the three interpreters before data collection began. For data collection, approximately 10% of the samples were evaluated by all three interpreters and used in post-collection quality assessment. The remaining 757 samples were randomly distributed to interpreters, maintaining an approximately equal proportion of samples per strata for each. The three interpreters analyzed 334, 336 and 333 samples respectively (Table 22). All 839 samples were used in the analysis, however, majority voting was used as the reference class for the 10% percent of the samples evaluated by all three interpreters.

Table 22. Distribution of the 839 samples analyzed.

Strata	10% reserved	Interpreter			Total
		1	2	3	
Stable forest	2	7	4	5	18
Stable deforestation	4	19	19	9	51
Increment	45	143	147	135	470
Buffer over increment	24	80	74	89	267
Buffer over deforestation	7	3	10	13	33
Marginal Totals	82	252	254	251	839
Grand Total analyzed by interpreter		334	336	333	

All the interpreters used the same imagery and tools to interpret the sample LU/LC classes. The evaluations were carried out whenever possible using the historical period. In very rare cases, evaluations needed to be carried out on close dates (2-5 days after or before) due to cloud impairment or mosaic artifacts still remaining from imagery processing, or when the point location was of insufficient clarity for the interpreters to make a confident choice. This was necessary to guarantee the best quality of classifications while maintaining the reference dataset as close as possible to the HRP boundary.

The interpretation and classification of the samples was performed in the QGIS program⁹⁰ and the output data were treated with the R language⁹¹.

⁹⁰ QGIS.org, 2024. QGIS Geographic Information System. QGIS Association. <http://www.qgis.org>

⁹¹ R Core Team (2024). *_R_: A Language and Environment for Statistical Computing_*. R Foundation for Statistical Computing, Vienna, Austria. <<https://www.R-project.org/>>.

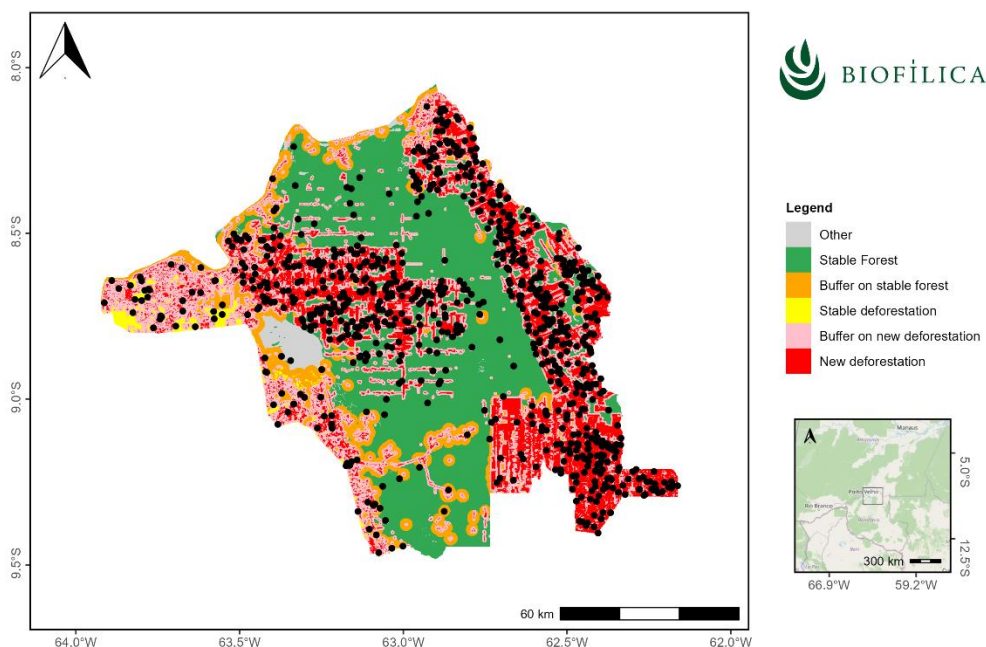


Figure 23 The strata and resulting distribution of sample points in the project's reference region (coordinate reference system: WGS 84)

The interpreters classified the land cover of each sample in each period (2000 and 2022). The final reference data is land cover change, which was obtained by comparing the interpretations of each period (**Table 23**):

Table 23. Final ranking relational key

Class in 2000	Class 2022	Final response class
Forest	Forest	Stable Forest
Forest	Deforestation	Increase
Forest	Other	Increase
Deforestation	Deforestation	Stable Deforestation
Deforestation	Other	Stable Deforestation
Other	Deforestation	Stable Deforestation
Other	Other	Other

The final agreement between the interpreters was evaluated (with 10% of the data classified) on the final response class data. Total agreement (cases where all three ratings are the same) was observed in 72 points (87.8%) and partial agreement (cases where at least two ratings are the same) in 10 points (12.2%). The final inter-interpreter reliability was assessed using the Kappa statistic (Fleiss' Kappa for m

Raters), calculated using the *irr* package.⁹² in R. The Kappa statistic was **0.865**, indicating **strong agreement**⁹³ between **interpreters**.

Table 24: Result of the Fleiss kappa test (function `irr::kappam.fleiss`):

Subjects	=	82
Raters	=	3
Kappa	=	0.865
z	=	18.3
p-value	<	0.001

Estimation of land use change area and calculation of historical deforestation rate in the reference region

Area estimation was performed using the procedures described in section 8.1.1.5 of the VM0015 v1.2 Methodology. That procedure uses stratified sampling of reference data to obtain unbiased estimates of the area of each target LU/LC and LU/LC change class. The Table 25 shows the results.

The area of each class in the reference region was estimated by adding the area estimates of each reference class within each stratum (first to last row Table 25):

$$\hat{S}_j = \sum_i \frac{n_{i,j}}{n_{i,.}} \times S_i$$

Where:

$\hat{S}_j$: Estimated area of reference class j;

$n_{i,j}$: number of samples of reference class j in stratum i;

$n_{i,.}$: total number of samples in stratum i;

S_i : area of the stratum i.

Per Table 25, the total areas of LU/LC and LU/LC change between 2000 and 2022 are:

- 943,266 hectares of stable forest
- 59,615 hectares of stable deforestation; and
- 387,869 hectares of increased deforestation during the historical period.

Estimation of the uncertainty in LC change areas and calculation of the uncertainty penalty factor

⁹² Gamer M, Lemon J, <puspendra.pusp22@gmail.com> IFPS (2019). `_irr`: Various Coefficients of Interrater Reliability and Agreement_. R package version 0.84.1, <https://CRAN.R-project.org/package=_irr>.

⁹³ McHugh ML. Interrater reliability: the kappa statistic. *Biochem Med (Zagreb)*. 2012;22(3):276-82. PMID: 23092060; PMCID: PMC3900052. <<https://pubmed.ncbi.nlm.nih.gov/23092060/>>

The standard error of the area estimate of reference class j was calculated as:

$$s.e.(\hat{S}_j) = \sqrt{\sum_i p_{j,i} \times (1 - p_{j,i}) \times W_i^2}$$

Where:

$s.e.(\hat{S}_j)$: Standard error of the estimated area of reference class j;

$p_{j,i} = n_{i,j}/n_{.,j}$: proportion of samples of reference class j in stratum i;

W_i : relative size of stratum i;

Finite population corrections dropped given large strata sizes.

Uncertainty of deforestation area was calculated as the relative ratio (standard error / estimate)%. The estimated increase in deforestation during the historical period had an uncertainty of 3.7%, below the 10% tolerable by the methodology, dispensing with the need for a conservative discount (**Error! Reference source not found.**).

Table 25. Contingency table and LU/LC change area estimates.

Stratum Class	Deforestation	Regeneration	Stable Forest	Stable Deforestation	Other	Samples	Mapped Area (strata)	W
Stable Forest	0	0	31	0	1	32	517,192	34.8%
Buffer over deforestation	0	0	6	0	2	8	122,747	8.3%
Stable deforestation	0	1	0	5	0	6	18,468	1.2%
Buffer over increment	18	2	179	22	7	228	408,136	27.5%
Deforestation increment	514	0	43	7	1	565	390,936	26.3%
Other	0	0	0	0	0	0	27,142	1.8%
Total Samples	532	3	259	34	11	839	1,484,622	100.0%
Area Estimate (ha)	387,869	6,658	943,266	59,615	87,214			
Area Estimate Variance	75,337,377	14,247,441	748,472,800	74,898,256	74,898,256			

Table 26 Uncertainty of deforestation estimate and final activity data estimate, after discount.

Results	Value
Historical reference period (years)	22
Estimated area over this period	387,869
Activity Data (ha)	17,630
Standard Error	395
Sampling Error (CI90%)	648.95
Uncertainty	3.7%
Conservativeness Penalty Increase	0%
Final Activity Data (ha)	17,630

Application of the penalty factor to obtain final estimates of total historical deforestation area and annual rate

Since the uncertainty was lower than 10%, no conservative discount was needed. Therefore, the total deforestation during the historical period was estimated as **387,869 ha**, with an annual rate of **17,630 ha/year**.

4.1.2 Projection of Future Deforestation

Projection of the Quantity of Future Deforestation

Due to inconclusive evidence of the existence of a trend of deforestation rates in the reference region (Section 3.4.3), the historical average approach was used to project future deforestation in the area.

To calculate future rates, we used the following equation from page 48 of the VM0015 1.2:

$$ABSLRR_{i,t} = ARR_{i,t-1} \times RBSLRR_{i,t}/100$$

Where:

$ABSLRR_{i,t}$: Annual area of baseline deforestation in stratum i within the reference region at year t (ha/yr)

$ARR_{i,t-1}$: Area with forest cover in stratum i in the reference region at year $t - 1$ (ha)

$RBSLRR_{i,t}$: Deforestation rate applicable to stratum i within the reference region at year t (%)

t : 1, 2, 3, ..., T , a year of the proposed project crediting period (dimensionless)

i : 1, 2, 3 ... IRR, a stratum within the reference region (dimensionless)

We calculated $RBSLRR_{i,t}$ as follows:

$$RBSLRR_{i,t} = -\frac{\log\left(\frac{ARR_{2022}}{ARR_{2000}}\right)}{2022 - 2000} = 1.566\%$$

Where ARR_{2022} and ARR_{2000} were calculated as the estimated area values from Table 25 (stable forest and stable forest + deforestation increment, respectively).

Table 27 to Table 29 shows resulting projected deforestation ($ABSLRR_{i,t}$) values for the next baseline validation period for the reference region, the project area and the leakage belt, after the spatial allocation (next section):

Table 27 Baseline annual deforestation areas in the Reference Region.

Project year t		Stratum i in the reference region	Total	
		1	annual	cumulative
		ABSLRR $_{i,t}$	ABSLRR $_t$	ABSLRR
Initial	Final	ha	ha	ha
01-Jan-2023	31-Dec-2023	14,768	14,768	14,768
01-Jan-2024	31-Dec-2024	14,537	14,537	29,305
01-Jan-2025	31-Dec-2025	14,309	14,309	43,614
01-Jan-2026	31-Dec-2026	14,085	14,085	57,699
01-Jan-2027	31-Dec-2027	13,865	13,865	71,564
01-Jan-2028	31-Dec-2028	13,648	13,648	85,212

Table 28 Baseline annual deforestation areas in the Project Area.

Project year t		Stratum i of the reference region in the project area	Total	
		1	annual	cumulative
		ABSLPA $_{i,t}$	ABSLPA $_t$	ABSLPA
Initial	Final	ha	ha	ha
01-Jan-2023	31-Dec-2023	2,809	2,809	2,809
01-Jan-2024	31-Dec-2024	2,765	2,765	5,573
01-Jan-2025	31-Dec-2025	2,721	2,721	8,295
01-Jan-2026	31-Dec-2026	2,679	2,679	10,974
01-Jan-2027	31-Dec-2027	2,637	2,637	13,611
01-Jan-2028	31-Dec-2028	2,596	2,596	16,206

Table 29 Baseline annual deforestation areas in the Leakage Belt.

Project year t		Stratum i of the reference region in leakage belt	Total	
		1	annual	cumulative

		ABSLK _t	ABSLK _t	ABSLK
Initial	Final	ha	ha	ha
01-Jan-2023	31-Dec-2023	2,426	2,426	2,426
01-Jan-2024	31-Dec-2024	2,388	2,388	4,815
01-Jan-2025	31-Dec-2025	2,351	2,351	7,166
01-Jan-2026	31-Dec-2026	2,314	2,314	9,480
01-Jan-2027	31-Dec-2027	2,278	2,278	11,758
01-Jan-2028	31-Dec-2028	2,242	2,242	14,001

Projection of the Location of Future Deforestation

Logistic regression was used to define the location of future deforestation. Logistic regression is suitable for this application because: a) it is a widely used method in science, simple and has competitive performance compared to more complex models; b) it estimates probabilities, which are an adequate measure of deforestation risk ; c) it allows for incorporating appropriate auxiliary data to explain the location of deforestation; d) it capable of providing assessment of local uncertainty.

The main steps taken in this stage were:

1. Organization of georeferenced maps of land use and land cover and georeferenced maps with the explanatory factors of deforestation;
2. Calibration of the model, determining the model's parameters, their significance and goodness of fit;
3. Assessment of the prediction accuracy of the model (Figure of Merit - FOM);
4. Development of the baseline deforestation scenario.

Preparing the factor maps:

To perform this step, we selected 4 static spatial variables that explain the spatial distribution of deforestation in the reference region (Table 30 and Figure 24). In addition to these static variables, dynamic maps of distance to deforestation and forest patch area were included. The dynamic variables were added to reflect their change of status in 2000, 2011 and 2022.

Together, these variables enable the deforestation risk model to account for accessibility, protection level and ecological aspects of the landscape, and cover some of the variables commonly related to deforestation.

Table 30 lists these variables, their sources, and the main processing steps applied to obtain them, among other information. All variables were resampled to a pixel dimension of approximately 30m x 30m, to fit the deforestation dataset used (PRODES). The spatial distribution of these variables is shown in Figure 24.

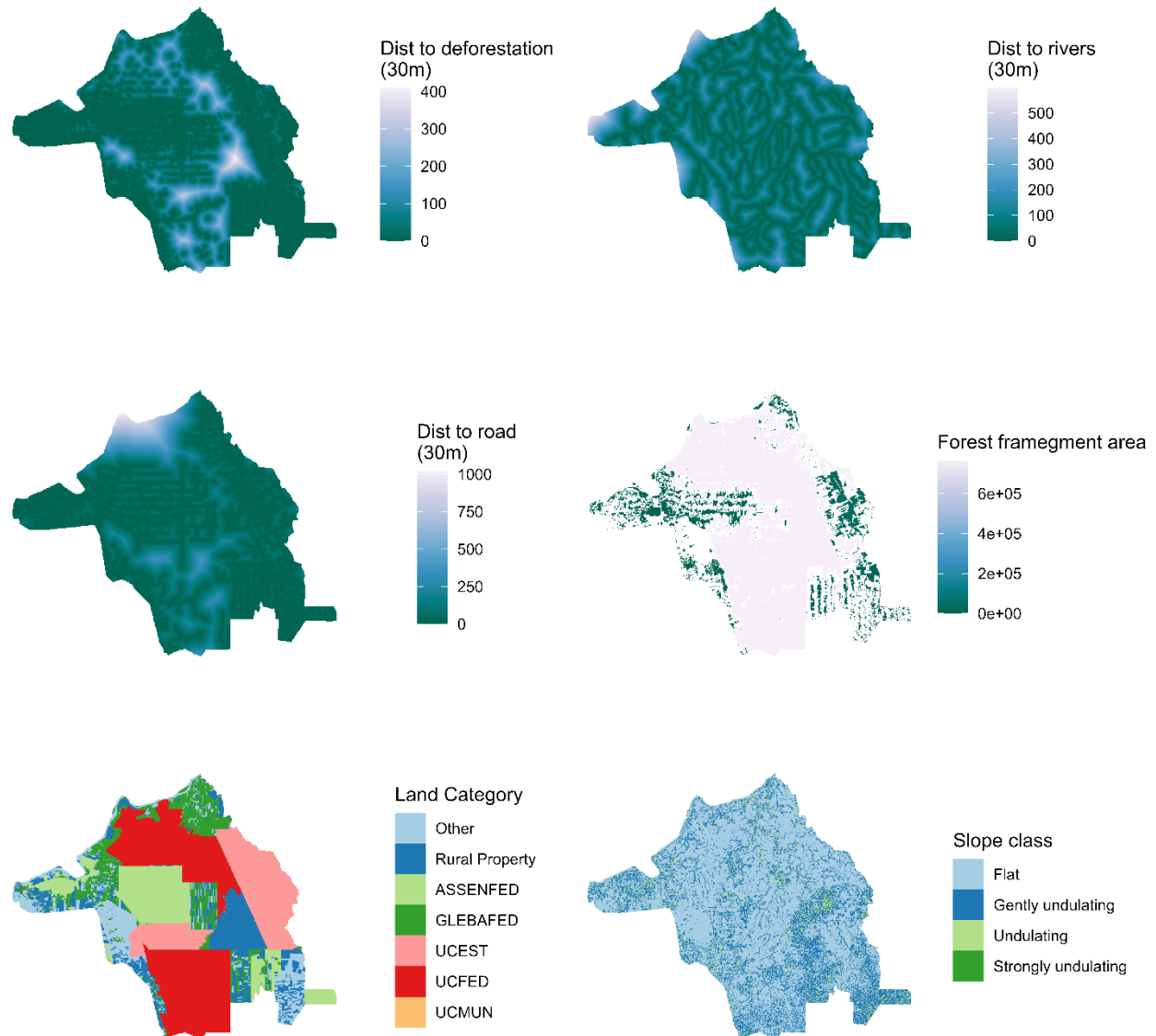


Figure 24 Factor map.

Table 30 - List of maps, variables and factor map.

⁹⁴ Available at: http://terrabrasilis.dpi.inpe.br/download/dataset/legal-amz-prodes/raster/prodes_amazonia_legal_2023.zip

⁹⁵ Available at: https://terrabrasilis.dpi.inpe.br/download/dataset/legal-amz-prodes/vector/prodes_amazonia_legal.gpkg.zip

⁹⁶ Available at: <https://dados.mma.gov.br/dataset/unidadesdeconservacao>

⁹⁷ Available _____ at:
https://certificacao.incra.gov.br/csv_shp/export_shp.py?code=eyJrYWQlOiIjb2RlQ3J5cHRvZ3JhcGh5IiwiaWxnljoiZGlyIiwiaW5ljiOiQTl1NkdDTSJ9..0eO_DwJ6ROPHjqt_C56oqHM4QRSR-S1gMBWHfCoh7cZENI1UV5TmTI3L9IZFQ.MXYF7DWUQPAmV_YzPYC6-Q

⁹⁸ Available at: <https://metadados.snirh.gov.br/geonetwork/srv/por/catalog.search#/metadata/0f57c8a0-6a0f-4283-8ce3-114ba904b9fe>

⁹⁹ Available at: <https://servicos.dnit.gov.br/vgeo/>

¹⁰⁰ Available at: <https://www.imazongeo.org.br/>

¹⁰¹ Brazilian Geological Survey. Available at: <https://sosgisbr.com/tag/declividade/>

Table 31 shows the coefficients of the logistic regression, exponentiated to better reflect their relative impacts on the deforestation odds ratio. All coefficients had high statistical significance, and the model had an AIC of 167088.2, compared to 246242.2 of the null model. The full model reduced the residual deviance by approximately 32%.

The three most important variables in the model were distance to roads, land status class and distance to old deforestation, while distance to rivers had minimal impact in reducing the residual deviance of the model (Table 28). The exponentiated coefficients indicate that unclassified regions (the omitted land status class) had the highest risk of deforestation, while Federal Conservation Units had the lowest risk (greatest reduction of deforestation risk in relation to the omitted class). They also indicate that Federal settlements have deforestation risk level of almost at the same level as of that of rural properties in the reference region.

Table 31: (Exponentiated) Logistic regression coefficients

Model Term	Coefficient	Standar Error	Test-statistic	p-value
(Intercept)	1.048784275	0.029042951	1.640042029	0.1010
dist_drenagem	1.000490239	0.000109967	4.456941422	0.0000
dist_desm	0.998587521	4.80466E-05	-29.41891141	0.0000
dist_estradas	0.987922138	0.000185084	-65.65350087	0.0000
area_frag_ha	1.000000852	1.94396E-08	43.80658552	0.0000
land_status:Rural Property	0.761741174	0.020750594	-13.11521235	0.0000
land_status:ASSENFED	0.695762797	0.021398700	-16.95180007	0.0000
land_status:GLEBAFED	0.269632312	0.023057497	-56.84467975	0.0000
land_status:UCEST	0.126475003	0.045289757	-45.65514857	0.0000
land_status:UCFED	0.023379644	0.032764770	-114.6319527	0.0000
land_status:UCMUN	0.124198062	0.356676122	-5.848100235	0.0000
Slope:Suave/ondulado	1.225703636	0.013403259	15.18399950	0.0000
Slope:Ondulado	1.358944206	0.027390852	11.19746398	0.0000
Slope:Forte ondulado	1.427720149	0.145915060	2.440316097	0.0147

Table 32: Factors sorted by residual deviance reduction

Factor	Res. Dev. Reduction
intercept	0
dist_drenagem	4
slope	313
area_frag_ha	840

dist_desm	3,715
land_status	34,651
dist_estradas	39,657

The prediction of the logistic regression applied to the reference region produces a deforestation risk map that identifies areas with the highest (1) and lowest (0) probability of deforestation (Figure 25). This deforestation risk map is the starting point for generating future baseline deforestation scenarios.

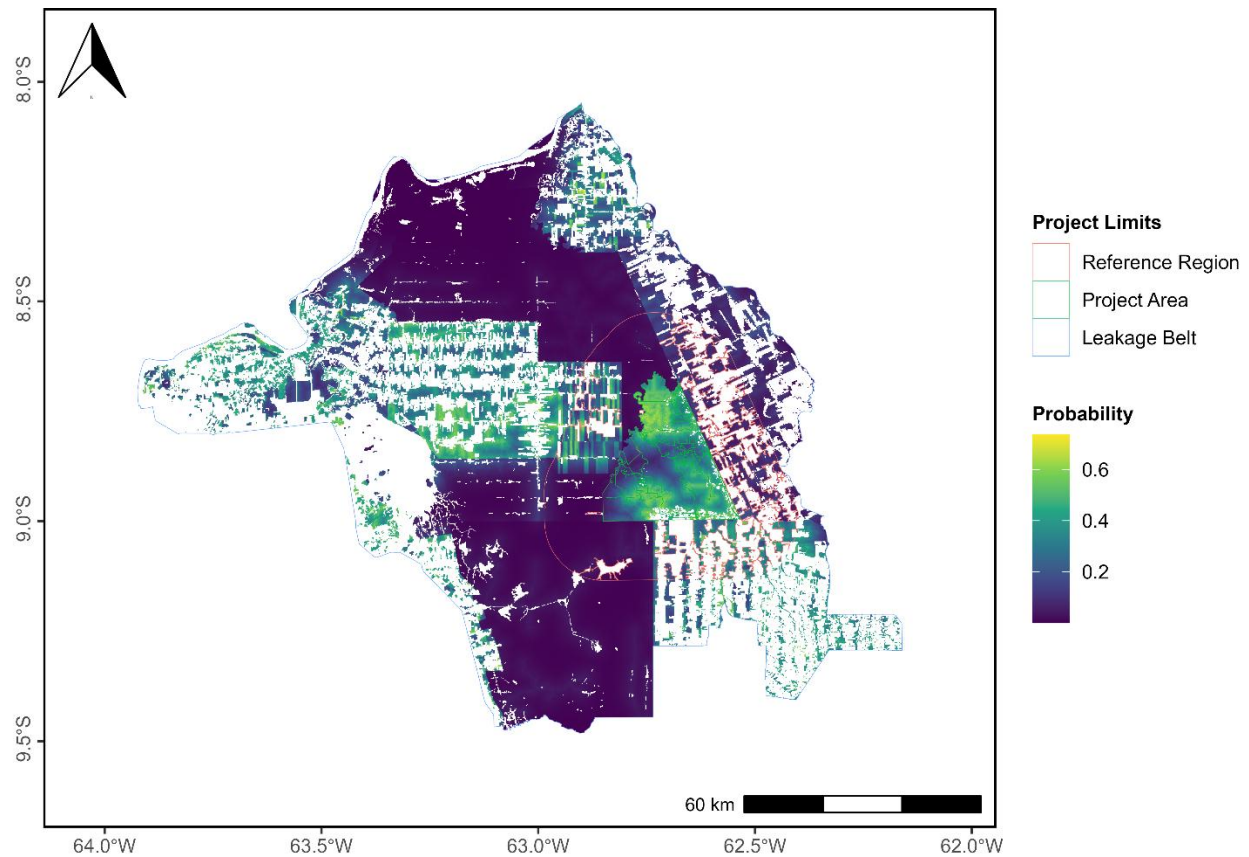


Figure 25 - Risk of deforestation in the Reference Region from 2022

Selecting the most accurate deforestation risk map

To assess the quality of the model generated, option “a” (calibration and confirmation using two historical sub-periods), available in the VM0015 methodology version 1.2, was chosen (page 57). Data on deforestation between 2000 and 2011 and the predictor variables listed were used to calibrate the model, while the map of deforestation up to 2022 was used for the confirmation process. In this process, a 2022 deforestation map was simulated from the data observed between 2000 and 2011.

The FOM (Figure of Merit) technique was applied to assess the accuracy of the simulated map in 2022. The FOM result is the ratio of the intersection of the observed change (change between the reference map at time 1 and time 2, 2012 and 2022) and the simulated change (change between the reference map at time 1 and the simulated map at time 2) in relation to the union of the observed change and the predicted change, as defined in equation 9 of the VM0015 v1.2 methodology.

$$FOM = B / (A+B+C)$$

Where:

- FOM = Figure of Merit (adimensional)
- A = Area of error due to observed change predicted as persistence (ha)
- B = Correct area due to observed change predicted as change (ha)
- C = Area of error due to observed persistence predicted as change (ha)

We obtained change and persistence maps for the reference region based on the predicted probability map and deforestation rates for the calibration period. The estimated change map was calculated as:

$$predicted\ change\ map = area\ of\ change * \frac{probability\ map}{\sum probability\ map}$$

$$predicted\ persistence\ map = area\ of\ persistence * \frac{(1 - probability\ map)}{\sum (1 - probability\ map)}$$

Where:

predicted change map: map of estimated area of deforestation for 2012-2022.

area of change: projected area of change for 2012-2022 (confirmation period). This was obtained from maps of deforestation from the PRODES system.

probability map: map of predicted deforestation probabilities for 2012-2022;

predicted persistence map: map of estimated area of forest persistence for 2012-2022;

area of persistence: projected area of forest persistence for 2012-2022 (confirmation period).

A, B and C values used to calculate the FOM value were estimated by:

$$A = \sum (predicted\ persistence\ map \times I(deforestation\ map))$$

$$B = \sum (predicted\ change\ map \times I(deforestation\ map))$$

$$C = \sum (predicted\ change\ map \times I(persistence\ map))$$

Where $I(X)$ is the indicator operator: 1, when land cover change class is X; 0, otherwise.

Table 33- Calibration and validation results.

Term	Area (ha)	Percentage
A	199,270	14.1%
B	114,636	8.1%
C	154,690	11.0%
Forest Persistence	943,266	66.8%
Total	1,411,862*	100.0%

* The Project area was removed from calibration to avoid project effects

The VM0015 methodology indicates that the minimum threshold for the best fit measured by the FOM should be defined by the net change observed in the reference region during the model's calibration period. The observed net change should be calculated as the total area of change modeled in the reference region during the calibration period (percentage of the total area of the reference region), and the FOM value should be at least equivalent to this value. If the FOM value is below this threshold, the project proponent must demonstrate that at least three models have been tested (three deforestation risk maps), and the map with the best FOM must be used.

The net change observed in the Reference Region for the period 2000 to 2011 was 130.539 ha (8.8% of the reference region), and the FOM value obtained by applying equation 9 of the VM0015 methodology with the data from **Error! Reference source not found.** was 22.08%, higher than the required threshold. The deforestation risk map developed in the calibration phase offers good performance for spatially projecting changes in land use up to 2052 in the REDD+ Manoa Reference Region.

The methodology requires testing multiple models to identify the most accurate one. We calculated the FOM values for models with increasing number of variables, from the model with the least fit (least deviance reduction) to the model with the highest fit (the full model). The results, summarized in Table 34, indicate that FOM values generally increase with the inclusion of additional variables, likewise the deviance reduction. The full model yielded the highest FOM (22.05%), confirming that all selected variables significantly influence the spatial distribution of deforestation.

Table 34- FOM Values and Variables Included in Each Model

Model (variables included)	FOM value	Passed
<i>dist_drenagem</i>	9.97%	yes
<i>dist_drenagem + dist_desm</i>	10.21%	yes

<i>dist_drenagem + dist_desm + dist_estradas</i>	16.27%	yes
<i>dist_drenagem + dist_desm + dist_estradas + area_frag_ha</i>	16.64%	yes
<i>dist_drenagem + dist_desm + dist_estradas + area_frag_ha + land_status</i>	24.46%	yes
<i>dist_drenagem + dist_desm + dist_estradas + area_frag_ha + land_status + slope</i>	24.47%	yes

Consequently, the full model was selected as the most reliable model for projecting deforestation patterns in the reference region.

Mapping the location of future deforestation

The procedure for selecting the pixels with the highest risk of deforestation and preparing the deforestation baseline maps was carried out by sorting the area estimates maps inside the project area the leakage belt and the rest of the reference region. Inside each region, the pixels of highest probabilities were selected according to their ranks and marked as projected deforestation until their areas exceed the projected deforestation for the respective region each year. This makes the mapping procedure consistent with area estimates per region described in the next sections.

The result is presented showing the projected deforestation in the Reference Region for the first 6 years of this second period of the project baseline (Figure 26), from 2023 to 2028.

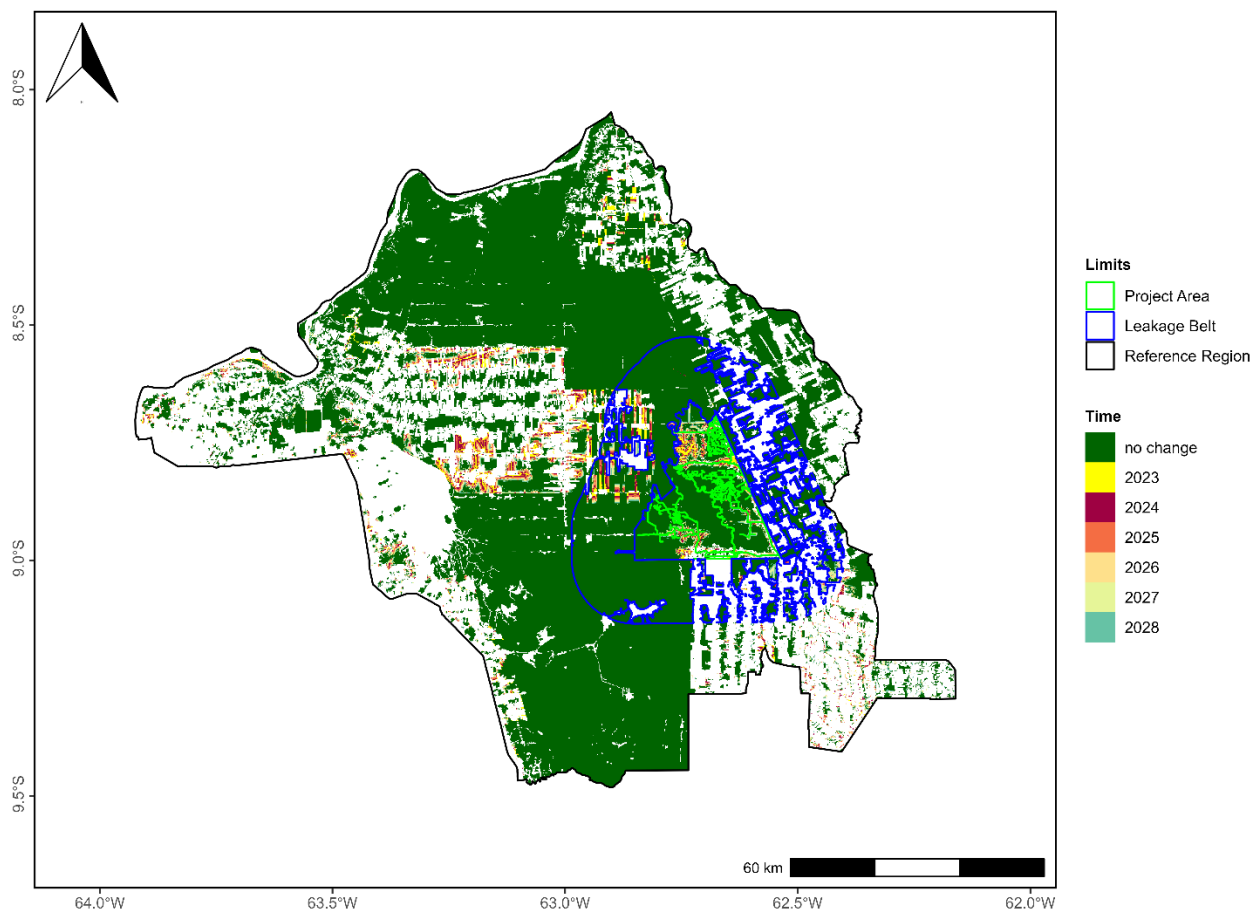


Figure 26 - Baseline deforestation in the Reference Region until 2028

4.1.3 Definition of Land Use and Land Cover Change Component of the Baseline Calculation of Baseline Activity Data Per Forest Class

We applied a methodology deviation for calculating the area of baseline deforestation in the project and leakage belt areas. Instead of using ranked probabilities values to allocate future deforestation to the reference region, then subsequently calculating the resulting area allocated to the project area and leakage belt, we used a different approach. Instead, we multiplied the yearly projected deforestation area in the reference region by the probability map, creating maps of estimated deforestation area per pixel. Then, we summed the resulting values for pixels inside the project area and leakage belt to calculate their respective projected deforestation for each year.

More precisely, the area of future deforestation inside the project area and leakage belt were calculated using the equations below:

$$ABSLPA_{i,t} = ABSLRR_{i,t} \times \frac{\sum_{u \in AP_i} Risk_u}{\sum_{u \in RR_i} Risk_u}$$

$$ABSLK_{i,t} = ABSLRR_{i,t} \times \frac{\sum_{u \in LK_i} Risk_u}{\sum_{u \in RR_i} Risk_u}$$

Where:

$ABSLPA_{i,t}$: Annual area of baseline deforestation in stratum i within the project area at year t (ha/yr);

$ABSLK_{i,t}$: Annual area of baseline deforestation in stratum i within the leakage belt at year t (ha/yr);

$ABSLRR_{i,t}$: Annual area of baseline deforestation in stratum i within the leakage belt at year t (ha/yr);

AP_i, LK_i, RR_i : pixels pertaining to the stratum i of the project area, leakage belt and reference region, respectively;

$Risk_u$: estimated deforestation risk (probability) for pixel u

This procedure amounts to allocating deforestation to each area proportionally to their total expected risk of deforestation. This can be proven to be a more accurate (less biased) way to allocate deforestation to regions than the standard procedure described by the Methodology.

As result, baseline deforestation was estimated as 16,206 hectares in the Project Area between 2023 and 2028 (Table 35) and 14,001 hectares in the leakage belt (Table 36).

Table 35 Annual area deforested by forest class icl within the project area in the baseline case (table 14 of VM0015 v1.2).

Project year t		Stratum i of the reference region in the project area	Total	
		1	annual	cumulative
		$ABSLPA_{i,t}$	$ABSLPA_t$	$ABSLPA$
Initial	Final	ha	ha	ha
01-Jan-2023	31-Dec-2023	2,809	2,809	2,809
01-Jan-2024	31-Dec-2024	2,765	2,765	5,573
01-Jan-2025	31-Dec-2025	2,721	2,721	8,295
01-Jan-2026	31-Dec-2026	2,679	2,679	10,974
01-Jan-2027	31-Dec-2027	2,637	2,637	13,611
01-Jan-2028	31-Dec-2028	2,596	2,596	16,206

Table 36 Annual deforested area by forest class icl within the leakage belt in the baseline case (table 15 of VM0015 v1.2).

Project year t		Stratum i of the reference region in leakage belt	Total	
			1	
		ABSLK $_{i,t}$	ABSLK $_t$	ABSLK
Initial	Final	ha	ha	ha
01-Jan-2023	31-Dec-2023	2,426	2,426	2,426
01-Jan-2024	31-Dec-2024	2,388	2,388	4,815
01-Jan-2025	31-Dec-2025	2,351	2,351	7,166
01-Jan-2026	31-Dec-2026	2,314	2,314	9,480
01-Jan-2027	31-Dec-2027	2,278	2,278	11,758
01-Jan-2028	31-Dec-2028	2,242	2,242	14,001

Calculation of Baseline Activity Data Per Post-Deforestation Forest Class

Method 1 available in Methodology VM0015 was used to define the class that will replace the forest cover in the project baseline. Table 37 shows the area of zone 1, which encompasses the project area, leakage belt and leakage management areas, and the corresponding area of each use and cover class after deforestation.

Table 37 Annual area deforested in each zone within the project area in the baseline scenario (Table 18 of VM0015 v1.2).

Area established after deforestation per zone within the project area			Total baseline deforestation in the project area	
IDz>			1	
Name>		Zone 1	ABSLPA $_t$	ABSLPA
Project year $_t$		ha	ha	ha
Initial	Final			
01-Jan-2023	31-Dec-2023	2,809	2,809	2,809
01-Jan-2024	31-Dec-2024	2,765	2,765	5,573
01-Jan-2025	31-Dec-2025	2,721	2,721	8,295
01-Jan-2026	31-Dec-2026	2,679	2,679	10,974
01-Jan-2027	31-Dec-2027	2,637	2,637	13,611
01-Jan-2028	31-Dec-2028	2,596	2,596	16,206

Table 38 Annual area deforested in each zone within the leakage belt in the baseline scenario (Table 19 of VM0015 v1.2).

Area established after deforestation per zone within the leakage belt			Total baseline deforestation in the leakage belt	
IDz>			1	
Name>		Zone 1	ABSLK _t	ABSLK
Project year _t		ha	ha	ha
Initial	Final			
01-Jan-2023	31-Dec-2023	2,426	2,426	2,426
01-Jan-2024	31-Dec-2024	2,388	2,388	4,815
01-Jan-2025	31-Dec-2025	2,351	2,351	7,166
01-Jan-2026	31-Dec-2026	2,314	2,314	9,480
01-Jan-2027	31-Dec-2027	2,278	2,278	11,758
01-Jan-2028	31-Dec-2028	2,242	2,242	14,001

4.1.4 Calculation of Baseline Activity Data Per LU/LC Change Category

Does not apply.

4.2 Estimation of Baseline Carbon Stock Changes and Non-CO2 Emissions (Step 6)

The carbon stock estimate for the Forest class was obtained through a primary forest inventory, carried out in 2023 by the technical team of Florestal-Planejamento, Paisagismo e Consultoria Ltda. in partnership with Biofílica Investimentos Ambientais. The main results of this study are presented below. More information can be found in the document “Forest inventory for estimating carbon stocks in above and below ground biomass (roots) and dead wood from the Manoa REDD+ Project” (Florestal-Planejamento Consultoria Ltda, 2023).

Sampling the conglomerates

40 conglomerates were set up, distributed in the 4 pre-defined strata in the Manoa Farm area. Each conglomerate contains 4 sampling units, totaling 160 samples. Table 39 shows the number of conglomerates installed in each stratum. Annex I contains the coordinates of the central points of the conglomerates.

Table 39 Number of conglomerates installed in each stratum of Manoa Farm

Strata	Area (ha)	%	Number of conglomerates
--------	-----------	---	-------------------------

Lowland Open Ombrophilous Forest in Logged Area (FOATB_AE)	36,213	48.95%	19
Submontane Open Ombrophilous Forest in Logged Area (FOAS_AE)	21,605	29.20%	12
Lowland Open Ombrophilous Forest in an Unexplored Area (FOATB_NE)	10,054	13.59%	5
Submontane Open Ombrophilous Forest in an Unexplored Area (FOAS_NE)	6,108	8.26%	4
Total	73,980	100.00%	40

In total, 21,168 individuals were inventoried in the conglomerates, of which 20,577 were live trees (97.2%) and 591 were standing dead trees (2.8%).

Of these 21,168 living trees inventoried, 11 individuals had DBH greater than 124 cm, which were downgraded to 124 cm for biomass calculations, as a conservative measure. The range of application of the equation proposed by Nogueira (2008), described above, varies from 5 to 124 cm DBH.

1) Analysis of variance between strata

To carry out the analysis of variance, all the individuals collected in the conglomerates were taken into account, considering the total carbon variable, which includes carbon estimates for live trees (aerial part and roots) and standing dead trees, as shown in Table 40. Note that the $F_{calculated}$ value (2.1444) is lower than the $F_{tabulated}$ (3.9096), at the 1% significance level. It can therefore be concluded that there is no significant difference between the variances of the 4 strata previously considered. This does not mean that the averages are the same, but that their differences, which have not been proven, can be explained by random variation.

Table 40 Analysis of Variance of the means of the conglomerates within the 4 strata defined prior to the forest inventory

Source of variation	SQ	gl	MQ	$F_{calculated}$	valor-P	$F_{tabelado}$
Between groups	651,2043	3	217,0681	2,1444	0,0969	3,9096
Within groups	15.791,0368	156	101,2246			
Total	16.442,2411	159				

As no statistically significant difference was found between the strata, the results will be presented without stratification.

2) Number of individuals

Table 41 shows the number of individuals per hectare inventoried in the 40 conglomerates installed. The overall average between live and dead standing trees was 529.2 ± 18.8 ind.ha⁻¹. Considering only live trees, the average was 514.4 ± 18.3 ind.ha⁻¹, representing 97.2% of the individuals inventoried. As for standing dead trees, the overall average was 14.8 ± 1.7 ind.ha⁻¹, representing 2.8% of the individuals inventoried.

Table 41 Number of individuals per hectare, distributed between living and dead standing trees

Tree situation	Average number of individuals ha ⁻¹			
	n° of individuals	%	IC	Sample error
Living tree	514.4	97.2%	± 18.3	3.55 %
Standing dead tree	14.8	2.8%	± 1.7	11.49 %
Unified average	529.2		± 18.8	3.55 %

3) Basal area

Overall, the average basal area per hectare (considering both living and dead standing trees) was 24.9188 ± 1.2110 m² ha⁻¹. Considering only live trees, the average was 23.6886 ± 1.1506 m² ha⁻¹. For standing dead trees, the overall average was 1.2302 ± 0.1872 m² ha⁻¹.

Table 42 Basal area (m² ha⁻¹), distributed between live and dead standing trees

Tree situation	Average Basal Area (m ² ha ⁻¹)			
	Basal area	%	IC	Sample error
Living tree	23.6886	95.06%	± 1.1506	4.86 %
Standing dead tree	1.2302	4.94%	± 0.1872	15.21 %
Unified average	24.9188		± 1.2110	4.86 %

4) Carbon Stock

Table 43 shows the calculations of the carbon stock in the different components, estimated using the 40 conglomerates installed in the Manoa Farm area. The sampling error was calculated with 95% confidence.

The carbon stock of the “living tree above ground” component was estimated at 116.5464 ± 6.8395 MgC ha⁻¹, with a sampling error of 5.87%. For the “living tree below ground” component, the carbon stock was estimated at 20.4059 ± 1.2353 MgC ha⁻¹, with a sampling error of 6.05%. In total, the “living trees” had a stock of 136.9522 ± 8.0743 MgC ha⁻¹, with a sampling error of 5.90%.

The “standing dead trees” had an estimated stock of 1.0455 ± 0.2346 MgC ha⁻¹, with a sampling error of 22.44%. The high sampling error when only this component is considered may be due to the calculation of the carbon content of each individual, which takes into account the density class of the wood (healthy,

intermediate and rotten). The sampling error in the analysis of the number of individuals for this component was 11.49% (Table 41) and for the basal area it was 15.21% (Table 42).

Combining all the reservoirs collected through the conglomerate inventory, the total carbon stock (living trees above and below ground and standing dead trees) was 137.9977 ± 8.1646 MgC ha⁻¹, with a sampling error of 5.92%.

According to the data presented in Table 43, the accuracy of all the estimates (except for standing dead trees) was below the minimum required in forest inventories (15% at 95% probability).

Table 43 Carbon stock results, considering the components live trees (above and below ground) and standing dead trees

Trees situation	Total Carbon Average (MgC ha ⁻¹)			
	Carbon	%	IC	Sample error
Living Tree	136.9522	99.24%	± 8.0743	5.90 %
Above Ground	116.5464	84.46%	± 6.8395	5.87 %
Below Ground	20.4059	14.79%	± 1.2353	6.05 %
Standing dead tree	1.0455	0.76%	± 0.2346	22.44 %
Unified average	137.9977		± 8.1646	5.92 %

Impact on reduction

A) Impact on reducing the DBH of large trees to 124 cm

As previously mentioned, 11 individuals had a DBH greater than 124 cm, which were lowered to 124 cm for the biomass calculations, as a conservative measure. The range of application of the equation proposed by Nogueira (2008) varies from 5 to 124 cm DBH. Table 44 shows the 11 trees that had their DBH lowered to 124 cm, and their impact on the biomass calculations of the living standing trees.

Table 44 trees that had their DBH lowered to 124 cm

Cong.	Subparcela	Nº ind	Nome Vulgar	DAP Mensurado (cm)	DAP Considerado (cm)	Carb. Total Mensurado (MgC ha-1)	Carb. Total Considerado (MgC ha-1)
4	3	14	Castanheira	124,14	123,82	11,6915	11,6190
7	4	54	Faveira-branca	179,85	123,82	28,7031	11,6190
13	4	4	Bandarra	124,14	123,82	11,6915	11,6190
18	3	123	Faveira-ferro	139,74	123,82	15,5742	11,6190
26	3	57	Abiu	177,94	123,82	27,9701	11,6190
30	1	115	Castanheira	143,88	123,82	16,7153	11,6190
35	1	106	Angelim-pedra	139,74	123,82	15,5742	11,6190
36	3	51	Castanheira	168,70	123,82	24,5829	11,6190
37	2	40	Castanheira	131,78	123,82	13,5117	11,6190
37	2	90	Castanheira	162,34	123,82	22,3952	11,6190
40	1	2	Cedromara	133,69	123,82	13,9910	11,6190
Total						202,4008	127,8089
Diferença							74,5919
Diferença por hectare							1,8648

According to the data in Table 44, if the measured DBH was used to calculate the Total Carbon (above and below ground) of the 11 largest trees found in the inventory, there would be an increase of 74.5919 MgC in the total sum of the living trees, or 1.8648 MgC ha-1. As the Total Carbon of live trees was estimated at 116.5464 MgC ha-1 (Table 43), reducing the DBH to values less than 124 cm resulted in a percentage loss of 1.60% in the calculation of the live tree reservoir. Considering the total carbon of all the reservoirs, the percentage drops to 1.2%, so there is no need to use another equation to calculate the carbon of these trees.

5) Diametric distribution (live trees)

The diametric distribution is presented in 12 classes, separated into intervals of 10 cm DBH (Table 45 and Figure 34). This analysis was only carried out considering live trees. Looking at the graph in Figure 34, it can be seen that the forest has a “J-inverted” structure, i.e. many individuals concentrated in the smallest size classes and few individuals in the largest classes. According to Martini (1996) this structure is interpreted as an indicator of population stability, so there is no indication of disturbance in the forest structure.

As can be seen in Table 45, the population with a DBH of up to 50 cm represents 96.26% of the individuals sampled and concentrates 61.67% of the forest's total carbon stock. Individuals with DBH above 50 cm represent 3.74% of the total and store 38.33% of the total biomass.

Table 45 Diametric distribution of the number of individuals sampled and total carbon stock, highlighting the accumulated frequency below and above 50 cm DBH

Class DAP (cm)	Nº individual s	Nº individual s ha ¹	Nº individual s (%)	Accumulat ed (%)	Mg C total	Mg C ha ¹	tC (%)	Accumulat ed (%)
10-20	13169	329.2	64.00%	64.00%	820.94	20.52	14.99%	14.99%
20-30	4253	106.3	20.67%	84.67%	971.89	24.30	17.74%	32.73%
30-40	1655	41.4	8.04%	92.71%	866.60	21.66	15.82%	48.55%
40-50	730	18.3	3.55%	96.26%	718.68	17.97	13.12%	61.67%
50-60	414	10.4	2.01%	98.27%	678.95	16.97	12.39%	74.06%
60-70	146	3.7	0.71%	98.98%	347.86	8.70	6.35%	80.41%
70-80	125	3.1	0.61%	99.59%	419.86	10.50	7.66%	88.07%
80-90	23	0.6	0.11%	99.70%	113.82	2.85	2.08%	90.15%
90-100	15	0.4	0.07%	99.77%	95.91	2.40	1.75%	91.90%
100-110	19	0.5	0.09%	99.86%	147.25	3.68	2.69%	94.59%
110-120	13	0.3	0.06%	99.93%	123.41	3.09	2.25%	96.84%
>120	15	0.4	0.07%	100.00%	172.93	4.32	3.16%	100.00%
Total geral	20577	514.4	100.00%		5,478.09	136.95		

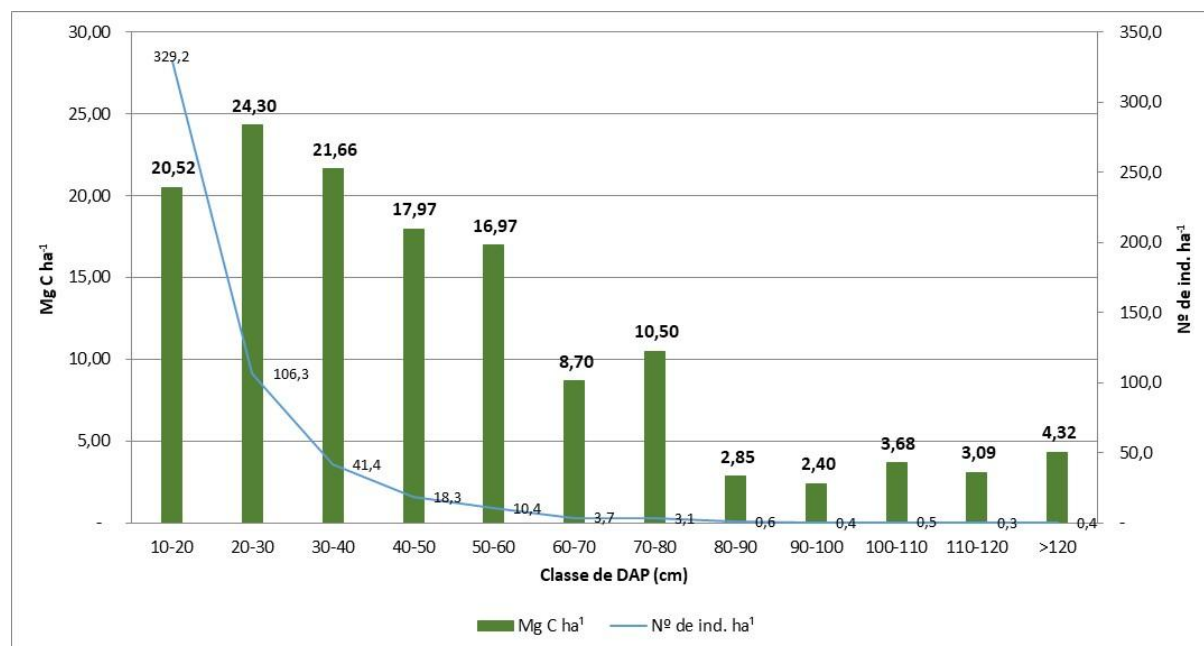


Figure 27 Distribution of the number of individuals and carbon stock in the different Breast Height Diameter (BHD) classes in the Fazenda Manoa forest

Sampling in the plots for dead wood on the ground

As explained above, the sampling of dead wood on the ground took advantage of the central bites of the conglomerates. Each plot for this component is made up of two 50-meter cross bores, totaling 40 sampling units, divided proportionally into the 4 strata previously defined in the Manoa Farm area.

1) Density of dead wood

In order to determine the average density for each wood condition class, dead wood samples were collected from all the classes present in each plot, resulting in the number of samples described below:

- Class 1 Solid wood: 28 samples
- Class 2 Intermediate: 31 samples
- Class 3 Rotten: 33 samples

The samples were sent to the UNIR laboratory (Rolim de Moura Campus), where all the procedures for determining density were carried out, the results of which are described in Table 46. The sampling error was calculated with 90% confidence (according to methodology VMD0002v1.0, page CP-D-9).

Table 46 Statistical analysis of the density of dead wood samples on the ground

Variables	Class 1 Solid wood	Class 2 Intermediate	Class 3 Rotten wood
Mean (Mg.m-3)	0.6431	0.4767	0.3743
Sample variance	0.0257	0.0250	0.0270
Standard deviation	0.1602	0.1580	0.1644
Coefficient of Variation (%)	24.9124	33.1428	43.9290
Variance of the mean	0.0009	0.0008	0.0008
Standard error of the mean	0.0303	0.0284	0.0286
Absolute error / Confidence interval (Mg.m-3)	0.0516	0.0482	0.0485
Relative sampling error (%)	8.0191	10.1032	12.9533

With regard to the statistical analysis of dead wood density, the VMD0002v1.0 methodology states that:

- ✓ If the 90% confidence interval is equal to or less than 10% of the mean, the mean density value is applied in the project calculations.
- ✓ If the 90% confidence interval is greater than 10% of the mean, the lower 90% confidence limit of the mean density estimate is applied in the project calculations.

According to the results described in Table 47, for class 1 (solid wood) the error was less than 10% and the average density can be used. However, for classes 2 (intermediate) and 3 (rotten wood), the statistical error was greater than 10%, at 90% probability, and the lower limit of the confidence interval should be used as the average density. Therefore, the values described below were applied to the equations (both for dead wood on the ground and for standing dead trees):

- Class 1 Solid wood: 0.6431 Mg.m-3
- Class 2 Intermediate: 0.4285 Mg.m-3
- Class 3 Rotten: 0.3258 Mg.m-3

2) Statistical analysis

Table 47 Analysis of Variance of the mean plots of dead wood on the ground, installed in the 4 strata defined prior to the forest inventory

Source of variation	SQ	gl	MQ	F _{calculado}	valor-P	F _{tabelado}
Between groups	263,6130	3	87,8710	0,6435	0,5921	4,3771
Within groups	4.915,9065	36	136,5530			
Total	5.179,5194	39				

To check for statistically significant differences between the strata, an analysis of variance was carried out, using the calculated average carbon in Mg ha⁻¹ in each sampling unit as a parameter. The data is shown in Table 47.

According to the data in Table 47, the F_{calculated} value (0.6435) is lower than the F_{tabelado} (4.3771), at the 1% significance level. It can therefore be concluded that there is no significant difference between the variances of the 4 strata previously considered, and the results will be presented without stratification.

Random sampling estimators were used for the statistical analysis of the data. The sampling error was calculated with 95% confidence. The data is summarized in Table 48.

Table 48 Statistical analysis of the 40 plots of dead wood on the ground at Fazenda Manoa

Estimators	Value
Number of samples	40 unid
Mean	11.9886 Mg ha ⁻¹
Sample Variance	132.8082
Standard Deviation	11.5242
Coefficient of Variation	96.1265
Variance of the Mean	3.4053
Standard Error of the Mean	1.8221
t-value (95%)	2.0231
Absolute sampling error	3.6864 Mg ha ⁻¹
Relative sampling error	30.7 %
Desirable error limit	15%

Sampling intensity	168.1
--------------------	-------

According to the data shown in Table 51, the average stock of dead wood on the ground, estimated using the 40 plots, was 11.9886 ± 3.6864 MgC.ha⁻¹, with a sampling error of 30.7%. To achieve the desired sampling error of 15% (according to methodology VMD0017), 169 sample plots would have to be installed. Table 49 shows the results of the carbon stock of this reservoir in each plot installed.

Table 49 Carbon stock of dead wood on the ground of each sampling unit installed at Manoa Farm

Unidade amostral	Carbono Mg ha ⁻¹	Unidade amostral	Carbono Mg ha ⁻¹
1	27,4410	21	19,5062
2	18,8965	22	13,5827
3	15,8958	23	17,9205
4	13,9012	24	7,4853
5	18,5572	25	0,9622
6	16,5783	26	1,7927
7	61,8156	27	13,3793
8	5,2981	28	10,8834
9	13,7463	29	12,0955
10	3,0348	30	7,4930
11	38,5178	31	-
12	3,2554	32	4,0146
13	2,1085	33	6,5804
14	14,7260	34	21,7616
15	4,4209	35	8,5335
16	15,2543	36	-
17	6,7030	37	-
18	4,8526	38	13,2935
19	0,3160	39	11,1997
20	15,9735	40	7,7680

The highest stock was found in plot 7, with 61.8156 MgC.ha⁻¹, followed by plot 11, with 38.5178 MgC.ha⁻¹. Three plots had an estimated stock of less than 2 MgC.ha⁻¹ (19, 25 and 26) and in another three plots no dead wood was found on the ground (31, 36 and 37).

Logging in a forest management area takes place randomly, causing a low impact on the forest. According to forest management monitoring reports for Fazenda Manoa (Manoa, 2023), the area of forest impacted by logging activities (roads, patios, skid trails and tree clearings) varies between 9.75% and 12.74%, i.e. around 87-90% of the forest remains intact. This logging model generates residues in a concentrated manner, mainly in clearings and on the sides of roads and yards. The sampling system, as recommended

in the VMD0002v1.0 methodology, ends up allowing plots to be installed in areas that result in low or zero volume values, because these lines cross areas with no residues, or volumes with very high values, in the case where the lines cross areas with a high concentration of residues.

Another source of variation observed was the high concentration of dead wood pieces in the lower diameter classes, as can be seen in Table 50, which shows the distribution of the pieces sampled by diameter class. Around 52% of the pieces have a diameter of less than 20 cm and only 3% of the pieces have a diameter of more than 60 cm.

Table 50 Diameter class of the pieces sampled in the 40 plots installed to estimate dead wood on the ground

Part diameter class	Number of parts	%
Less than 20 cm	130	52%
Between 20 and 40 cm	89	36%
Between 40 and 60 cm	22	9%
Larger than 60 cm	7	3%
Total pieces sampled	248	100%

As an example, applying the equation for estimating dead wood on the ground (Equation [8]) to a 70 cm diameter piece collected in a 100 m transect would result in a volume of 60.45 m³.ha⁻¹. For a piece 20 cm in diameter, collected along the same transect, the calculated volume is 4.93 m³.ha⁻¹.

When calculating the estimate of biomass and carbon in the “dead wood on the ground” reservoir, the low occurrences of material with large diameters (which contribute greatly to the estimate of biomass per hectare), the variability in the spatial distribution of woody residues in the forest and also samples installed in areas without the presence of residues, caused high sampling errors, requiring a large sampling effort to increase the accuracy of the estimates.

The high sampling error is reported in studies consulted in the literature on the application of the interceptor line method for estimating dead wood on the ground. After analyzing 50 transects, each 50 meters long, installed in the Irati National Forest in the state of Paraná, Deus et. al (2017) reported a sampling error of 36.18%, concluding that the interceptor line method requires a large number of sampling units. Cruz Filho and Silva (2009) obtained results with a statistical error below 10% in a study carried out in managed and unmanaged forests in the municipality of Moju-PA. However, in this experiment carried out in 4 Work Units of 100 ha each, 12 sample plots were installed, made up of transects (interceptor lines) of 1,000 meters each, totaling 12,000 meters of samples for 400 ha, generating a large sampling intensity.

Galvão Filho (2010) evaluated the applicability of this method to quantify forestry residues in a managed area in the municipality of Paragominas-PA, establishing different layouts and sample unit sizes. A total of 38 interceptor lines were laid across a 100 ha Work Unit, 19 lines in a north-south direction and 19

lines in an east-west direction. With the data collected, simulations were carried out with three layouts (“square”, “cross” and “L”), with arrangements of 5 and 9 sample units 100, 150 and 200 m long for the “square” and “L” layouts, and 100 and 200 m for the “cross” layout, distributed systematically throughout the area. After analyzing the results, the author concludes that the best layout was the “L” shape, arranged in 5 sample units with 150 meters on a side, followed by the “square” layout, with 9 samples with 200 meters on a side, both with a statistical error of less than 10% at 95% probability. He also concludes that the “cross” arrangement (as indicated by the VMD0002v1.0 methodology) did not meet the criteria, with errors ranging from 19.26 to 65.09%. Finally, the author emphasizes that the results obtained in this work are preliminary, since it was carried out in only one 100 ha Work Unit, and recommends that this experiment be repeated in other forest management areas.

Summary of the results obtained

Table 51 shows the summary of the results obtained for each carbon pool inventoried, and the unified data. The unification of the sampling error (sum of the errors for each reservoir) was done as described on page 19 of the VMD0055 module, described in the following equations:

- Unified standard error of the mean

$$S_{\bar{x}(A+B+C+D)} = \sqrt{s_{\bar{x}(A)}^2 + s_{\bar{x}(B)}^2 + s_{\bar{x}(C)}^2 + s_{\bar{x}(D)}^2}$$

- Unified relative sampling error (%)

$$E\%_{(A+B+C+D)} = 100. t. \frac{S_{\bar{x}(A+B+C+D)}}{\bar{x}_{(A)} + \bar{x}_{(B)} + \bar{x}_{(C)} + \bar{x}_{(D)}}$$

Where:

A: Live tree reservoir - above ground

B: Reservoir Live tree - below ground

C: Reservoir Standing dead tree

D: Reservoir Dead wood on the ground

t: tabulated value with n-1 degrees of freedom (g.l.) and 95% probability. In this case, (40-1) g.l. was considered, resulting in a value of t= 2.0231.

Table 51 Results of descriptive statistics and unification of reservoirs

Carbon reservoir	Average value (MgC ha ⁻¹)	Variance of the mean (s ² _{x̄})	Standard error of the mean (s _{x̄})	IC	Sample error	%
Living tree - above ground	116.5464	11.9321	3.4543	± 6.8395	5.87 %	77.7%

Carbon reservoir	Average value (MgC ha ⁻¹)	Variance of the mean (s _x ²)	Standard error of the mean (s _x)	IC	Sample error	%
Living tree - below ground	20.4059	0.3892	0.6239	± 1.2353	6.05 %	13.6%
Standing dead tree	1.0455	0.0140	0.1185	± 0.2346	22.44 %	0.7%
Dead wood on the ground	11.9886	3.4053	1.8221	± 3.6864	30.75 %	8.0%
Total	149.9864	15.7407	3.9675	± 8.0265	5.35 %	100.0%

According to the data in Table 51, the total amount of carbon stored in the Manoa Forest was estimated at 149.9864 ± 8.0265 MgC.ha⁻¹, with a sampling error of 5.35%. The above-ground live tree reservoir contributed 77.7% of the stock, followed by estimates from the roots of live trees, with 13.6%. The unified dead wood component contributed 8.7% of the stock, proving to be a significant reservoir within the sampling process.

1) Calculating Reduced Emissions

To determine the reduced emissions, the stock estimated in the inventory must be multiplied by 3.6667, since 1 kg of C is equivalent to 3.66667 kg of CO₂ (mass of CO₂ = 44 and mass of C = 12; 44/12 = 3.66667). Thus, the final result of the study was:

❖ **Manoa Farm Stock: 149.9864 Mg.C.ha-1 or 549.9506 MgCO₂e.ha-1**

[Projected post-deforestation classes for the project area and leakage belt in the baseline scenario and existing non-forest classes in the leakage management areas:](#)

The predominant post-deforestation land-cover within the reference region during the historical reference period land is pasture. So, the same is considered for the project area and the leakage belt in the baseline scenario. In the leakage management areas, the vegetation, when present, is also defined as pasture.

Considering this context, an IPCC default biomass stock present on grasslands after conversion from other land use has been used. The default value for Tropical (Moist and Wet) is 16.10 t d.m/ha. Available on: Chapter 6: Grassland, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use.

Calculation of carbon stock change factors

The Table 52 presents the carbon stock change factors (or variation in stored carbon) for different initial forest classes following deforestation. The values are distributed across consecutive years starting from t₀, the initial moment of deforestation.

Table 52 Carbon stock change factors for initial forest classes icl (Method 1, Project Area)

Year after deforestation	$\Delta C_{ab,icl,t}$	$\Delta C_{bb,icl,t}$	$\Delta C_{dw,icl,t}$	$\Delta C_{tot,icl,t}$
--------------------------------	-----------------------	-----------------------	-----------------------	------------------------

0	t^*	414,11	7,25	4,63	425,99
1	t^{*+1}	0,00	7,25	4,63	11,88
2	t^{*+2}	0,00	7,25	4,63	11,88
3	t^{*+3}	0,00	7,25	4,63	11,88
4	t^{*+4}	0,00	7,25	4,63	11,88
5	t^{*+5}	0,00	7,25	4,63	11,88
6	t^{*+6}	0,00	7,25	4,63	11,88
7	t^{*+7}	0,00	7,25	4,63	11,88
8	t^{*+8}	0,00	7,25	4,63	11,88
9	t^{*+9}	0,00	7,25	4,63	11,88

Table 53 refers to the variation in carbon stock in forest products ($\Delta C_{totfcl,t}$) following deforestation over several years.

Table 53 Carbon stock change factors for final classes fcl or zones z (Method 1, Project Area)

Year after deforestation		$\Delta C_{totfcl,t}$
0	t^*	0.00
1	t^{*+1}	3.45
2	t^{*+2}	3.45
3	t^{*+3}	3.45
4	t^{*+4}	3.45
5	t^{*+5}	3.45
6	t^{*+6}	3.45
7	t^{*+7}	3.45
8	t^{*+8}	3.45
9	t^{*+9}	3.45

Calculating the baseline of carbon stock changes

Method 1 of VM0015 version 1.2 (activity data are available for classes) was used to calculate the baseline of carbon stock changes in the project area and the leakage belt for year t, according to equation 10 on page 81 of VM0015 version 1.2.

4.3 Project Emissions

Ex Ante Estimation of Actual Carbon Stock Changes

The real changes in the carbon stock occur due to the following factors:

1. Planned activities within the project area;
2. Unplanned deforestation that is unavoidable; and
3. Possible future catastrophic events - which are unpredictable and therefore excluded from the ex ante assessment.

Ex Ante Estimation of Actual Carbon Stock Changes due to Planned Activities

Some areas of the project undergo planned deforestation due to the construction of roads and yards for Manoa's sustainable forest management activities. Because they follow the principles and criteria of the FSC and PEFC, they do not produce large openings in the forest.

In this case, the reduction in carbon stock related to deforestation for the implementation of infrastructure such as the opening of roads and forestry yards in each annual production unit (APU) within the project area was calculated.

This calculation was based on the Manoa farm's post-exploration reports from 2013 to 2022, which identified an average of 37 hectares per year of open area in the UPAs for infrastructure in the management activity.

Table 54 Average planned deforestation 2013-2022

UPA	Year	Planned Deforestation Area
UPA 7	2013-2014	39.319 ha
UPA 4	2015-2016	27.8588 ha
UPA 6	2015-2016	24.7285 ha
UPA 27	2017-2018	25.0336 ha
UPA 01	2017-2018	27.84 ha
UPA 10	2019	28.4629 ha
UPA 15	2020	48.12 ha
UPA 17	2021	52.4192 ha
UPA 11	2022	59.2722 ha
Average		37 ha

Table 55 (table 43 of the VM0014 v1.2 methodology) shows the estimated area of planned deforestation and the impact on the carbon stock in the project area.

Table 55 Ex-ante decrease in carbon stock due to planned deforestation in the project area

Project year t		Areas of planned deforestation x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned deforestation	
		IDcl = 1 Forest		annual	cumulative
		$APDPA_{icl,t}$	$C_{tot_{icl,t}}$	$\Delta CPDdPA_t$	$\Delta CPDdPA$
Initial	Final	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	37.00	549.95	20,348.15	20,348.15
01-Jan-2024	31-Dec-2024	37.00	549.95	20,348.15	40,696.31
01-Jan-2025	31-Dec-2025	37.00	549.95	20,348.15	61,044.46
01-Jan-2026	31-Dec-2026	37.00	549.95	20,348.15	81,392.62
01-Jan-2027	31-Dec-2027	37.00	549.95	20,348.15	101,740.77
01-Jan-2028	31-Dec-2028	37.00	549.95	20,348.15	122,088.93

Timber Extraction

The forest management activity planned by Indústria de Madeiras Manoa Ltda. will be monitored and reported at each project verification event, and this monitoring will be based on the Post-Exploration Reports.

In this sense, a significance analysis was performed using the tool “Tool for testing significance of GHG emissions in A/R CDM project activities” in order to assess the impact of emissions from timber activities on project emissions. Data provided by the Manoa farm regarding the annual intensity of forest exploitation and the amount of carbon extracted were used for the calculation, since the average annual volume of carbon extracted calculated for forest management at the Manoa farm was 130,516 tCO₂e. The potential for increasing carbon in the managed forest was also considered, since, according to West et al. (2013), an area managed in the reduced impact system regenerates about 2.8 tons of above-ground biomass per hectare per year (4.89 tCO₂e/ha.year). Thus, the calculated balance of changes in carbon stock due to logging activity was 13,838 tCO₂e per year.

The significance assessment was based on the relationship between the balance of changes in carbon stock due to logging and total baseline emissions. The results showed that emissions related to logging are below the 5% significance threshold required by the Standard and can therefore be disregarded from the project emissions scope.

All calculations related to the significance test were shared with the audit team. If a reduction in carbon stock due to logging is observed, Table 44 of VM0015 v1.2 will be completed ex-post.

The construction of infrastructure for forest management activities, such as yards and roads, will be considered planned deforestation in the project area. And according to VM0015, the carbon stock of forest management products intended to constitute durable wood goods can be conservatively ignored in the project scenario.

Charcoal production and firewood collection

Charcoal production or firewood collection is not expected. This type of use was not identified among the families during the social diagnosis. If there is a reduction in the forest's carbon stock due to this activity, table 45 of VM0015 will be presented ex post. Table 56 presents the ex-ante estimate of the reduction in carbon stock due to activities planned by the project.

Table 56 Total ex ante carbon stock decrease due to planned activities in the project area

Project year t		Total carbon stock decrease due to planned deforestation		Total carbon stock decrease due to planned logging activities		Total carbon stock decrease due to planned fuel-wood and charcoal activities		Total carbon stock decrease due to planned activities	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		ΔCPDdPA_t	ΔCPDdPA	ΔCPLdPA_t	ΔCPLdPA	ΔCPFdPA_t	ΔCPFdPA	ΔCPAdPA_t	ΔCPAdPA
Initial	Final	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	20,348.15	20,348.15	0.00	0.00	0.00	0.00	20,348.15	20,348.15
01-Jan-2024	31-Dec-2024	20,348.15	40,696.31	0.00	0.00	0.00	0.00	20,348.15	40,696.31
01-Jan-2025	31-Dec-2025	20,348.15	61,044.46	0.00	0.00	0.00	0.00	20,348.15	61,044.46
01-Jan-2026	31-Dec-2026	20,348.15	81,392.62	0.00	0.00	0.00	0.00	20,348.15	81,392.62
01-Jan-2027	31-Dec-2027	20,348.15	101,740.77	0.00	0.00	0.00	0.00	20,348.15	101,740.77
01-Jan-2028	31-Dec-2028	20,348.15	122,088.93	0.00	0.00	0.00	0.00	20,348.15	122,088.93

Ex Ante Estimation of Carbon Stock Changes due to Unavoidable Unplanned Deforestation Within the Project Area

The project has the capacity to reduce unplanned deforestation in the project area by 99.96%.

This result was obtained from an average extracted from the ex-post results of the project, between the period 2013 and 2022.

The table below was extracted from the ex-post monitoring reports and shows the predicted deforestation according to the baseline compared to what actually occurred. Based on this data, it was possible to

calculate that, over the 10 years of the first baseline, only 0.04% of the predicted unplanned deforestation actually occurred, which allows us to define an effectiveness index of 0.04%.

In the table, 5,383 are the hectares predicted in the baseline and 2.09 is the amount of unplanned deforestation that actually occurred from 2013 to 2022.

Table 57 Areas deforested annually in each monitored zone within the project area

VCS Verification	Area establisheh after deforestation per zone within the project area		Total monitored deforestation in the project area		Baseline	Protected forest	
	IDz>	1					
	Name>	Zone 1	Annual	Cumulative	Annual	Annual	Cumulative
	Project year _t	ha	ha	ha	ha	ha	ha
1st VCS verification	2013	0	0	0	198	198	1,450
	2014	0	0	0	425	425	
	2015	0	0	0	469	469	
	2016	0	0	0	358	358	
2nd VCS verification	2017	0	0	0	674	674	2,518
	2018	0	0	0	497	497	
	2019	0	0	0	713	713	
	2020	0	0	0	634	634	
3rd VCS verification	2021	2,07	2,07	2,07	715	712.93	1,415
	2022	0,02	0,02	2,09	702	701.98	
							5,383

Ex Ante Estimated Net Actual Carbon Stock Changes in the Project Area

Table 58 presents the changes in the carbon stock related to planned activities and the Effectiveness of the project

Table 58 Ex-ante estimate of the net change in carbon stock in the project area under the project scenario (table 47 of VM0015 v1.2).

Effectiveness Index; %	Project Year t	Total carbon stock decrease due to planned activities	Total carbon stock decrease due to unavoided unplanned deforestation	Total carbon stock change in the project case

		annual	cumulative	annual	cumulative	annual	cumulative
		ΔCPAdPA_t	ΔCPAdPA	ΔCUDdPA_t	ΔCUDdPA	ΔCPSPA_t	ΔCPSPA
Initial	Final	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	20,348.2	20,348.2	598.2	598.2	20,946.4	20,946.4
01-Jan-2024	31-Dec-2024	20,348.2	40,696.3	600.7	1,199.0	41,895.3	41,895.3
01-Jan-2025	31-Dec-2025	20,348.2	61,044.5	603.1	1,802.1	62,846.6	62,846.6
01-Jan-2026	31-Dec-2026	20,348.2	81,392.6	605.5	2,407.6	83,800.3	83,800.3
01-Jan-2027	31-Dec-2027	20,348.2	101,740.8	607.9	3,015.5	104,756.3	104,756.3
01-Jan-2028	31-Dec-2028	20,348.2	122,088.9	610.2	3,625.7	125,714.7	125,714.7

						5	
						8	
						.	
						4	

Ex Ante Estimation of Actual Non-CO2 Emissions from Forest Fires

Non-CO2 emissions from forest fires were not accounted for in the baseline scenario. Table 59 shows the expected net changes and non-CO2 emissions in the project area. Emissions that occur during the development of project activities will be monitored and reported if there is an increase in projected emissions compared to the scenario with the project.

Table 59 Total ex-ante estimate of net changes in carbon stock and non-CO2 emissions in the project area (table 49 of VM0015 v1.2).

Project Year t		Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO ₂ emissions from forest fires in the project area	
		annu al	cumulati ve	annual	cumulative	annual	cu mul ativ e	annu al	cumulative
		ΔCPA dPA _t	ΔCPAdPA	ΔCUDdPA _t	ΔCUDdPA	ΔCPSPA _t	ΔC PSP A	EBBP SPA _t	EBBPSPA
Initial	Fin al	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tC O ₂ e	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	20,348.2	20,348.2	598.2	598.2	20,946.4	20,946.4	5.7	5.7
01-Jan-2024	31-Dec-2024	20,348.2	40,696.3	600.7	1,199.0	20,948.9	41,189.3	5.6	11.2
01-Jan-2025	31-Dec-2025	20,348.2	61,044.5	603.1	1,802.1	20,951.3	62,284.6	5.5	16.7
01-Jan-2026	31-Dec-2026	20,348.2	81,392.6	605.5	2,407.6	20,953.7	83,380.3	5.4	22.1

01-Jan-2027	31-Dec-2027	20,348.2	101,740.8	607.9	3,015.5	20,956.0	104,756.3	5.3	27.4
01-Jan-2028	31-Dec-2028	20,348.2	122,088.9	610.2	3,625.7	20,958.4	125,714.7	5.2	32.6

4.4 Leakage Emissions

Ex Ante Estimation of Leakage (Step 8)

Ex Ante Estimation of Decrease in Carbon Stocks and Increase in GHG Emissions Due to Leakage Prevention Measures

The activities that will be carried out to prevent the leakage are described in section 1.19.1 of this PD.

Carbon Stock Changes due to Activities Implemented in Leakage Management Zones

As described in section 5.3, no activity to contain the leakage will cause an increase in GHG emissions.

Ex Ante Estimation of CH₄ and N₂O Emissions from Grazing Animals

As noted previously, no activities are anticipated that would result in a significant increase in CH₄ and N₂O emissions. Therefore, Tables 58 and 59 of VM0015 were not applied.

Total Ex Ante Estimated Carbon Stock Changes and Increases in GHG Emissions due to Leakage Prevention Measures

Table 59 of VM0015 does not apply.

Ex Ante Estimation of Decreases in Carbon Stocks and Increases in GHG emissions due to Activity Displacement Leakage

As described in Step 3, the agents of deforestation are external to the Manoa Farm area and act largely within the context of illegality. Considering that the project must act indirectly with such agents, promoting courses, events, and environmental education activities to train and raise awareness among the local community, the project expects to achieve significant results in the medium and long term.

According to the initial PD, a displacement factor of 15% was adopted for the first 10 years of the project. After this period, a reduction in the displacement factor to 10% would be considered for the next 5 years and 5% from the fifteenth year onwards, already considering the influence of the project in this context. Therefore, at this stage of the project, it was decided to maintain a 12% displacement for the first two years, after which it will gradually decrease, as shown in the table below.

In this context, it is important to take into account the fact that, while monitoring the Leakage Belt, the project proponents do not intend to act directly with the agents involved in possible deforestation that may occur in areas outside the boundaries of the Project Area. As such, the leakage displacement factor tends to remain constant at the first two years and reduce afterwards, throughout the project's remaining accreditation period. Table 60 shows the ex-ante estimate of leakage due to activity displacement, considering the displacement factor.

Table 60 Ex-ante estimation of leakage due to activity displacement (table 61 of VM0014v1.2)

Project Year t		Total ex ante estimated decrease in carbon stocks due to displaced deforestation		Total ex ante estimated increase in GHG emissions due to displaced forest fires	
		annual	cumulative	annual	cumulative
		$\Delta CADLK_t$	$\Delta CADLK$	$EADLK_t$	$EADLK$
Initial	Final	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	143,579	143,579	1,357	1,357
01-Jan-2024	31-Dec-2024	144,171	287,751	1,336	2,693
01-Jan-2025	31-Dec-2025	132,692	420,442	1,205	3,898
01-Jan-2026	31-Dec-2026	133,217	553,660	1,186	5,084
01-Jan-2027	31-Dec-2027	133,735	687,395	1,168	6,252
01-Jan-2028	31-Dec-2028	122,041	809,436	1,045	7,297

Table 61 Ex-ante estimate of total leakage

Project Year t	Total ex ante GHG emissions from increased grazing activities	Total ex ante increase in GHG emissions due to displaced forest fires	Total ex ante decrease in carbon stocks due to displaced deforestation	Carbon stock decrease due to leakage prevention measures	Total net carbon stock change due to leakage	Total net increase in emissions due to leakage
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annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
$EgLK_t$	Eg	$EADLK_t$	EAD	$\Delta CADLK_t$	ΔCA	$\Delta CLPMLK_t$	$\Delta CLPMLK$	ΔCLK_t	ΔCLK	ELK_t	ELK

			L K		L K		D L K						
Initial	Final	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	0	0	1,357	1,357	143,579	143,579	0	0	143,579	143,579	1,357	1,357
01-Jan-2024	31-Dec-2024	0	0	1,336	2,693	144,171	287,751	0	0	144,171	287,751	1,336	2,693
01-Jan-2025	31-Dec-2025	0	0	1,205	3,898	132,692	420,442	0	0	132,692	420,442	1,205	3,898
01-Jan-2026	31-Dec-2026	0	0	1,186	5,084	133,217	553,660	0	0	133,217	553,660	1,186	5,084
01-Jan-2027	31-Dec-2027	0	0	1,168	6,252	133,735	687,395	0	0	133,735	687,395	1,168	6,252

	0 2 7					9 5							
01-Jan-2028	3 1- D e c- 2 0 2 8	0	0	1,045	7 , 2 9 7	122,041	8 0 9 , 4 3 6	0	0	122 ,04 1	809 ,43 6	1,045	7,297

4.5 Estimated GHG Emission Reductions and Carbon Dioxide Removals

Ex-ante estimate calculation of GHG emissions total net reduction

VM0015 v1.2 Equation 19 has been used to calculate the ex-ante estimate of the project emission reduction.

Ex-ante calculation of Verified Carbon Units (VCUs).

VM0015 v1.2 Equation 20 was applied to estimate the number of VCUs. The project Risk Factor parameter was estimated using the VCS AFOLU Non-Permanence Risk Tool, resulting in 12%.

Table 62 Ex ante estimated net GHG emission reductions (ΔREDD_t) and Verified Carbon Units (VCU_t)

Project Year t		Baseline carbon stock changes		Baseline GHG emissions		Ex ante project carbon stock changes		Ex ante project GHG emissions	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	
	ΔCBSLPA_t	ΔCBSLPA	$\Delta\text{EBBBSLPA}_t$	$\Delta\text{EBBBSLPA}$	ΔCPSPA_t	ΔCPSPA	EBBPSPA_t	EBBPSPA	
Initial	Final	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01-Jan-2023	31-Dec-2023	1,196,493	1,196,493	11,308	11,308	20,946	20,946	5.7	5.7
01-Jan-2024	31-Dec-2024	1,201,429	2,397,922	11,131	22,439	20,949	41,895	5.6	11.2
01-Jan-2025	31-Dec-2025	1,206,286	3,604,208	10,957	33,396	20,951	62,847	5.5	11.0
01-Jan-2026	31-Dec-2026	1,211,068	4,815,277	10,785	44,181	20,954	83,800	5.4	10.9
01-Jan-2027	31-Dec-2027	1,215,775	6,031,052	10,616	54,797	20,956	104,756	5.3	10.7
01-Jan-2028	31-Dec-2028	1,220,408	7,251,460	10,450	65,247	20,958	125,715	5.2	10.5

Continuation of table 64

Ex ante leakage carbon stock changes		Ex ante leakage GHG emissions		Ex ante net anthropogenic GHG emission reductions		Ex ante VCUs tradable		Ex ante buffer credits	
annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative

ΔCLK_t	ΔCLK	ELK_t	ELK	$\Delta REDD_t$	$\Delta REDD$	VCU_t	VCU	VCB_t	VCB
tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
143,579	143,579	1,357	1,357	1,041,913	1,041,913	900,848	900,848	141,066	141,066
144,171	287,751	1,336	2,693	1,046,098	2,088,011	904,440	1,805,288	141,658	282,723
132,692	420,442	1,205	3,898	1,062,390	3,150,401	920,149	2,725,437	142,240	424,963
133,217	553,660	1,186	5,084	1,066,490	4,216,891	923,677	3,649,114	142,814	567,777
133,735	687,395	1,168	6,252	1,070,527	5,287,418	927,149	4,576,262	143,378	711,155
122,041	809,436	1,045	7,297	1,086,809	6,374,227	942,875	5,519,137	143,934	855,089

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	Deforestation
Data unit	Hectare (ha)
Description	Maps of areas of forest cover converted into areas of non-forest cover
Source of data	Measured using data from the PRODES/INPE project
Value applied	Reference Region - 17,630 ha/year (2000 to 2022)
Justification of choice of data or description of measurement methods and procedures applied	The PRODES matrix data containing the record and quantification of deforested areas greater than or equal to 6.25 hectares was added with the annual increment vector data containing records of deforested areas between 1 and 6.25 hectares currently made available by PRODES.
Purpose of data	• Determining the baseline scenario • Calculation of baseline emissions • Calculation of project emissions • Leakage calculation
Comments	Source of information :https://terrabrasilis.dpi.inpe.br/geonetwork/srv/eng/catalog.search#/metadata/507294db-a789-42dd-9158-9dea77d9293f https://terrabrasilis.dpi.inpe.br/geonetwork/srv/eng/catalog.search#/metadata/5f5cfb4c-e207-4932-9c93-2d51cea8adbc

Data / Parameter	Ctot
Data unit	tCO ₂ e ha ⁻¹
Description	Average carbon stock per hectare in all carbon pools in the forest class used in the baseline scenario
Source of data	Calculated using allometric equations and data measured in the field
Value applied	549.4382 MgCO ₂ eq.ha ⁻¹

Justification of choice of data or description of measurement methods and procedures applied	The value of above and below ground biomass and dead wood were accounted for through field collection of data extracted from the Manoa farm in September 2023, following the VM0015 v1.2 methodology. All details are presented in the “Forest Inventory for Estimating Carbon Stock in Above and Below Ground Biomass (roots) and Dead Wood of the Manoa REDD+ Project”, carried out by Florestal Planejamento Consultoria Ltda.
Purpose of data	• Determining the baseline scenario • Calculation of baseline emissions • Calculation of project emissions • Leakage calculation
Comments	See documents: • Forest Inventory for Estimating Carbon Stocks in Above and Below Ground Biomass (roots) and Dead Wood from the Manoa REDD+ Project • Project Description – Baseline

Data / Parameter	DBH
Data unit	cm
Description	Diameter at Breast Height (130 cm) for each tree with a DBH equal to or greater than 10 cm in each forest inventory plot.
Source of data	Measured in the field by Florestal Paisagismo
Value applied	See spreadsheet with field data
Justification of choice of data or description of measurement methods and procedures applied	VCS Methodology Requirement VM0015. Forest inventory data collected in 2023 in multiple plots located in a wide spatial distribution.
Purpose of data	• Determining the baseline scenario • Calculation of baseline emissions • Calculation of project emissions • Leakage calculation
Comments	Main variable for estimating carbon stock

Data / Parameter	$BGB_{fw} = 0,0469 \times DAP^{2,4754} \times f_{c1}$ $AGB_{fw} = EXP(-1,716 + 2,413 \times \ln(DAP))$
Data unit	Kg (fresh weight of biomass)
Description	Equation to convert DBH into fresh biomass
Source of data	1. SILVA, 2007

	2. NOGUEIRA, 2008
Value applied	1. $BGB_{fw} = 0,0469 \times DAP^{2,4754} \times fc1$ 2. $AGB_{fw} = EXP(-1,716 + 2,413 \times \ln(DAP))$
Justification of choice of data or description of measurement methods and procedures applied	Equation developed for forests with similar characteristics to those in the reference region
Purpose of data	• Determining the baseline scenario • Calculation of baseline emissions • Calculation of project emissions • Leakage calculation
Comments	-

Data / Parameter	CF
Data unit	t
Description	Carbon content in dry biomass
Source of data	Nogueira, E.; Fearnside, P.; Nelson, B., et al., 2008. Forest biomass estimates in the Brazilian Amazon: New allometric equations and biomass adjustments from wood volume inventories. Forest Ecology and Management, 256 (11), pp.1853-1867
Value applied	0,485
Justification of choice of data or description of measurement methods and procedures applied	Value found in scientific literature
Purpose of data	• Determining the baseline scenario • Calculation of baseline emissions • Calculation of project emissions • Leakage calculation
Comments	-

Data / Parameter	44/12
Data unit	tCO2e
Description	Carbon Mass to CO2e Mass Conversion Factor

Source of data	Cientific literature: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU.
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	IPCC Standard Value
Purpose of data	• Baseline scenario determination • Baseline emissions calculation • Project emissions calculation • Leakage calculation
Comments	

Data / Parameter	Opening of area for management infrastructure
Data unit	Hectares
Description	Area opened for construction of infrastructure necessary for sustainable forest management activities, such as yards, primary and secondary roads.
Source of data	Post-Exploratory Report and expert opinion
Value applied	37 hectares per year
Justification of choice of data or description of measurement methods and procedures applied	Data are collected in the field after harvesting activity and recorded in post-exploration reports. To determine the value of 37 hectares per year (Ex ante value), the average of the areas opened due to forest management between 2013 and 2022 was calculated.
Purpose of data	• Baseline scenario determination • Baseline emissions calculation • Project emissions calculation • Leakage calculation
Comments	

5.2 Data and Parameters Monitored

Parameters for monitoring deforestation, emissions and credit generation:

Data / Parameter	ABSLPA _t
Data unit	Hectare (ha)
Description	Annual area of baseline deforestation in the Project Area in year t
Source of data	Calculated using remote sensing and data available from reliable sources
Description of measurement methods and procedures to be applied	Monitoring of the forest component through remote sensing using satellite images and data from reliable sources
Frequency of monitoring/recording	Annual
Value applied	Table 10 of VM0015 v1.2
Monitoring equipment	Geotechnologies: remote sensing and geographic information systems
QA/QC procedures to be applied	Data obtained at medium spatial resolution (between 10m and 100m) will be used to map changes in forest cover and define land use classes. Later, to validate and refine the mapping described, data obtained by high-resolution sensors (up to 5m pixels) will be used. The minimum accuracy of the land use and land cover classification map is 80 per cent
Purpose of data	Calculation of project emissions
Calculation method	According with VM0015 v.1.2
Comments	-

Data / Parameter	ΔCUDdPA_t
Data unit	tCO ₂ -e
Description	Total change in real carbon stock due to unavoided and unplanned deforestation in year t in the Project Area

Source of data	Calculated from the detected areas of forest loss due to unplanned deforestation in the Project Area and the estimated average carbon stock for the initial forest class
Description of measurement methods and procedures to be applied	Monitoring of the ABSLPAt indicator for subsequent calculation of the change in carbon stock from unplanned and unavoided deforestation
Frequency of monitoring/recording	Annual
Value applied	Table 49 VM0015 v1.2
Monitoring equipment	Emissions spreadsheets
QA/QC procedures to be applied	Good practices applied in calculating ABSLPAt
Purpose of data	- Calculating project emissions
Calculation method	The parameter is estimated by multiplying the areas of unplanned deforestation by the estimated average carbon stock value for the initial forest class. The sum of the residual emissions from the carbon stock below ground and in dead wood is also taken into account, as these reservoirs have an annual decay rate of 1/10, causing emissions over the years. Finally, the value of the carbon stock estimated for the Reference Region in a post-deforestation scenario is subtracted from this result, giving the net value of the carbon stock that has been reduced by unplanned and unavoided deforestation.
Comments	-

Data / Parameter	ΔCPDdPA_t
Data unit	tCO _{2e}
Description	Total reduction in carbon stock due to planned deforestation in year t in the Project Area.
Source of data	Calculated using the detected areas of forest loss due to planned deforestation in the Project Area and the average carbon stock.

Description of measurement methods and procedures to be applied	Monitoring of the $APDPA_{icl,t}$ indicator for subsequent calculation of the change in carbon stock resulting from planned deforestation.
Frequency of monitoring/recording	Annual
Value applied	Table 43 da VM0015 v1.2
Monitoring equipment	Emissions calculation spreadsheet
QA/QC procedures to be applied	Good practices applied in calculating $APDPA_{icl,t}$
Purpose of data	- Calculation of project emissions
Calculation method	The change in carbon stock is estimated by multiplying the detected area of forest loss in the Project Area and the average carbon stock per unit area
Comments	-

Data / Parameter	$AUFPA_{icl,t}$
Data unit	Hectare (ha)
Description	Areas affected by forest fires in the icl class where carbon stock recovery occurs in year t
Source of data	Calculated using remote sensing and data available from reliable sources
Description of measurement methods and procedures to be applied	Identification of affected areas from reliable sources with data on hotspots and fire scars. Photointerpretation technique with high-resolution images to validate the data obtained and identify and quantify the affected areas.
Frequency of monitoring/recording	Whenever forest fires are identified
Value applied	To be accounted for in each monitoring
Monitoring equipment	Geotechnologies: remote sensing and geographic information systems

QA/QC procedures to be applied	Data or images obtained by high-resolution sensors (up to 5m pixels) will be used to validate and refine the mapping of areas affected by fires. The minimum mapping accuracy is 80 per cent
Purpose of data	Calculation of project emissions
Calculation method	According with VM0015 v.1.2
Comments	-

Data / Parameter	$\Delta\text{CUF}_{\text{dPA}_t}$
Data unit	tCO ₂ -e
Description	Total decrease in carbon stock due to unplanned (and planned - where applicable) forest fires in year t in the Project Area
Source of data	Calculated using the areas affected by forest fires in the Project Area and the estimated average carbon stock for the initial forest class
Description of measurement methods and procedures to be applied	Monitoring of the $\text{AUFPA}_{\text{icl},t}$ parameter for subsequent calculation of the change in carbon stock from the areas affected by forest fires.
Frequency of monitoring/recording	With each occurrence of forest fires
Value applied	To be accounted for at each monitoring
Monitoring equipment	Emissions spreadsheet
QA/QC procedures to be applied	Best practices applied in calculating $\text{AUFPA}_{\text{icl},t}$
Purpose of data	- Calculation of project emissions
Calculation method	The change in carbon stock is estimated by multiplying the area affected by catastrophic events by the average carbon stock estimated for the initial forest class.
Comments	-

Data / Parameter	ACPAicl,
Data unit	Hectare (ha)
Description	Area affected by catastrophic events in the icl class in year t within the Project Area
Source of data	High resolution satellite images
Description of measurement methods and procedures to be applied	Identification of affected areas from reliable data sources. Photointerpretation technique with high-resolution images to validate the data obtained and identify and quantify the affected areas.
Frequency of monitoring/recording	Each time a catastrophic event occurs
Value applied	To be counted at each monitoring
Monitoring equipment	Geotechnologies: remote sensing and geographic information systems
QA/QC procedures to be applied	Data or images obtained by high-resolution sensors (up to 5m pixels) will be used to validate and refine the mapping of areas affected by catastrophic events. The minimum mapping accuracy is 80 per cent
Purpose of data	- Calculation of project emissions
Calculation method	According with VM0015 v.1.2
Comments	-

Data / Parameter	ΔCUCdPA_t
Data unit	tCO ₂ -e
Description	Total decrease in carbon stock due to catastrophic events in year t in the Project Area
Source of data	Calculated using the areas affected by forest fires in the Project Area and the estimated average carbon stock for the initial forest class

Description of measurement methods and procedures to be applied	Monitoring of the $ACPA_{i,t}$ parameter for subsequent calculation of the change in carbon stock from areas affected by catastrophic events
Frequency of monitoring/recording	At each occurrence of a catastrophic event
Value applied	To be accounted for at each monitoring
Monitoring equipment	Emissions spreadsheet
QA/QC procedures to be applied	Best practices applied in the calculation of $ACPA_{i,t}$
Purpose of data	- Calculation of project emissions
Calculation method	The change in carbon stock is estimated by multiplying the area affected by catastrophic events by the average carbon stock estimated for the initial forest class.
Comments	-

Data / Parameter	$ABSLLK_t$
Data unit	Hectare (ha)
Description	Annual area of baseline deforestation in the Leakage Belt in year t
Source of data	Calculated using remote sensing and data available from reliable sources
Description of measurement methods and procedures to be applied	Monitoring of the forest component through remote sensing using satellite images and data from reliable sources
Frequency of monitoring/recording	Yearly
Value applied	Table 11 of VM0015 v1.2
Monitoring equipment	Geotechnologies: remote sensing and geographic information systems

QA/QC procedures to be applied	Data obtained at medium spatial resolution (between 10m and 100m) will be used to map changes in forest cover and define land use classes. Later, to validate and refine the mapping described, data obtained by high-resolution sensors (up to 5m pixels) will be used. The minimum accuracy of the land use and land cover classification map is 80 per cent
Purpose of data	- Leakage calculation
Calculation method	According with VM0015 v.1.2
Comments	-

Data / Parameter	$\Delta CADLK_t$
Data unit	tCO ₂ -e
Description	Total decrease in carbon stocks due to displaced deforestation in year t
Source of data	Calculated from the detected areas of forest loss in the Leakage Belt, the average carbon stock and the estimated loss in carbon stock projected by the baseline
Description of measurement methods and procedures to be applied	Monitoring of the $\Delta BSLLK_{icl,t}$ indicator for subsequent calculation of the change in carbon stock from deforestation displaced to the Leakage Belt
Frequency of monitoring/recording	Annual
Value applied	Table 61 of VM0015 v1.2
Monitoring equipment	Emissions spreadsheets
QA/QC procedures to be applied	Best practices applied in the calculation of $\Delta BSLLK_{icl,t}$
Purpose of data	- Leakage calculation
Calculation method	The parameter is estimated by multiplying the areas of forest loss by the estimated average carbon stock value for the initial

	forest class. The sum of the residual emissions from the carbon stock below ground and in dead wood is also taken into account, as these reservoirs have an annual decay of 1/10, causing emissions over the years. Next, the value of the carbon stock estimated for the Reference Region in a post-deforestation scenario is subtracted from this result, giving the net value of the carbon stock that was reduced by the displaced deforestation. Finally, the estimated loss of carbon stock in the Leakage Belt projected by the baseline is subtracted from this value.
Comments	-

Data / Parameter	$EgLK_t$
Data unit	tCO ₂ -e
Description	Emissions from animals on pastures in the leakage management areas in year t
Source of data	Existing records on the practice of grazing
Description of measurement methods and procedures to be applied	Monitoring of the $\Delta BSLLK_{icl,t}$ indicator for subsequent calculation of the change in carbon stock from deforestation displaced to the Leakage Belt
Frequency of monitoring/recording	Annual
Value applied	Table 62 of VM0015 v1.2
Monitoring equipment	Emissions spreadsheets
QA/QC procedures to be applied	Best practices applied in the calculation of $\Delta BSLLK_{icl,t}$
Purpose of data	- Leakage calculation
Calculation method	The parameter is estimated by multiplying the areas of forest loss by the estimated average carbon stock value for the initial forest class. The sum of the residual emissions from the carbon stock below ground and in dead wood is also taken into account, as these reservoirs have an annual decay of 1/10, causing emissions over the years. Next, the value of the carbon stock estimated for the Reference Region in a post-deforestation

	scenario is subtracted from this result, giving the net value of the carbon stock that was reduced by the displaced deforestation. Finally, the estimated loss of carbon stock in the Leakage Belt projected by the baseline is subtracted from this value.
Comments	-

Data / Parameter	EADLK _t
Data unit	tCO ₂ -e
Description	Total ex ante increase in GHG emissions due to displaced forest fires in year t
Source of data	Calculated using the areas affected by forest fires in the Leakage Belt and the estimated average carbon stock for the initial land use class
Description of measurement methods and procedures to be applied	Identification of affected areas from reliable sources with data on hotspots and fire scars. Photointerpretation technique with high-resolution images to validate the data obtained and identify and quantify the affected areas.
Frequency of monitoring/recording	Whenever forest fires are identified
Value applied	Table 62 of VM0015 v1.2
Monitoring equipment	Geotechnologies: remote sensing and geographic information systems
QA/QC procedures to be applied	Data or images obtained by high-resolution sensors (up to 5m pixels) will be used to validate and refine the mapping of areas affected by fires. The minimum mapping accuracy is 80 per cent
Purpose of data	- Leakage calculation
Calculation method	The variation in carbon stock is estimated by multiplying the area affected by the forest fire by the average carbon stock estimated for the initial land use class.
Comments	-

Data / Parameter	ΔREDD_t
Data unit	tCO ₂ -e
Description	Net reduction in anthropogenic greenhouse gas emissions attributable to AUD Project activity in year t
Source of data	Parameter is calculated by subtracting the carbon stock rates in the baseline scenario from the changes in the carbon stock over the course of the Project.
Description of measurement methods and procedures to be applied	The calculation of net reductions in anthropogenic GHG emissions attributable to Project activities will be calculated using Equation 19 and Table 64 of Methodology VM0015 v1.2.
Frequency of monitoring/recording	Annual
Value applied	To be accounted for at each monitoring
Monitoring equipment	Emissions spreadsheets
QA/QC procedures to be applied	Best practices applied to the calculations of the basic parameters for calculating the Project's emissions that were previously described
Purpose of data	- Calculation of baseline emissions - Calculation of project emissions - Leakage calculation
Calculation method	Emissions will be calculated using the guidelines in section 8.4.1.2 of the VM0015 v1.2 methodology
Comments	-

Data / Parameter	VCU _t
Data unit	tCO ₂ -e
Description	Quantity of Verified Carbon Units (VCU) to be made available for trading in year t

Source of data	Value resulting from subtracting/discounting the risk factor (buffer) from net reductions in anthropogenic GHG emissions (ΔREDDt).
Description of measurement methods and procedures to be applied	The VCU's will be calculated using Equations 20, 21 and 22 and Table 64 of Methodology VM0015 v1.2.
Frequency of monitoring/recording	Annual
Value applied	To be accounted for at each monitoring
Monitoring equipment	Emissions spreadsheets
QA/QC procedures to be applied	Good practices applied to the calculations of the basic parameters for calculating the Project's emissions that were previously described
Purpose of data	- Calculation of baseline emissions - Calculation of project emissions - Leakage calculation
Calculation method	Emissions will be calculated using the guidelines in section 8.4.1.3 of the VM0015 v1.2 methodology
Comments	-

Data / Parameter	Deforestation in the project area and leakage belt
Data unit	Hectare (ha)
Description	Areas of forest cover converted to non-forest cover areas within the project area and leakage belt of the Manoa REDD+ Project
Source of data	Calculated using remote sensing images together with GPS data collected in the field.
Description of measurement methods and procedures to be applied	Monitoring of forest cover in the project area and leakage belt will be done through analysis of satellite images. When data from the PRODES system are not available, monitoring of forest cover will be done by automatic classification and visual interpretation of images from other optical sensors or SAR data.

Frequency of monitoring/recording	Annual
Value applied	To be accounted for at each monitoring
Monitoring equipment	Remote sensing images from digital processing software, geographic information systems and navigational GPS.
QA/QC procedures to be applied	Images with a special resolution of 30m or more will be used for mapping. The minimum mapping unit is 1ha. Assessment of classifications will be done through data collected in the field using GPS navigation. The minimum accuracy of the land use and land cover classification map is 80%.
Purpose of data	Calculation of project emissions
Calculation method	In the event that areas of unplanned deforestation are detected, the Forest Cover Mark of Excellence Map will be updated by map algebra.
Comments	PRODES Digital Project: http://www.dpi.inpe.br/prodesdigital/prodes.php More information on quality control and assurance is available at: (CÂMARA et al., 2006). Methodology for calculating the annual deforestation rate in the Legal Amazon

Data / Parameter	DAP
Data unit	cm
Description	Diameter at Breast Height (130 cm) for each tree with DBH equal to or greater than 10 cm in each forest inventory plot
Source of data	Calculated from the circumference at breast height measured in the field by Hdom
Description of measurement methods and procedures to be applied	DBH is calculated from the circumference at breast height (CAP) data of each monitored tree measured in the field.
Frequency of monitoring/recording	Forest inventory data collected over periods of up to 6 years in multiple plots (new baseline period).
Value applied	To be accounted for at each monitoring

Monitoring equipment	Calculated from the circumference at breast height of data measured in the field using a tape measure.
QA/QC procedures to be applied	Mandatory monitoring in accordance with Methodology VM0015. Forest inventory data collected over periods of up to 6 years in multiple plots (new baseline period).
Purpose of data	Indicate one of the following: • Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	DBH is calculated from the circumference at breast height (CAP) data of each monitored tree measured in the field.
Comments	

Parameters for monitoring Climate Scope activities

Theme: Monitoring avoided deforestation and reducing emissions

Data / Parameter	Area of avoided deforestation (Project area and Leakage Belt)
Data unit	Hectares (ha)
Description	Accounting for avoided deforestation in the project area and leakage belt. The analysis is based on the identification of areas that have not been deforested compared to the baseline scenarios.
Source of data	Geospatial analyses
Description of measurement methods and procedures to be applied	Remote sensing images from the LANDSAT8 satellite used by the PRODES project corresponding to orbit/point 231/66 and 232/6 complemented by data from the Deforestation Alert System (SAD), produced by Imazon.
Frequency of monitoring/recording	Each verification period
Value applied	To be accounted for in monitoring

Monitoring equipment	Not applicable
QA/QC procedures to be applied	Use of images with a spatial resolution of 30 metres or more for mapping and a minimum mapping unit of 1 ha. Use of methodology to assess data accuracy .
Purpose of data	Identification in hectares of the areas protected by the project
Calculation method	Not applicable
Comments	This indicator is related to the following Project activity: Account for areas of avoided deforestation and avoided emissions in the Project Area and in the Leakage Belt

Data / Parameter	Number of monthly bulletins generated
Data unit	Number
Description	Measurement of the number of deforestation and forest fire reports produced for the Project Area and Leakage Belt
Source of data	Bulletins generated monthly (internal database)
Description of measurement methods and procedures to be applied	All documents produced by the project will be stored in digital files throughout the project's accreditation period. In this way, the number of bulletins produced will be monitored and accounted for
Frequency of monitoring/recording	Annual
Value applied	To be accounted for in monitoring
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The bulletins will be generated based on geospatial data and field information from joint actions between the proponents. The project will continually evaluate the information generated by identifying improvements in the collection and recording processes and, where appropriate, adjustments will be made.
Purpose of data	- Monthly calculations of project emissions - Monthly leakage calculation

Calculation method	Not applicable
Comments	This indicator is related to the following Project activity: Perform satellite image monitoring to generate monthly bulletins
Data / Parameter	Number of deforestation alerts detected
Data unit	Number
Description	Use of a system that alerts of possible deforestation in the project area for monthly control of these occurrences
Source of data	Deforestation Alert System (SAD)
Description of measurement methods and procedures to be applied	Immediate identification of changes in forest cover, deforestation, fire, etc.
Frequency of monitoring/recording	Monthly
Value applied	To be accounted for in monitoring
Monitoring equipment	Described in section 1.12
QA/QC procedures to be applied	Each alert received will be duly recorded and identified in the field. Subsequently, the accuracy of the data issued by the SAD systems will be analysed to assess its effectiveness .
Purpose of data	- Have immediate control of possible changes in forest cover - Set up a database to better understand the periods when there are more occurrences and thus improve mitigation actions
Calculation method	Not applicable
Comments	This indicator is related to the following Project activity: Perform satellite image monitoring to generate monthly bulletins
Data / Parameter	Number of incidents detected and controlled

Data unit	Number
Description	Number of fires detected and controlled during the dry season, using satellite images, field activities or alerts and actions in the field for mitigation.
Source of data	• Satellite images • On-site/field visualisation • Alerts (system and/or warnings from neighbours) • Effective action in the field • Asset Surveillance Reports
Description of measurement methods and procedures to be applied	All incidents will be recorded through images/photographs and reports, as well as mitigation actions, and will be stored in digital files.
Frequency of monitoring/recording	Drought months/whenever they occur / Monthly for the number of intrusions
Value applied	To be accounted for in monitoring
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The project will continually evaluate the information generated by identifying improvements in the collection and recording processes and, where appropriate, adjustments will be made. As for the patrol activity, it is carried out by the employees of the Manoa farm adopting a strategy to have the "surprise effect", in case of detection of wood theft or invasion, the employees are trained to immediately report the occurrence to the forest manager.
Purpose of data	Creation of a database with detailed information on incidents and images/photographs to help monitor and mitigate incidents. Establishment of a specific monitoring calendar for the dry season. Evaluation of property surveillance actions and identification of means to improve them, in order to prevent future invasions.
Calculation method	Not applicable
Comments	This indicator is related to the following Project activities:

	- Perform satellite image monitoring to generate monthly bulletins; - Improve and monitor property surveillance actions - Conduct forest firefighting training for Manoa employees
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Data / parameter	Average response time to fire incidents
Data unit	Time (hours)
Description	Quantify the time required to contain incidents caused by fire.
Source of data	Report with information on monitored data
Description of measurement methods and procedures to be applied	All fire containment data will be stored in digital files throughout the Project's crediting period.
Frequency of monitoring/recording	Annual
Value applied	To be accounted for in monitoring
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The Project will undergo continuous evaluation of the information generated, through the identification of improvements in the collection and recording processes and, when relevant, the incorporation of adjustments in the Project's strategic planning
Purpose of data	Reduction in response time and in the extent of damage caused by forest fires, due to the effective intervention of trained employees.
Calculation method	Not applicable
Comments	This indicator is related to the following Project activity: Conduct forest firefighting training for Manoa employees

Data / parameter	Number of accesses cleared and maintained
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Data unit	Number
Description	This parameter monitors the number of strategic access points within the project area that have been cleared and maintained in good condition to prevent and mitigate forest fires.
Source of data	Internal reports on maintenance and monitoring activities carried out by the project team.
Description of measurement methods and procedures to be applied	- Regular visual inspection of strategic access points. - Reports completed by maintenance personnel and monitoring teams. - Use of standardized checklists to verify access conditions. - Responsible team: Field supervisors and infrastructure team.
Frequency of monitoring/recording	Monthly
Value applied	To be accounted for in monitoring
Monitoring equipment	Basic inspection equipment, such as vehicles and maintenance tools (e.g., tractors for clearing, manual tools).
QA/QC procedures to be applied	- Photographic records before and after maintenance. - Review and approval of reports by field management.
Purpose of data	To monitor the effectiveness of maintenance actions, ensuring rapid and safe access in emergency situations such as forest fires.
Calculation method	Count of access points cleared and maintained in good condition during the monitoring period.
Comments	This indicator is critical for assessing the readiness of project infrastructure to mitigate fire risks, ensuring the safety of operations and local biodiversity. This indicator is related to the following Project activity: Maintain access to strategic points at risk of fire
Data / Parameter	Number of patrols carried out

Data unit	Number of operations per year
Description	Number of surveillance patrols carried out during the monitoring period to prevent entry by third parties
Source of data	Asset Surveillance Reports
Description of measurement methods and procedures to be applied	Surveillance actions are monitored by recording the patrols carried out in a report
Frequency of monitoring/recording	Monthly
Value applied	To be accounted for in monitoring
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The activity is carried out by Manoa farm employees adopting a "surprise effect" strategy, in the event of detection of wood theft or invasion, employees are trained to immediately report the occurrence to the forestry manager.
Purpose of data	Evaluating asset surveillance activities and identifying whether the frequency is adequate
Calculation method	Not applicable
Comments	This indicator is related to the following Project activity: Improve and monitor property surveillance actions

Data / Parameter	Number of obstructed accesses
Data unit	Number
Description	This indicator represents the number of strategic access points to the property that have been effectively obstructed following forest management activities. The obstruction is implemented to limit unauthorized entry, reduce potential illegal activities such as logging or hunting, and support the preservation and protection of the managed area. The count includes all access points identified and targeted in the management plan, which have been rendered impassable or monitored through physical barriers or other appropriate measures.

Source of data	Photographic records and field evidence/maps indicating that these obstructions have taken place
Description of measurement methods and procedures to be applied	Implementation of physical barriers at strategic access points to limit unauthorised access
Frequency of monitoring/recording	Annually
Value applied	To be accounted for in monitoring
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Implementation of physical barriers at strategic access points to limit unauthorised access
Purpose of data	Identify the effectiveness of the obstructions (analyse whether their existence prevents new invasions), guaranteeing the maintenance of forest cover
Calculation method	Not applicable
Comments	This indicator is related to the following Project activity: Obstructing strategic access to the farm after forest management activity

Data / Parameter	Number of approved forest certifications
Data unit	Number
Description	Number of forest certifications approved
Source of data	Updated certificates
Description of measurement methods and procedures to be applied	All certificates will be stored in digital files throughout the Project's crediting period.
Frequency of monitoring/recording	Annual
Value applied	To be accounted for in monitoring

Monitoring equipment	Not applicable
QA/QC procedures to be applied	The Project will undergo continuous evaluation of the information generated, through the identification of improvements in the collection and recording processes and, when relevant, the incorporation of adjustments in the Project's strategic planning
Purpose of data	Maintain certifications related to forest conservation (e.g. forest management)
Calculation method	Not applicable
Comments	-

Data / Parameter	Corrective measures implemented per year
Data unit	Number
Description	Quantifies the corrective actions taken annually to ensure the continuation of high-quality forest management and compliance with forest certification requirements.
Source of data	Internal reports from Manoa, external certification audits, and records of corrective measures implementation.
Description of measurement methods and procedures to be applied	Corrective measures will be identified through internal and external audits. Implementation will be recorded in management reports, verifying the adequacy and effectiveness of the actions taken. Independent audits and document reviews will be applied to validate the data. The responsible parties will be Manoa's environmental and forest managers.
Frequency of monitoring/recording	Annual
Value applied	To be accounted for in monitoring
Monitoring equipment	N/A – data will be collected from documentary records and audits.
QA/QC procedures to be applied	Annual reviews of external audits and validation of records by forest management certifiers. Cross-checking procedures between data from different sources (internal and external reports).

Purpose of data	Maintenance and renewal of forest certifications and ensuring compliance with sustainable management standards.
Calculation method	Sum of the number of corrective measures documented and implemented during one year.
Comments	The implementation of corrective measures is crucial to mitigate non-compliance risks and ensure the continuous improvement of forest management practices. This parameter may be adjusted annually according to new certification requirements and audit results.

Data / Parameter	Percentage of permanent infrastructure
Data unit	Percentage
Description	This parameter will measure the percentage of permanent infrastructure built to carry out forest management, such as roads and esplanades.
Source of data	Technical reports, field data sheets, official documents from environmental agencies, etc.
Description of measurement methods and procedures to be applied	All the documents produced will be stored in digital files throughout the project's accreditation period. In this way, information on the activity will be monitored and accounted for
Frequency of monitoring/recording	Annual
Value applied	To be accounted for after project registration
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Systematized information on the benefits generated by the activities will be validated among the proponents, allowing for greater reliability and quality of the data. In addition, the project will continually evaluate the information generated, identifying improvements in the collection and recording processes and, where appropriate, incorporating adjustments into the project's strategic planning.

Purpose of data	Contribute to reducing environmental impacts and improving the sustainability of forestry operations. Strengthen compliance with environmental regulations and certification standards. Improve long-term forest management based on consistent data.
Calculation method	The methodology for opening roads and esplanades is described in Manoa's Sustainable Forest Management Plan, updated periodically, and road planning is subject to adjustments after the microzoning of each UPA. The calculation of the percentage of permanent infrastructure is the result of the equation: Percentage of permanent infrastructure = (area affected by permanent infrastructure/total area of the UPA exploited) x 100
Comments	This indicator is intended to monitor the impacts of the forest management carried out in the project area

Data / Parameter	Percentage of temporary infrastructure
Data unit	Percentage
Description	This parameter will measure the percentage of temporary infrastructure built to carry out forest management, such as trails and clearings
Source of data	Technical report, field data sheet, official documents from environmental agencies, etc.
Description of measurement methods and procedures to be applied	All documents produced will be stored in digital files throughout the project's crediting period. In this way, information about the activity will be monitored and accounted for
Frequency of monitoring/recording	Annual
Value applied	During the monitored period, two UPAs were explored, UPA 12 and UPA 13, however only the monitoring report of UPA 12 was available until the conclusion of the audit, therefore, the monitoring of UPA 13 will be done in the next monitoring period.

	In all, 10.32% of UPA 12 was used for the construction of temporary structures.
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The systematized information on the benefits generated by the activities will be validated among the proponents, allowing for greater reliability and quality of the data. In addition, the Project will undergo continuous evaluation of the information generated, through the identification of improvements in the collection and registration processes and, when relevant, the incorporation of adjustments in the Project's strategic planning
Purpose of data	Contribute to the reduction of environmental impacts and improvement in the sustainability of forestry operations. Enforce compliance with environmental regulations and certification standards. Improvement in long-term forest management, based on consistent data
Calculation method	The methodology for planning trails and clearings is described in the Forest Management Plan. And the impact of the activity is measured in the post-exploratory monitoring reports. The calculation of the percentage of temporary infrastructure is the result of the equation: Percentage of temporary infrastructure = (area affected by temporary infrastructure/total area of the UPA exploited) x 100
Comments	This indicator aims to monitor the impacts of the forest management carried out in the project area

Data / Parameter	Volume of timber harvested
Data unit	m3/ha
Description	This parameter will measure the total volume of timber logged during the monitored period
Source of data	Technical report, field data spreadsheet, official documents from environmental agencies, etc.

Description of measurement methods and procedures to be applied	All the documents produced will be stored in digital files throughout the project's accreditation period. In this way, information on the activity will be monitored and accounted for
Frequency of monitoring/recording	Annually or always after the exploitation of the UPAs exploited during the monitored period has been completed
Value applied	To be accounted for after project registration
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Systematized information on the benefits generated by the activities will be validated among the proponents, allowing for greater reliability and quality of the data. In addition, the project will continually evaluate the information generated, identifying improvements in the collection and recording processes and, where appropriate, incorporating adjustments into the project's strategic planning.
Purpose of data	Contribute to reducing environmental impacts and improving the sustainability of forestry operations. Strengthen compliance with environmental regulations and certification standards. Improve long-term forest management based on consistent data.
Calculation method	After extraction, when the wood arrives at the yard, the volume is calculated according to the following equation: $V = \frac{\left[\left(d_b^2 \cdot \frac{\pi}{4} \right) + \left(d_t^2 \cdot \frac{\pi}{4} \right) \right]}{2} \cdot L$ Where: • V=volume in m³; • L = length of the log in meters; • db= Diameter with bark of the base of the log in meters (obtained from the average of the largest and smallest diameter of the section – crosswise; • dt= Diameter with bark of the top of the log in meter (obtained from the average of the largest and smallest diameter of the section – crosswise. More detailed measurement information is available in the Sustainable Management Plan, which is updated periodically.

Comments	This indicator is intended to monitor the impacts of the forest management carried out in the project area
Data / Parameter	Burn scars in the leakage management area
Data unit	Hectare (ha)
Description	Areas affected by fires in leakage management area
Source of data	Calculated using remote sensing and data available from reliable sources
Description of measurement methods and procedures to be applied	Identification of affected areas in the leakage management zona from reliable sources with data on burn scars.
Frequency of monitoring/recording	Every two years, starting in 2026
Value applied	To be accounted for every two years from 2026 onwards
Monitoring equipment	Geotechnologies: remote sensing and geographic information systems
QA/QC procedures to be applied	Data or images obtained by high-resolution sensors (up to 5m pixels) will be used to validate and refine the mapping of areas affected by burn scars in the leakage management area. The minimum mapping accuracy is 80 per cent
Purpose of data	Monitoring of the use of fire in pastures in the leakage management area
Calculation method	-
Comments	-

Deviations in the project description in relation to the initial PD:

Monitoring indicators

Considering the monitoring period from 2017 to 2020, there were deviations in relation to two proposed indicators: “Harvest damage assessment” and “Frequency of surveillance and patrol operations”.

However, the deviations that occurred did not compromise the monitoring of the project, as can be analyzed in the descriptions below.

The “Harvest damage assessment” indicator was proposed to assess the damage that occurred in the management operations by comparing the pre- and post-situation of the individuals present in the installed plots. The indicator was designed to be monitored with the unit of m^3/ha , however, the process of recording post-exploration damages raises the number of damaged and dead individuals in an analyzed area without considering the volume of each individual. Thus, the indicator was analyzed and reported in the unit of individual/ha.

The indicator “Frequency of surveillance and patrol operations” was initially proposed to assess the functioning of property surveillance actions. This activity aims to promote mitigation actions against invasion in the Project Area and, consequently, to act to combat illegal and unplanned deforestation and forest degradation. Surveillance actions have been carried out continuously throughout the project since 1997, presenting specific tactics. Based on the costs associated with the maintenance of surveillance infrastructures (Casa Curica and Casa Rio Preto), it is possible to prove their use and, consequently, the continuity of surveillance operations, as observed in the patrol reports and in the expense reports of Fazenda Manoa, made available to VVB. However, the recording of activities only began in 2020. Therefore, the monitoring of the actions as well as the completion of the aforementioned indicator were compromised due to the lack of records that could quantitatively prove the actions. Despite this gap, it was possible to indirectly identify the effect of surveillance actions in the Project Area, as there was no unplanned illegal deforestation in the area during the verified period. Thus, proving that asset surveillance actions were carried out.

5.3 Monitoring Plan

The Climate Impact Monitoring Plan contains the essential aspects for demonstrating the reduction of emissions from deforestation and degradation due to avoided unplanned deforestation (according to the applied methodology VM0015 v.1.2). Thus, it allows monitoring changes in the carbon stock over the lifetime of the project due to changes in land use within the project area and in the leak belt.

Given that the project is going through a CCB seal revalidation process, some activities planned in the PDD that have not yet been executed, as well as some monitoring indicators that currently have no documented evidence, will be monitored after the completion of this revalidation. Monitoring of these items in the respective RMs will be incorporated into the next audit events.

The Project's Climate Impact Monitoring Plan cover the tasks: (1) Monitoring changes in carbon stock and GHG emissions for periodic checks; 2. Task 2: Revisiting baseline projections for future baseline-setting periods

Part 1. Monitoring of changes in carbon stocks and GHG emissions for periodic checks

1.1 Monitoring of current changes in carbon stocks and GHG emissions in the project area.

Monitoring changes in carbon stock and GHG emissions in the Project Area involves four main scopes, which are:

- I. project implementation,
- II. land use and land cover change,
- III. carbon stocks and non-CO2 emissions, and
- IV. impacts of natural disturbances and other catastrophic events.

The following are the monitoring details of the four scopes:

a) Technical description of the monitoring tasks

The monitoring of changes in carbon stock and GHG emissions within the project area will be carried out through the monitoring of planned and unplanned deforestation, as described in Section 5.2. The monitoring of the efficiency of REDD+ activities that aim to avoid unplanned deforestation will be developed by Biofíllica through the monitoring of these areas of forest cover by satellite images and field verification in the project area.

b) Data to be collected

Table 63 Data to be collected for monitoring changes in carbon stock and GHG emissions for periodic checks

Data/Parameter	Description	Unit	source	Frequency
C_{total}	Average carbon stock for all carbon pools in forest class icl	tCO ₂ e ha ⁻¹	Calculated using allometric equations and field-measured data.	Collected over periods of up to 6 years.
$APDPA_{icl,t}$	Areas of planned deforestation in forest class icl in year t in the project area.	Hectares (ha)	Calculated using remote sensing images, technical maps and data, field information and post-exploratory management data.	Annual
$\Delta CPLdPA_t$	Total decrease in carbon stocks due to planned harvesting activities in year t in the project area.	Ton of carbon dioxide equivalent (tCO ₂ -e)	Calculated	Annual

Data/Parameter	Description	Unit	source	Frequency
$ACPA_{icl,t}$	Annual area within the project area affected by catastrophic events in class icl in year t.	Hectares (ha)	Calculated using remote sensing images.	Each time a catastrophic event occurs.
$\Delta CUCdPA_t$	Total decrease in carbon stock due to catastrophic winds in year t in the project area	Ton of carbon dioxide equivalent (tCO ₂ -e)	Calculated	Each time a catastrophic event occurs.
$\Delta CUFdPA_t$	Total decrease in carbon stock due to unplanned wildfires in year t in the project area	Ton of carbon dioxide equivalent (tCO ₂ -e)	Calculated	Each time a catastrophic event occurs.
$\Delta CUDdPA_t$	Total current change in carbon stock due to unavoided planned deforestation in year t in the project area.	Ton of carbon dioxide equivalent (tCO ₂ -e)	Calculated	Annual
$\Delta CPSPA_t$	Total change in carbon stock in the project area in year t.	Ton of carbon dioxide equivalent (tCO ₂ -e)	Calculated	Annual

c) Summary of the data collection procedure

Monitoring of the implementation of the Project activities

The monitoring of the implementation of REDD+ activities will be carried out through schedules, activity performance reports and indicators, financial reports, attendance lists, meeting minutes, established procedures and protocols, forest cover maps, among other relevant documents.

Monitoring of changes in land use and cover

This monitoring will be developed and carried out for planned and unplanned deforestation in the Project, through the mapping of the forest cover of the Project Area, through qualified and scientifically recognized sources, such as PRODES and DETER, developed through INPE, MapBiomass, developed by a collaborative network formed by NGOs, universities and technology startups, among other qualified and recognized sources that may be used in the future. The choice of methodology will be evaluated in order to meet the requirements of data quality and accuracy.

Furthermore, for the monitoring of planned deforestation, areas opened for the implementation of infrastructure, such as road construction, expansions and storage yards within the Project Area, will be considered, as well as reports, post-exploration maps and satellite images containing information on forest cover. Areas converted to the non-forest class will be used.

In order to speed up the deforestation mapping process, different visual classification and interpretation techniques may be used during the Project, such as complementary mapping using alternative images and sensors and data collected in the field.

After the deforestation data has been collected, these will be compared with the baseline scenario, and the emission reduction values for the monitored period will be based on the comparison between expected and actual deforestation.

Monitoring of changes in carbon stocks and non-CO2 emissions

According to VM0015, in forest management areas, monitoring of carbon stocks is mandatory if the areas are subject to a significant reduction in carbon stocks in the project scenario, in relation to the ex-ante assessment.

Carbon stock monitoring is carried out through forest inventory, measuring the diameter at breast height (DBH = 130 cm) for each tree with DBH greater than or equal to 10 centimeters within the forest inventory plots. DBH is the main variable used to estimate carbon stock and changes in carbon stock in the Manoa REDD+ Project.

Monitoring of non-CO2 emissions from forest fires is done through mapping satellite images, identification of affected areas and calculations described in VM0015 (Section 8.1.5.2 - Baseline non-CO2 emissions from forest fires).

Monitoring of natural disturbances and other catastrophic events

The reduction of carbon stock and the increase in GHG emissions, as well as the reduction of significant carbon stock caused by natural disturbances or catastrophic events will be controlled, monitored and reported in a similar way to non-CO2 emissions in the Project Area. Therefore, if there is a significant decrease in carbon stock due to natural disturbances or catastrophic events, this reduction will be reported in the verification processes using Tables 53, 54 and 55 of the Approved Methodology VM0015 version 1.2

d) Quality control and assurance procedures

Monitoring of changes in land use and land cover:

Changes in carbon stocks due to the conversion of forested areas into non-forested areas through planned and unplanned deforestation will be monitored. Likewise, changes in carbon stocks due to uncontrolled forest fires and other catastrophic events will be monitored and discounted in the project scenario in cases where they are significant. The quality control and assurance of these analyses will be

carried out through the accuracy process indicated by the VM0015 methodology version 1.2, which will be the same regardless of the type of data used in the monitoring.

The analysis will be carried out through the analysis of the general accuracy and the kappa index obtained from a confusion matrix such as that of Congalton (1999), in which at least 100 randomly distributed points will be generated in relation to the area analyzed through a geographic information system. Validation will be carried out through high spatial resolution satellite images and/or data collected in the field. The minimum mapping accuracy, as per VM0015, for each class or category of the land use and land cover map must be 80%.

In addition to the precision process carried out, when necessary, field checks will be carried out in areas where the conversion of forest areas to non-forest areas is identified, whether due to unplanned deforestation or uncontrolled forest fires and other catastrophic events.

Monitoring of carbon stock and non-CO2 emissions:

The procedure to control and ensure the quality of forest management is carried out by Manoa in the pre-harvest inventory phases, during and after harvest. Biofíllica will have access to the original field reports and sheets. It will have a copy of these documents throughout the life cycle of the project. Inventory and monitoring spreadsheets and reports for remaining areas will be available to the verification agency at each verification event.

e) Data archiving

Biofíllica Ambipar Environment keeps all data and reports from the Manoa REDD+ Project stored in digital files throughout the duration of the Project. The original reports and field records collected by the asset security activity are stored by Manoa. All documents related to the monitoring of the Manoa REDD+ Project are compiled in printed and/or digital files and made available to the verifiers at each verification event.

f) Organization and responsibilities of the parties involved in all the above points

These activities are the responsibility of Biofíllica Invetimentos Ambientais.

1.1.1 Monitoring Project Implementation

The implementation of REDD+ activities will be monitored using financial spreadsheets, performance and quality reports, social management reports, vegetation cover maps, meeting reports, invasion occurrence reports, and other relevant documents.

1.1.2 Monitoring of land use and land cover changes within the project area

Monitoring of planned and unplanned deforestation will be carried out using data provided annually by PRODES (INPE), which uses satellite images with a spatial resolution of 30 meters. The mapping will subsequently be validated based on an accuracy assessment with high-resolution images and field verification when necessary. Monitoring of deforestation for the implementation of infrastructure for social activities will be carried out using specific field records, and for the construction of roads,

branches, and storage yards within the project area, pre-exploration reports and maps and satellite images containing information on the forest cover area converted into non-forest classes will be used. In order to achieve greater flexibility in the deforestation mapping process, different visual classification and interpretation techniques may be used during the project, such as complementary mapping using alternative images and sensors and data collected in the field.

Data on deforestation events will be compared to the baseline scenario. Values of reduced emissions during the deforestation period will be based on the comparison between predicted and actual deforestation.

1.1.3 Monitoring of changes in carbon stock

Within the project area:

The ex ante estimate of carbon stock by forest class is expected not to change during the baseline period. However, VCS Methodology VM0015 requires monitoring of carbon stock in the project area subject to significant loss of carbon stock in the project scenario according to the ex ante assessment due to controlled deforestation and planned management activities, or areas subject to significant unplanned decrease in carbon stock in the baseline scenario.

The total change in carbon stock due to unavoided unplanned deforestation within the project area is calculated as follows:

$$\Delta\text{CUDdPA}_t = \sum_{y=1}^t \left(\sum_{icl=1}^{icl} \text{AUDPA}_{icl,y} * \Delta\text{Ctot}_{icl,t-y} - \sum_{fcl=1}^{fcl} \text{AUDPA}_{fcl,y} * \Delta\text{Ctot}_{fcl,t-y} \right)$$

Where:

ΔCUDdPA_t Total change in carbon stock due to unavoided unplanned deforestation within the project area in year t.

$\text{AUDPA}_{icl,y}$ area of unplanned deforestation in the initial forest class icl year t within the project area in the scenario with the project.

$\Delta\text{Ctot}_{icl,Ac}$ Carbon stock loss in the initial forest class icl at the time of the AC change (# of years after the LU/LC change).

$\text{AUDPA}_{fcl,y}$ non-forest class area fcl at time t within the project area after unplanned deforestation in the scenario with the project.

$\Delta\text{Ctot}_{fcl,Ac}$ Carbon stock gain in the final non-forest class fcl at the time of the Ac change (# of years after the LU/LC change).

If there is a significant reduction in carbon stock due to sustainable forest management activities, this reduction will be reported in the verification processes through what is established in the VCS Methodology VM0015 version 1.2.

Within the leakage management areas:

No areas will be subject to planned loss of carbon stock in the leakage management areas in the project scenario.

Monitoring of non-CO2 emissions from forest fires:

The monitoring of non-CO2 emissions from forest fires is carried out through satellite image mapping, identifying the affected area, and calculations described in VM0015 v.1.2.

1.1.4. Monitoring the impacts of natural disturbances and other catastrophic events

Losses in carbon stocks and increases in GHG emissions due to natural disturbances or catastrophic events will be monitored through satellite monitoring of forest cover using the same methods applied for monitoring forest cover in the project area (Section 5.2).

The main activities to be developed for data collection and processing are:

- Selection of optical satellite images with less cloud cover, taken at times close to the Amazon dry season and with adequate radiometric quality;
- Georeferencing of satellite images with topographic graphics at a scale of 1:100,000 or NASA images in MrSID in orthorectified format;
- Mapping of affected forest cover areas.

Emissions from natural disturbances or catastrophic events will be estimated by multiplying the area of mapped forest loss by the average forest carbon stock. If there is a significant reduction in carbon stock due to natural disturbances or catastrophic events, this reduction will be reported in the verification processes using tables 53, 54 and 55 of the approved methodology VCS VM0015 version 1.2.

1.2 Leakage Monitoring

a) Technical description of monitoring tasks:

The Manoa REDD+ Project will involve two leakage source monitoring activities:

I. Monitoring of the reduction in carbon stocks and/or increase in GHG emissions associated with leakage prevention measures if the project proponents implement activities such as tree planting, agricultural intensification, fertilization, forage production and/or other improvement measures in agricultural areas and livestock farming. If these activities cause a reduction in carbon stocks and/or increase in GHG emissions in the leakage management areas, these changes in carbon stocks and/or GHG emissions will be estimated by Biofíllica Investimentos Ambientais.

II. Monitoring of forest cover in the leakage belt through satellite imagery will be carried out by Biofíllica Investimentos Ambientais.

b) Data to be collected

Table 64 Data to be collected for monitoring the leakage.

Data	Description	Unit	Source	Frequency
$\Delta CLPMLK_t$	Carbon stock reduction due to leakage prevention measures	tCO ₂ -e	Calculated	Annual
$EgLK_t$	Emissions from grazing animals in the leakage management area in year t	tCO ₂ -e	Calculated	Annual
$ELPMLK_t$	Total annual increase in GHG emissions from leakage prevention measures in year t	tCO ₂ -e	Calculated	Annual
$\Delta CabBSLLK_t$	Total changes in carbon stock in the leakage belt area	tCO ₂ -e	Calculated	Annual

c) Brief description of data collection procedures

Monitoring changes in carbon stock and GHG emissions associated with leakage prevention activities

The main activities developed for collecting and processing data for monitoring changes in carbon stock due to the implementation of activities in leakage management areas are:

Leakage prevention activities will be listed;

- A map showing the intervention areas and type of intervention will be prepared;
- Areas in which leakage prevention activities impact the carbon stock will be identified;
- Non-forest classes existing within these areas will be identified;
- Carbon stocks in the identified classes will be measured or estimates from the literature will be used;
- Changes in carbon stock in leakage management areas in the project scenario will be reported using table 56 of methodology VM0015;
- Net changes in carbon stock caused by leakage prevention measures during the baseline period and the project crediting period will be calculated;
- Calculation results will be reported in Table 57 of the VM0015 methodology.

Monitoring of carbon stock decrease and increase in GHG emissions due to leakage displacement:

Monitoring of changes in carbon stock

Procedures for data collection used will be the same as those applied to monitoring deforestation in the project area (Section 5.2).

Monitoring of increase in GHG emissions

Emissions from forest fires are not accounted for in the baseline.

d) Control and quality assurance procedures

Monitoring of changes in carbon stock and GHG emissions associated with deforestation prevention activities:

To be determined depending on the activity, if implemented.

Monitoring of carbon stock decrease and increase in GHG emissions due to leakage displacement:

Procedures for control and quality assurance used will be the same as those applied to monitoring deforestation in the project area (Section 5.2).

e) Data archiving

Original reports and field files will be stored by Manoa. Biofílica Ambipar Investimentos Ambientais will keep a copy of these documents in digital format throughout the life of the project. The original (raster) and processed (vector) digital data of satellite images, coordinates, technical maps, field photos and files will be stored by Biofílica throughout the life of the project. Annual map of deforestation areas, satellite images and reports will be made available to each verification body at each verification event.

f) Organization and responsibilities of the parties involved in the above

These activities are the responsibility of Biofílica Ambipar Environmental Investments.

1.2.1 Monitoring of changes in carbon stocks and GHG emissions associated with leakage prevention activities

Reductions in carbon stocks due to activities developed in leakage management areas are not expected since no activities to improve agricultural techniques or manage pasture areas that could alter carbon stocks and increase GHG emissions when compared to the baseline scenario are planned for implementation.

The following activities in leakage management areas may occasionally cause a decrease in carbon stocks or an increase in GHG emissions:

- Changes in carbon stocks due to activities implemented in leakage management areas; According to the most recent version of the VCS Standard, nitrous oxide (N₂O) emissions from nitrogen fertilization are always considered negligible. Consumption of fossil fuels is always considered negligible in AUD project activities and should not be considered.

1.2.2 Monitoring of carbon stock decline and GHG emissions increase due to leakage displacement

Data on activities in the leakage belt area will be determined using the same method applied to monitoring deforestation in the project area (Section 5.2). If during the monitoring process a deforestation event greater than expected in the baseline scenario is identified in the leakage belt, and such deforestation is attributed to deforestation drivers in the project area, the carbon stock losses will be accounted for and reported using tables 40 and 37 of the approved methodology VM0015.

The total change in carbon stock due to unplanned unavoided deforestation within the leakage belt area is calculated as follows:

$$\Delta CBSLLK_t = \sum_{y=1}^t \left(\sum_{icl=1}^{icl} AUDLK_{icl,y} * \Delta Ctot_{icl,t-y} - \sum_{fcl=1}^{fcl} AUDLK_{fcl,y} * \Delta Ctot_{fcl,t-y} \right)$$

Where:

$\Delta CBSLLK_t$ Total change in carbon stock due to unplanned unavoided deforestation within the leakage belt area in year t.

$AUDLK_{icl,y}$ Area of unplanned deforestation in forest class icl in year t within the leakage belt area in the project scenario.

$\Delta Ctot_{icl,Ac}$ Loss in carbon stock in initial forest class icl at time of change Ac (# of years after LU/LC).

$AUDLK_{fcl,y}$ Area of non-forest class fcl at time t within the leakage belt area following unplanned deforestation in the project area.

$\Delta Ctot_{fcl,Ac}$ Gain in carbon stock in final non-forest class fcl at time of change Ac (# of years after LU/LC change).

1.2.3 Total estimated ex post leakage

The results will be presented to the verification team at each verification event using table 62 of the VM0015 methodology.

1.3 Ex post net reductions of GHG gases

a) Technical description of the monitoring tasks

During the verification process, the results will be presented using table 64 of the approved methodology VM0015 version 1.2 together with the spatial data (deforestation maps, when available).

b) Data to be collected T

Table 65 Data to be collected for monitoring net ex-post GHG reductions

Data	Description	Unit	Source	Frequency
ΔREDD_{t}	Net reduction of anthropogenic GHG emissions attributed to AUD project activities in year t	tCO ₂ -e	Calculated	Annual
VCU _t	Number of Verified Carbon Units (VCUs) to be made available for trading in time t	tCO ₂ -e	Calculated	Annual

c) Brief description of the data collection procedure

The number of Verified Carbon Units (VCUs) to be generated by Manoa REDD+ Project activities in year t will be calculated using equations 19 and 20 of the approved methodology VM0015 version 1.2.

d) Quality control and assurance procedures

All the tasks and tools indicated in part 2 of the VM0015 methodology will be used to ensure that the data is suitable for the verification process and the number of VCUs is reliable.

e) Data archiving

All data and reports from the Manoa REDD+ Project will be stored by Biofílica Investimentos Ambientais in digital files throughout the project. All documents relating to project monitoring will be compiled and made available to the verification body at each verification event.

f) Organization and responsibilities of the parties involved in the above

These activities are the responsibility of Biofílica Ambipar Investimentos Ambientais.

2. Task 2: Revisiting baseline projections for future baseline-setting periods

2.1. Up-to-date information on the agents, vectors and underlying causes of deforestation

Statistical and spatial data, studies and information on the agents, vectors and underlying causes of deforestation needed to carry out steps 2 and 3 of the VM0015 methodology were updated and used in the revision of the baseline projections of 2023 after the fixed 10-year period.

2.2. Adjustment of the change component and land use and cover in the baseline

If a national or sub-national baseline becomes available during the fixed baseline period, it will be applied in the following period. In the event that no national or sub-national baseline becomes available, step 4 of methodology VM0015 will be redone considering the 10-year period (2013-2022) using the updated variables on agents, vectors and adjacent causes of deforestation in the reference region. The two main

components to be revisited are: annual area of deforestation and the location of deforestation in the baseline.

The assumptions and hypotheses considered in the modeling of future deforestation dynamics (socio-economic data), as well as the data used in the spatial projection (updating of roads, locations and distance of new deforestation) will be reviewed and updated.

In 2023, the 10-year period of the project's initial baseline came to an end. Consequently, all necessary adjustments to update the new baseline were applied. All the steps taken to establish this new baseline are described in detail in the "Application of Methodology" section of this document.

2.3. Adjustments to the carbon component of the baseline

The spatial estimation of the carbon component were revisited in accordance with methodology VM0015 version 12. During the lifetime of the project new techniques and methodologies can be analyzed for spatial estimation of biomass, such as LIDAR or SAR data.

APPENDIX: CONTINUOUS COMMUNICATION (SECTION 2.1.2)

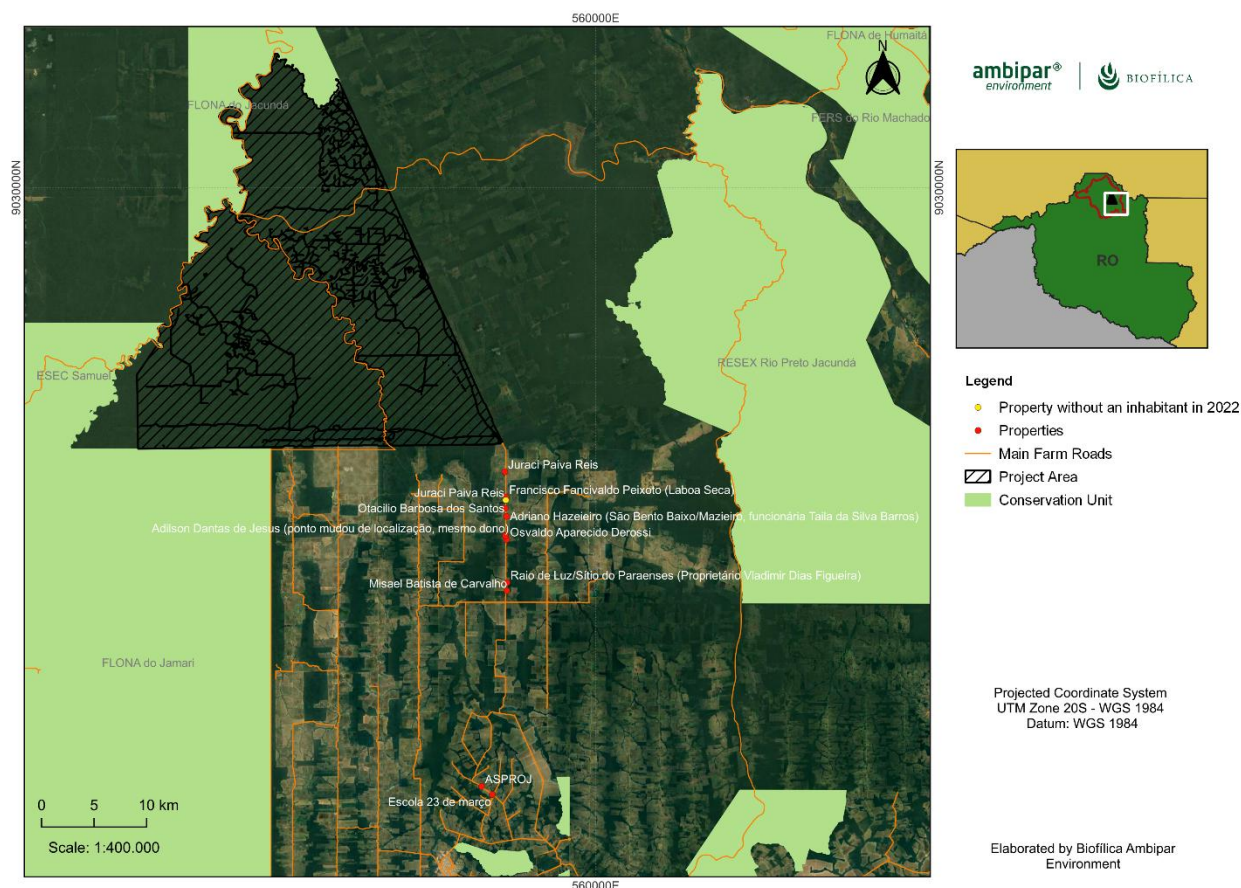
Communication and consultation between the proponents and stakeholder groups about the project and its impacts, which enables discussion about the progress of the project's activities, both in the form of complaints and suggestions, takes place through three methods: applying a questionnaire to survey the positive and negative impacts (Figure 28), making the ombudsman channel available (Figure 30) and developing the suggestion box (Figure 31).

1) Application of a questionnaire to survey positive and negative impacts::

The application of a questionnaire to survey positive and negative impacts is in line with the monitoring measures established for the social aspects that could be impacted by forest management and REDD+ Project activities. Where appropriate, Manoa compensates for the impacts. There are two questionnaire models (Figure 28), one for rural producers and the other for institutions, which are applied on the property of neighbors who live within 15km of the Manoa farm entrance gate (15Figure 29). Both have a question about the positive and negative aspects of Forest Management, and the questionnaire applied to institutions includes an additional question about their main difficulties

FICHA DE MAPEAMENTO SOCIAL - PRODUTORES RURAIS	FICHA DE MONITORAMENTO SOCIAL
Nome da Propriedade: _____ Endereço: _____ Coordenadas UTM: _____ m (E) ; _____ m (N) Atividade exercida: _____ Dados de contato: - Nome do Proprietário: _____ - Nome do funcionário: _____ - Fone fixo: _____ Email: _____ - Celular do Representante: _____ 1. Quais os impactos causados pelo PMF: - Positivos: _____ - Negativos: _____ Responsável pela coleta dos dados: _____ Responsável pela informação dos dados: _____ Assinatura: _____ Local de data: _____/_____/____	Nome da Instituição: _____ Endereço: _____ Coordenadas UTM: _____ m (E) ; _____ m (N) Atividade exercida: _____ Dados de contato: - Nome do representante legal: _____ - Função: _____ - Fone fixo: _____ Email: _____ - Celular do Representante: _____ a) escolas rurais: - Qual o grau de escolaridade fornecido: _____ - Nº de alunos por escolaridade: _____ - Para vários dos alunos por escolaridade: _____ - Principais dificuldades: _____ b) Associações de Produtores: - Atividade principal da associação: _____ - Nº de associados: _____ - Principais dificuldades: _____ 1. Quais os impactos causados pelo PMF: - Positivos: _____ - Negativos: _____ Responsável pela coleta dos dados: _____ Responsável pela informação dos dados: _____ Assinatura: _____ Local de data: _____/_____/____

Figure 28 Questionnaire templates for monitoring impacts. Farmers on the left and institutions on the right



15Figure 29 Map of the areas visited for the social monitoring report around the Forest Management Area (FMA)

The questionnaire is administered between the months of July and October to the residents present at the time of Manoa's visit. The number of questionnaires answered varies from year to year, because the owners or employees are not always present at the time and because the property can be bought or sold from one year to the next.

In addition to the questionnaires, Manoa also provides a copy of the public summary of the management plan, which includes information about the REDD+ Project, the fauna protected on Manoa Farm and the social impact of Manoa's activities, as well as the telephone number and e-mail address of Manoa's ombudsman channel. In the future, the project intends to improve the questionnaire to better understand whether stakeholders know how to contact the farm if necessary and to better communicate the results of the REDD+ Project during the application of the questionnaires.

2. Availability of the Ombudsman Channel

In order to promote effective communication with stakeholders in the surrounding area in cases where possible damage or negative impacts arising from its activities need to be repaired, the company has set up a public ombudsman channel. Through the ombudsman's office it is possible to communicate from any source, such as complaints, dissatisfaction or even suggestions. Information on the ombudsman

channel is available at the entrance to the farm, for easy access by neighbors, and on Triângulo's website¹⁰² (Figure 30).



Figure 30 Triângulo's website on the left, with details of the ombudsman channel at the bottom of the page and, on the right, a photo of the Manoa sign with the telephone number and e-mail address of the ombudsman channel to contact if necessary.

The Finance manager is responsible for registering, analyzing and forwarding requests to the appropriate department.

3. Development of the suggestion box

The third front of consultation and communication is the suggestion box (Figure 31), which was designed as a project improvement in relation to communication channels, with the aim of dealing with possible suggestions, demands or complaints from Manoa farm employees.

The box will have to be opened by the technicians responsible in front of all the farm's employees, and the records will be evaluated one by one in order to apply the necessary actions considering each demand.

¹⁰² Site triângulo. Available at: <https://www.triangulo.com.br/sustentabilidade/>. Acessado em: 11 de julho, 2023.



Figure 31 Suggestion box located in the cafeteria at Fazenda Manoa.

4) Other communication channels

In addition to the three main fronts of consultation and communication established by Manoa, dialogue has also been established through other means, such as e-mail exchanges, meetings and informal chats. During the forest management period, activities begin with lectures and training on low-impact management and the correct procedures. Then, every 20 or 30 days, meetings take place to reinforce safety procedures and discuss employees' doubts, requests and suggestions. Since 2022, these meetings have been documented in reports, which have been shared with the VVB.

At Manoa's office, communication with external stakeholders, such as schools and environmental institutions, is handled as follows: Manoa receives the institution's request for an environmental education, technical training or other action via email or telephone, assesses which requests will be met and then proceeds to carry out the activity. The criteria used to decide which request will be granted varies according to the priorities established by Manoa, activities with the potential to involve a large portion of the forestry sector, for example, are a priority. Activities that result in community benefits are also a priority (the proponents are working to better define Manoa's priority criteria). After the activity has been carried out, when Manoa receives thanks and/or feedback from the activity, the process is considered complete.

5. Analysis and forwarding of requests

The process of analyzing and dealing with requests received by each channel is shown in a flowchart in Figure 32. The relevance of each request is assessed according to the following criteria:

- a) According to the type of request, which can be a complaint, doubt, suggestion, compliment, etc.

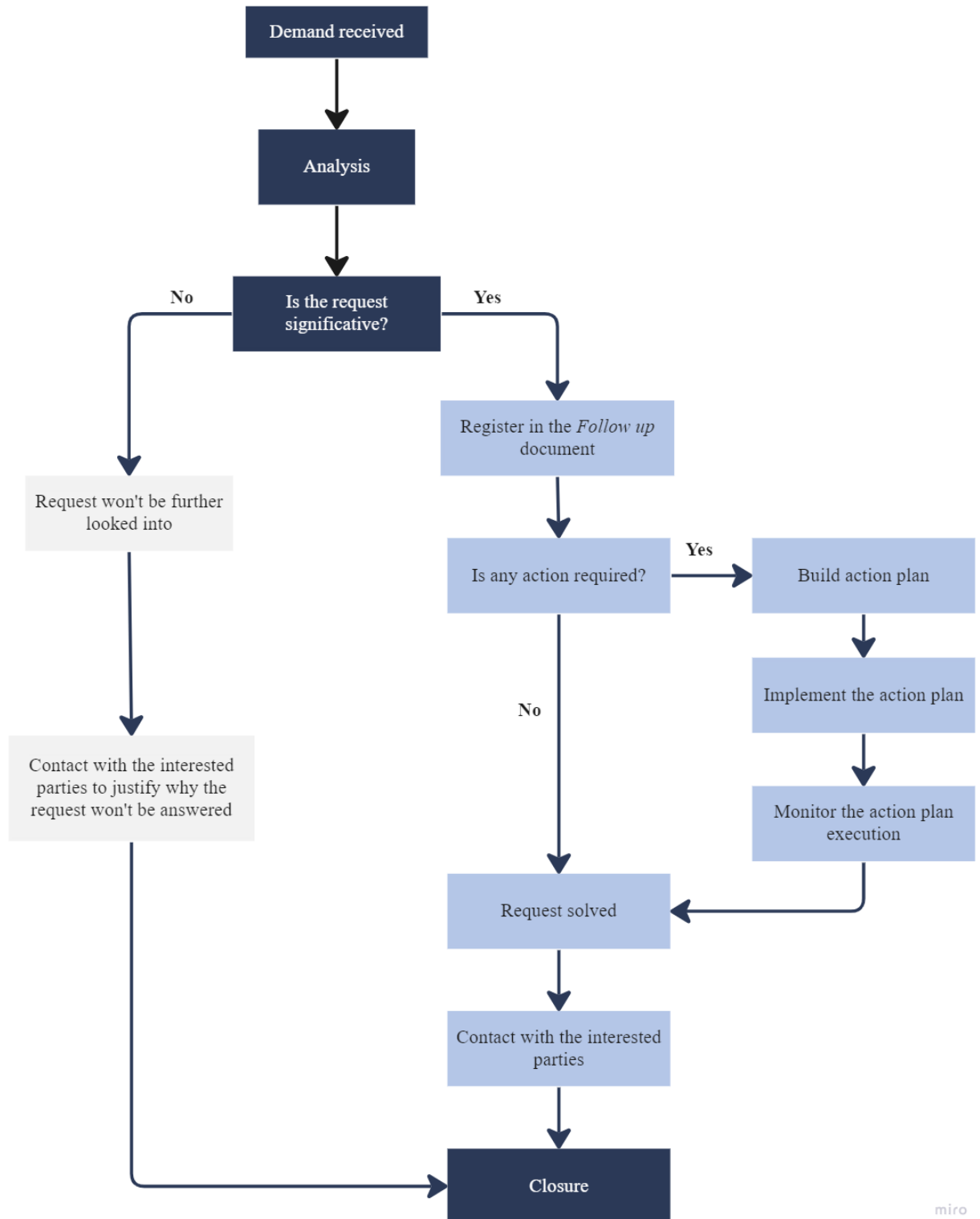
- b) Regardless of the type of request, those that (1) are related to the company's activities, (2) involve impacts caused by the company, (3) have the potential to cause an environmental, social or economic impact are considered significant.
- c) Donation-type requests that do not have the potential to bring a community return are automatically considered non-significant, as this type of activity is not part of the company's policy. Manoa prioritizes actions that have a positive and significant impact on as many people in the community as possible.

Manoa tries to respond to requests as quickly as possible and the way in which the result of the analysis of the request is reported to the interested parties varies according to the communication channel used and the characteristics of the interested party, for example, internal requests made by employees via the suggestion box can be answered via the notice board, email and/or WhatsApp. However, requests made by neighbors are usually answered in person. Responses to other requests will vary according to the most appropriate method (by email, telephone, in person, letter, etc.). Feedback to interested parties is always the responsibility of the Forest Manager and/or Forest Engineer

In addition, whenever a Manoa employee identifies an emergency situation (e.g. forest fire, actions that go against company policy) on the Manoa farm, regardless of the type of situation, the field coordinator must be informed immediately.

Manoa's Human Resources and Finance Manager are responsible for monitoring and negotiating with unions, the Ministry of Labor and other institutions regarding workers' rights/duties. Contact with environmental agencies, whether for interpellations, evaluations, requests for information or any other matter related to the environment, is carried out by the Forestry Department and the Forestry Engineer. Cases involving legal issues are referred to the company's legal department.

Claims related to land issues, with the potential for conciliation, are dealt with by the Forest Manager. Claims that need to be discussed in court are referred to the legal department. Requests or contacts involving the press are made by the Marketing department, which uses its own tools or the specialized work of a press agency.



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Figure 32 Flowchart of how each request received through the project's communication channels is handled