METHODOLOGY

CARBONFLOR PSA

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1 INTRODUCTION

This Methodology was developed by ECCON's technical team, with contributions from Reservas Votorantim, to quantify and value Environmental Services and allow the execution of Payment for Environmental Services projects, adapting national and international techniques that are suited to the reality of Brazilian conservationist landowners.

It is expected that the scientific work of development and improvement of this Methodology can be transferred to an independent and internationally recognized institution in the future, so that the innovation efforts of the development team can focus on other needs of the international community.

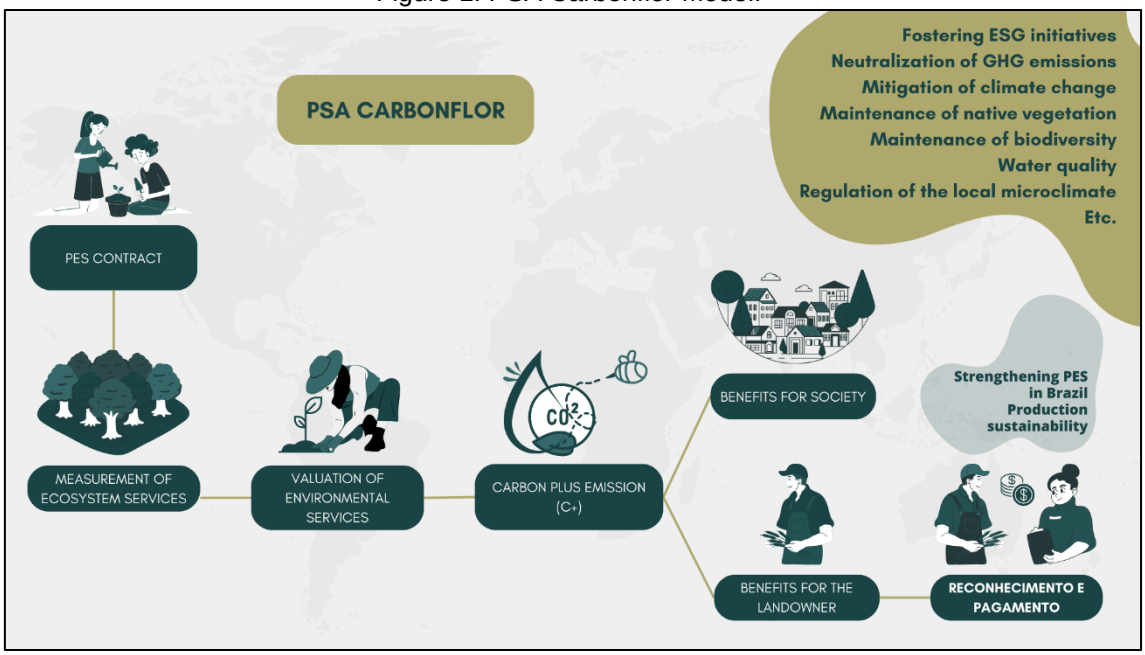
The intention behind the Methodology is to create mechanisms capable of measuring, reporting, and verifying the generation, maintenance and increase of Ecosystem Services (EcS) and Environmental Services (EnS) in each property, with the purpose of allowing them to negotiate titles or bonds related to Payment for Environmental Services.

The methodology creates the Carbon Plus (C+). It is an equivalent to the concept of carbon credit. It represents a title of right over an intangible and incorporeal asset that is tradable, representing the reduction or removal of one ton of carbon dioxide equivalent.

The Environmental Services (EnS) will be valued and converted into titles that (i) encourage the provision of environmental services, (ii) contribute to climate change mitigation, (iii) meet the demands for legal and methodological security required in international scientific and market environments, and (iv) promote social benefits.

The C+ titles can be traded in Brazil and internationally, meeting the demands of society and institutions worldwide, which will contribute to the growth of the current carbon markets.

Figure 1. PSA Carbonflor Model.



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2 PSA CARBONFLOR

PSA Carbonflor was born out of a need to measure and value conservation on private properties, understanding that conserved native vegetation in rural properties contributes to the maintenance of water cycles, helps in the fight against climate change, and contributes to the maintenance of biodiversity through habitat for fauna and flora, among other contributions.

In this context, it is essential to remember and differentiate two key concepts:

a) Ecosystem Services (EcS): services provided by nature, essential for the conservation of biodiversity, maintenance of ecosystems, and the well-being of human beings.
b) Environmental Services (EnS): individual or collective actions of people (e.g., rural landowners) that contribute to the maintenance or improvement of ecosystem services.

Given the urgency of combating climate change and the recognition that native vegetation provides EcS, while individual actions favor the maintenance of EnS, there is a need for a mechanism that promotes conservation on private lands.

PSA Carbonflor is, therefore, a Payment for Environmental Services (PES) program created by ECCON with a focus on valuing and paying EnS that maintain and expands EcS for a given region. The valuation is obtained with the use of metrics developed with a focus on the provision of EnS such as forest conservation, maintenance and improvement of water quality, maintenance of habitat for biodiversity (fauna and flora), maintenance of ecosystems and its carbon stocks, surveillance, and other services.

To quantify the provision of the presented EnS, measurement and verification methods of EcS will be used, which can be expressed through parameters called "Ecosystem Indicators", detailed throughout this methodology.

Thus, the maintenance of the EcS, the measurement of the Ecosystem Indicators and the payment for the EnS are sought as a financial incentive for the conservation of the environment and maintenance of the supplied EnS that contribute to climate stability. Once the EnS are recognized, valued, and validated, they can become transferable assets.

According to Article 3 of Federal Law No. 14,119/2021 (National Policy on Payment for Environmental Services), there are a series of payment modalities which are acceptable for environmental services. Such modalities are listed below:

> *I – direct, monetary or non-monetary, payment;*
> *II – provision of social improvements to rural and urban communities;*
> *III – compensation linked to a certificate of reduction of emissions due to deforestation and degradation;*
> *IV – green bonds;*
> *V – lending;*
> *VI – Environmental Reserve Quota (CRA), established by Law No. 12,651, of May 25, 2012.*

For the purposes of PES, this law defines (i) ecosystem services and (ii) environmental services in article 2:

> *"**II – Ecosystem services**: relevant benefits for society generated by ecosystems, in terms of maintenance, recovery or improvement of environmental conditions, in the following modalities:*
> *a) provision services: those that provide environmental goods or products used by humans for consumption or trading, such as water, food, wood, fibers and extracts, among others;*
> *b) support services: those that maintain the continuity of life on Earth, such as nutrient cycling, waste decomposition, production, maintenance or renewal of soil fertility, pollination, seed dispersal, population control of potential pests and potential vectors of human diseases, protection against ultraviolet solar radiation and maintenance of biodiversity and genetic heritage;*
> *c) regulation services: those that contribute to the maintenance of the stability of ecosystem processes, such as carbon sequestration, air purification, moderation of extreme weather events, maintenance of the hydrological cycle, minimization of floods and droughts and control of critical erosion and land slide processes;*
> *d) cultural services: those that constitute non-material benefits provided by ecosystems, through recreation, tourism, cultural identity, spiritual and aesthetic experiences and intellectual development, among others;*
> ***III - Environmental services**: individual or collective activities that favor the maintenance, recovery, or improvement of ecosystem services".*

3 DEFINITIONS

Adhesion: date on which the owner commits to conservation through a legal instrument and/or establishment of a letter of intent. The signing of a contract with a previously determined Valuation Period and adoption of the methodology will prove the conservation commitment that may have been assumed prior to the contract.

Area of Influence: region designated for the spatial analysis concerning the verification of Ecosystem Indicators and the comparison with the Project Area.

Carbon Plus (C+): intangible environmental title or asset from the provided EnS, representing the reduction of emission of one ton of CO_2 (carbon dioxide) equivalent (see item 5.6).

Ecosystem Indicator: is composed using information obtained through remote sensing, primary and /or secondary data, which are used by the methodological parameters that translate the EcS and EnS of a given area into quantitative data.

Ecosystem Services (EcS): relevant benefits for society generated by ecosystems, in terms of maintenance, recovery or improvement of environmental conditions, in the following modalities: a) *provision services*: those that provide environmental goods or products used by humans for consumption or trading, such as water, food, wood, fibers and extracts, among others; b) *support services*: those that maintain the continuity of life on Earth, such as nutrient cycling, waste decomposition, production, maintenance or renewal of soil fertility, pollination, seed dispersal, population control of potential pests and potential vectors of human diseases, protection against ultraviolet solar radiation and maintenance of biodiversity and genetic heritage; c) *regulation services*: those that contribute to the maintenance of the stability of ecosystem processes, such as carbon

sequestration, air purification, moderation of extreme weather events, maintenance of the hydrological cycle balance, minimization of floods and droughts and control of critical erosion and slope slide processes; d) cultural services: those that constitute non-material benefits provided by ecosystems, through recreation, tourism, cultural identity, spiritual and aesthetic experiences and intellectual development, among others.

Environmental Services (EnS): individual or collective activities that favor the maintenance, recovery, or improvement of ecosystem services.

GHG: greenhouse gases listed in Annex A of the Kyoto Protocol to the United Nations Framework Convention on Climate Change: (i) carbon dioxide (CO_2); (ii) methane (CH_4); (iii) nitrous oxide (N_2O); (iv) sulfur hexafluoride (SF_6); and (v) families of hydrofluorocarbon gases (HFCs) and perfluorocarbons (PFCs), whose emission reductions can be converted and generate C+ into tCO_2e.

GHG emissions: release of greenhouse gases and/or their precursors into the atmosphere.

Landowner: the person or entity who holds the rights of ownership or of land tenure over the property, under the terms of Brazilian law.

Local Community: group of people living in a certain geographical area inside or near the Project Area, presenting the same socioeconomic and cultural characteristics. Place where the inhabitants have familiarity with the Project Area region and can become stakeholders with interest in the Project Area and its neighborhood.

Marketable Carbon: amount corresponding to the carbon stock, in terms of tCO_2e, of a certain Project Area available for the final conversion into C+, after discounting the Risk of Loss and the Safety Reserve, when applicable.

Matrix of Ecosystem Indicators: coefficient, given as a percentage, that incorporates the weights and importance of the Ecosystem Indicators of a given Project Area, with the purpose of adding value to the Carbon stock indicator and enabling the issuance of C+ that considers all verified EcS.

Methodology: set of rules, processes and procedures developed by ECCON for the execution of projects under PSA Carbonflor. It is also rerefered to as the PSA Carbonflor Methodology.

Monitoring Agent: member of the local community or individual who performs the monitoring of the Ecosystem Indicators, the maintenance of the Environmental Services and the vegetation cover *on site,* to optimize the socio-environmental benefits of the project, empower the local community, promote environmental education and allow the scalability of the project.

Monitoring Report (MR): report that describes the process of monitoring the outcomes of the application of the methodology to attest that EnS are being maintained or improved. It can be done annually or at longer intervals, limited to five years.

Native Vegetation Area: area within the property with primary or secondary native vegetation, which is not fallow and has not suffered degradation for at least 10 years prior to the beginning of the Valuation Period.

Payer of Environmental Services (Acquirer of C+): Person or company that stimulates the conservation, maintenance and improvement of EnS through the

acquisition of C+ (see item 4.4), to offset GHG emissions and stimulate ESG initiatives, in addition to generating benefits for the EnS provider, while contributing to climate change mitigation.

Primary Data: raw data obtained directly *on site*, through instruments and direct observation.

Project Area: area of the property or group of properties included in the PSA Carbonflor where the Ecosystem Indicators will be measured. The unit providing EcS is the rural property, which may include one or more EcS.

Provider or Producer of Environmental Services: owner or landholder of area that provides EnS and can guarantee its provision during the Valuation Period.

PSA Carbonflor: payment for environmental services program developed by ECCON, with contributions from Reservas Votorantim, with valuation, constitution, and payment for EnS and constitution of Carbon Plus (C+) in properties with plots of preserved or conserved native area for remuneration of landowners providing EnS and meeting the demands of GHG emissions neutralization by society.

Reductions in GHG emissions: the result of activities that reduce GHG emissions by delaying or stopping the conversion of forest areas to other land uses, in which forest biomass would be lost. By way of example, GHG emissions are reduced when the conversion of a forest area to agricultural land use is avoided. Thus, biomass from forest land use (which has significantly higher carbon stock levels when compared to agricultural land use) is not lost, because of the environmental conservation service provided by PSA Carbonflor. That is, GHG reductions are the result of activities that ensure the maintenance of carbon stocks[1]. It is important to note that climate change already affects the dynamics of tropical forests in Brazil, putting at risk the biomass stock as well as the habitat for biodiversity and the climate cycle.

Report on Methodology Compliance (RMC): report that describes the adequacy of the project to the criteria for participation in the Methodology. The Report on Methodology Compliance is made to attest that the properties meet the demands of the Methodology.

Report on Methodology Compliance and Monitoring Report (RMCMR): It is the junction of the Report on Methodology Compliance and Monitoring Report that can be done in the first monitoring period, when the RMC presented with the first MR.

Risk of Loss: factors of threat and disruption to the maintenance of EcS and the provision of EnS.

Safety Reserve: portion of C+ that is segregated and is not sold, to serve as a guarantee, in case there is a measurable loss or decrease in EnS. The Safety Reserve varies with the duration of the project and the threat level to which the EnS are exposed (see item 5.5). The Safety Reserve will be released every 10 years during the project, as a fraction of the total reserve, if not used during that period project. It is a reserve against unforeseen events that may happen in the Project Area and that may compromise the continuity of EnS generation, such as deforestation, fires, invasions, withdrawal, among others.

[1] It is noted that, although GHG removals are not addressed in this Methodology, this is the mechanism by which carbon sequestration is considered in planting activities. In general, GHG reductions are related to maintaining the carbon stock of conserved forests, and GHG removals are related to carbon sequestration from reforestation plantations.

Secondary Data: data obtained indirectly through research, from accepted platforms (official or not) that are based on the analysis of Primary Data of a given region. Examples of secondary data: IBGE data, satellite images, land use and land cover data, etc.

Stock with Risk of Loss: the extent of areas that were affected by disturbances and lost native vegetation cover. It is then converted to carbon stock at risk of loss, in terms of tCO_2e. It must be calculated as indicated in item 5.4.1

Stored Carbon (post loss): amount corresponding to the carbon stock, in terms of tCO_2e, of a certain Project Area resulting from the discount of carbon stock regarding the areas that have been affected by the occurrence of Risk of Loss.

Stored Carbon: Ecosystem indicator determined by the Methodology to measure the EcS of carbon storage provided by the EnS of conservation of native vegetation. It is a carbon pool that has the potential to accumulate (or lose) carbon over time, which for the PSA Carbonflor program covers above-ground biomass, below-ground biomass, litter, and dead wood, as well as carbon stored in the soil. The amount of carbon retained within a pool is converted into tons of CO_2 equivalent.

Valuation Period: period between 30 and 100 years for EnS accounting and C+ commercialization. The valuation period begins with adhesion.

4 PSA CARBONFLOR PROGRAM GUIDELINES

PSA Carbonflor aims to create a systemic environment that meets (i) the remuneration needs of landowners providing EnS, which generate or increase EcS in their properties and (ii) the demand of society for the maintenance of climatic cycles, neutralization of GHG emissions, sustainable food production, maintenance of biodiversity, conservation of carbon stocks, among other benefits generated by EnS.

4.1 ECCON DATA

The ECCON Data platform, managed by ECCON, is used to provide transparency and enable the storage of information. It is a database of rural properties with natural vegetation and productive areas, which enable environmental business opportunities, in a scalable and replicable way.

The areas that adhere to PSA Carbonflor will be listed on ECCON Data and the data will be made available on the platform, including reports, metrics of the valued EnS, Ecosystem Indicators used in the analysis and availability of C+.

4.2 REGISTRATION OF PROJECT AREAS

The registration of areas must be made on the ECCON Data platform (item 4.1), which is free, online and involves procedures that aim to provide the safety of all parts. By using their login and password, the landowners access the user environment, where they enter personal data, information, photos of the property, and documents which are uploaded (such as: Property Registration, registration receipt of the Rural Environmental Registry, Rural Property Registration Certificate, plans, maps, polygons, etc.).

After all registration requirements are met, the property undergoes technical analysis that verifies compliance with prospecting criteria and suitability for environmental business.

This analysis allows the identification of criteria such as:

i. Geographic region and biome of interest;
ii. Extension;
iii. Overlap with protected areas, such as indigenous territories, quilombolas, protected areas, conservation units, among others;
iv. Permanent Preservation Areas (PPAs) and Legal Reserve (LR);
v. Non-protected areas suitable for the implementation of reforestation projects;
vi. Vegetation cover and deforestation history.

As to ensure a link with the user, new registrants digitally sign a term of service to that extent. After the verification filter, the areas considered fit are approved and published.

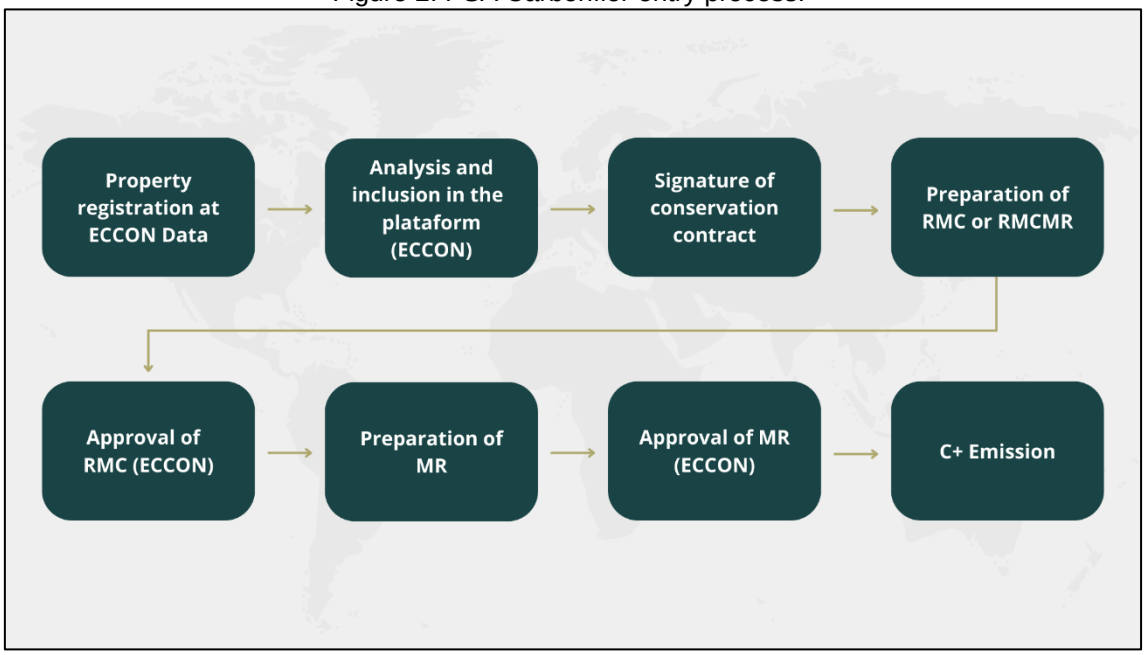
The following table describes the operations of the platform.

Table 1. Operations provided by ECCON Data.

Operation	Description
General document organization	The documents provided by the registered landowners are organized in a simple way so that all interested parties have easy access.
Cloud file storage	The platform has cloud data storage, a tool with large storage and organization capacity. In addition to consisting of a virtual environment more conducive to securing data independently, the risks of damage or loss of files and documents are significantly minimized.
Facilitated communication	Through a chat channel available in the platform's user environment, it is possible to ask questions about the registration process or about environmental operations, request documents, provide data, among other interactions.
Analysis of georeferenced information	The data of the areas submitted in the platform (in kmz, shp or dwg format), allow a complete evaluation of the land use, subsidizing the fulfillment of the eligibility criteria of rural owners.
Geoprocessing tools	Through geoprocessing tools, it is possible to verify the biome and the phytophysiognomy of the area. Furthermore, it is possible to visually evaluate the area and its overlap with potentially ineligible areas(embargoed areas, archaeological sites, conservation units, etc.). Georeferencing, combined with remote sensing analysis techniques, allows a complete evaluation promoted by the application of vector and raster data provided by competent official bodies. This method allows the verification of the selection criteria of rural owners in a geolocated way, enabling a more detailed validation process of a property.

Properties that wish to participate in PSA Carbonflor must submit their property for analysis on the platform. After its inclusion and signature of a contract consolidating participation in the Methodology, the Report on Methodology Compliance (RMC, item 7.1.2) must be prepared. With the approval of the report, the Monitoring Report is made (item 0) and subsequently the issuance of the C+ is requested.

Figure 2. PSA Carbonflor entry process.



4.3 LANDOWNERS AS PROVIDERS OF ENVIRONMENTAL SERVICES

The owners of the properties included in the PSA Carbonflor are suppliers of EnS to society and will be the holders of the C+ in their properties. Their duties are:

i. Ensure the continuity of the provision of EnS, which will be remunerated through the issuance of C+;
ii. Register in ECCON Data and provide data such as: name of the property, total extent of the area, extent of the area available for PSA, location, photos and documents of the property, data on invasions, existence of protected areas etc.
iii. Ensure and assume contractual responsibility that the property does not participate in any other PES program, thus avoiding the risk of double counting. In the specific case of water-related PES, it is important for the owner to indicate such participation at the time of submission of the property to ECCON Data. If the water PSA does not use carbon stock to generate credits, the participation in both PSA Carbonflor and the water-related PES is possible;
iv. Provide the necessary documentation to comply with the Methodology (see item 5.10.2.2);
v. Meet monitoring deadlines and ensure the veracity of the information reported.

4.4 ENVIRONMENTAL SERVICE PAYERS

The Payers of Environmental Services, or Acquirers of C+, exercise the role of remuneration of the landowners, acting, therefore, as payers for the EnS provided. The EnS payer will acquire C+, which will be their contribution to the services provided in the process of climate change mitigation.

Through such acquisition, in addition to contributing to the construction of a low-carbon economy, the acquirers will strengthen actions that benefit Brazilian biomes and conservationist rural producers. It is worth mentioning the added value of C+, as they contribute to social development by inserting rural owners in the carbon market and in

the market of payment for environmental services, valuing the practice of conservation of national biomes and ecosystems. Thus, by purchasing C+, acquirers will support the fulfillment of the UN 2030 Sustainable Development Goals.

The PSA Carbonflor methodology is aligned with the National Policy on Payment for Environmental Services, Law No. 14,119/2021, adapted to the Brazilian context, but also considering the international context. It is also a mechanism for implementing article 41 of the Forest Code, Law No. 12,651/2012. In this sense, the Methodology creates rules focused on the Brazilian context, facilitating the existence of projects in Brazilian properties and biomes, without eliminating the possibility of meeting international demands.

When purchasing C+, acquirers will have:

- Autonomy to view the volume of C+ and the areas to which they are linked;
- Transparency of information about the C+ and Project Areas;
- Traceability of the provided EnS, as well as the methodology and metrics used, based on the Ecosystem Indicators;
- Quality assurance of EnS;
- Innovation within the carbon market, considering the pioneer effort in developing a methodology which values EcS and constitution of C+, considering the Brazilian context, its social issues, and its biodiversity.

Corporate buyers will not be eligible if they are: (a) involved in acts of non-compliance with Law No. 12,846/2013 ("Brazilian Anti-Corruption Law"); (b) in the Register of Employers who have subjected workers to slave-like conditions ('Dirty List' of Slave Labor) of the Ministry of Labor and Social Security; (c) recognized for practices of non-compliance with environmental legislation and (d) companies with reputational characteristics that may impair the perception of the quality of C+.

4.5 CONTRACTUAL INSTRUMENTS

The legal relationships in PSA Carbonflor occur between ECCON, the landowners, and the acquirers of C+, being formalized in specific contracts.

Table 2. Contractual relations.

Instrument	Letter of intent	Adhesion Contract[2]	Purchase and Sale Constract[3]
Party	Landowner	ECCON and Landowner	ECCON and C+ Acquirer
Content	Letter of intent or documents proving the intent to conserve. It can be a letter from the owner describing his intention of conservation and	(i) qualification of the parties; (ii) implementation steps; (iii) Methodology; (iv) remuneration; (v) obligations; (vi) declarations and warranties; (vii) hypotheses of default;	(i) qualification of the parties, (ii) specification of the quantity of C+ to be acquired; (iiv) remuneration, price, and form of payment; (iv) obligations; (v) hypotheses of default; (vi) term of validity; (vii)

[2] It is noteworthy that, depending on the conditions agreed between ECCON and the owner, the model of the Adhesion Agreement may be replaced by a Service Agreement.
[3] In relation to the Purchase and Sale Agreement, it may be made between Landowner and Acquirer, with the consent of ECCON.

Instrument	Letter of intent	Adhesion Contract[2]	Purchase and Sale Constract[3]
	documents proving such acts.	(viii) term and hypotheses of renewal; (ix) responsibilities; (x) general provisions; (xi) specifications of the terms used; (xi) data and documents regarding the Project Area.	warranties and general provisions.

It is noteworthy that the Letter of Intent can be presented (i) as an official document of commitment to government agencies or other official institutions and (ii) as the letter of intent signed at the time of publication of the property on the ECCON Data platform.

4.6 CARBON MARKET AND PSA CARBONFLOR

The carbon market consists of transactions of GHG Emission Reductions or carbon sequestration generated by a given project for the offsetting of Emissions by other economic activities. It originated from the Kyoto Protocol in 1997, which allowed organizations located in Developing Countries to generate Emission Reductions that could be acquired by organizations committed to reducing their Emissions in Developed Countries with targets set by the Protocol. Over time, other regulated regional and national markets emerged.

In parallel, we have seen the formation of a voluntary market for carbon credits, which has grown significantly in Brazil and worldwide, as it is a flexible mechanism applicable to projects that seek to contribute to the reduction of deforestation, its consequent emissions, while contributing to the maintenance and increase of forested areas, allowing both domestic and international, voluntary, transactions.

The voluntary market is related to issues of corporate, social, and environmental responsibility (ESG - *Environmental, Social and Governance*). Organizations aim to acquire carbon credits to offset their emissions, not necessarily for the purpose of complying with legal obligations or international protocols.

It is an interesting system for the presentation of the organization to the market as an agent aware of its necessary contribution to the transition to a low-carbon economy. It is noted that organizations have also been investing in various environmental projects to contribute to Emission Reductions, without, however, using these Reductions to offset the Emissions generated by their activities. The rise of the ESG concept has further fostered the potential of the voluntary carbon market.

Pressure for companies to be environmentally responsible is growing from their shareholders, who give preference to investing in and buying products from companies that are aligned with ESG practices. Transparency and disclosure of information relating to environmental, social and governance practices are also often required by law. In Brazil, although there are legislative gaps on the subject, it is observed that, increasingly, companies are being called upon to publish information regarding ESG practices.

Regarding environmental factors, the climate agenda is in the spotlight globally, so reducing the carbon footprint has been one of the main practices adopted by large companies in the context of their ESG activities.

Within the scope of the voluntary market, projects are developed according to identified opportunities for reducing or sequestering emissions, and the methodology is usually certified and validated by a third party. At the end of each project monitoring cycle, carbon credits are issued, which can be traded. To ensure the quality of the projects and credits generated, it is necessary to adopt mechanisms and protocols that ensure the proper measurement, quality, and integrity of the generated carbon credits. Along the same lines, we seek to achieve such results with this methodology.

The theme of carbon market and PES is inserted in the agenda of sustainable finance. As mentioned above, in Brazil, one of the main laws that regulates and encourages the conservation of ecosystems and native vegetation is Federal Law 14.119/2021, which establishes the Policy on Payment for Environmental Services, in addition to Art. 41 of Federal Law 12.651/2012[4]. However, there are other initiatives that aim to remunerate Environmental Service providers in Brazil, such as “CPR Verde”, provided for in Federal Decree No. 10,828/2021. This title allows the rural producer and other agents that work in the agricultural supply chains to raise funds that will be redirected to the financing of the conservation of native forests and their biomes.

The carbon market puts Brazil, including people and companies that adhere to it, in a very competitive position, because it has extensive forest and agricultural areas whose protection, conservation or enrichment can be the object of carbon projects, for the EcS provided.

In addition to the high potential for EcS generation, projects developed in the conservation and EnS provision sector can generate several socio-environmental co-benefits, such as the reduction of erosion, the maintenance of local biodiversity, the improvement of water quality and availability, the maintenance of forest Ecosystem Services, positive effects on human health related to the reduction of deforestation and fires, among others.

Thus, to foster the potential of economic development, social equity and ecological balance, PSA Carbonflor allows that rural landowners participate in the carbon market, strengthening the view that conservation is an environmental business in Brazil. The C+ generated in the PSA Carbonflor, under the terms of the Methodology, will have pricing based on the measurement of the EcS generated for human well-being. There is also a social component (co-benefits) in the valuation of the payment, complying with the Sustainable Development Goals.

The high costs of international certification processes, coupled with challenges related to Brazilian legislation and biomes, prevent many landowners who conserve their lands from participating in this market. In this sense, PSA Carbonflor is adapted to the national reality, showing the value of the national biomes, recognition of landowners who conserve their lands, the generation of high-quality carbon credits, encompassing the EnS and EcS.

5 DEVELOPMENT OF THE METHODOLOGY

The subsequent items present the necessary information for understanding and for the construction of the reports related to this Methodology.

[4] Law for the protection of Native Vegetation.

5.1 ECOSYSTEM SERVICES (ECS)

The PSA Carbonflor Methodology is guided by (i) measurement of EcS generated in each Project Area and (ii) valuation of the EnS provided by the maintainer of such EcS, the Provider or Producer of Environmental Services.

5.1.1 CLASSIFICATION OF ECS

This methodology considers the various systems of EcS classification that the bibliography offers. Below are the characteristics of the three publications that were considered in the development of PSA Carbonflor.

i. MEA – Millennium Ecosystem Assessment.[5]
ii. TEEB – The Economics of Ecosystems & Biodiversity.[6]
iii. CICES - Common International Classification of Ecosystem Services.[7]

According to Costanza et al. 2017[8], " *The MEA, launched in 2001, was a predominantly ecological project under the United Nations Environmental Programme (UNEP) umbrella. After that, The Economics of Ecosystems and Biodiversity project (TEEB), initiated by Germany and the European Commission and later adopted by UNEP, added more of the economic aspects of ecosystem services. The Common International Classification of Ecosystem Services (CICES) was developed to provide a hierarchically consistent and science-based classification to be used for natural capital accounting purposes.* "

In addition, the Methodology is guided by the determinations of the Brazilian legislation on PES, Law No. 14,119/2021, which defines provision, support, regulation and cultural services.

Table 3 below is a brief comparison between the concepts of these four EcS sources.

[5] Available at: https://www.millenniumassessment.org/en/index.html
[6] Available at: https://teebweb.org/
[7] Available at: https://cices.eu/
[8] COSTANZA, Robert; GROOT, Rudolf of; BRAAT, Leon; KUBISZEWSKI, Ida; FIORAMONTI, Lorenzo; SUTTON, Paul; FARBER, Steve; GRASSO, Monica. Twenty years of ecosystem services: how far have we come and how far do we still need to go? **Ecosystem Services**, [S.L.], v. 28, p. 1-16, dec. 2017. Elsevier BV. https://doi.org/10.1016/j.ecoser.2017.09.008

Table 3. EcS ratings for PSA Carbonflor and its concepts.

Class	MEA (2005)	TEEB (2012)	CICES (2018)	PES Law
Regulation	Regulation of ecosystem processes.	Services that ecosystems provide when they act as regulators.	All the means by which living organisms can mediate or moderate the environment.	Those that contribute to the maintenance of the stability of ecosystem processes, such as carbon sequestration, air purification, moderation of extreme weather events, maintenance of the balance of the hydrological cycle, minimization of floods and droughts and control of critical erosion and slope slide processes;
Support	Services necessary for the production of all other types of ecosystem services.	Services that underpin most of the other services	Unrecognized.	Those that maintain the longevity of life on Earth, such as nutrient cycling, waste decomposition, production, maintenance or renewal of soil fertility, pollination, seed dispersal, control of populations of potential pests and potential vectors of human diseases, protection against ultraviolet solar radiation, and maintenance of biodiversity and genetic heritage
Provision	Products obtained from ecosystems.	They are the services of material or energy results from ecosystems.	Nutritional materials or not, and energetic materials of living systems, as well as abiotic materials and information.	Those that provide environmental goods or products used by humans for consumption or trading, such as water, food, wood, fibers and extracts, among others.
Cultural	Immaterial benefits.	The immaterial benefits obtained from contact with ecosystems.	All the immaterial and generally non-rival and non-consumable goods of ecosystems (biotic and abiotic) that affect the physical and mental states of people.	Those that constitute non-material benefits provided by ecosystems, through recreation, tourism, cultural identity, spiritual and aesthetic experiences, and intellectual development, among others

5.1.2 ECS – PSA CARBONFLOR

The Methodology directs the project proponent to discuss the classifications (see item 5.1.1) that they consider applying in the development of the PES project, as well as clearly pointing out which of the EcS encompassed by these classifications will be considered by the proponent to demonstrate the conservationist effort in the generation of EnS, which, among other things, promotes the conservation of the forest carbon stock.

As the Methodology considers the use of multiple classifications, the proponent must summarize the selected EcS for the development of the project. EcS shall be presented in table format.

Annex I. presents an example of a table relating to the EcS.

5.2 ECOSYSTEM INDICATORS AND ECS

The Ecosystem Indicator will be the factor used by this Methodology to characterize and attribute value to the EcS generated in the Project Area.

The next items will describe the following: the method of characterization of the vegetation fragments to be considered in the measurement, the Ecosystem Indicators to be used to characterize the Project Area and the method of valuation of the EcS from the calculated indicators.

If it is not possible to fill in any of the required and established Ecosystem Indicators, a justification is needed. It is also important to note that the list of EcS and indicators will evolve with the methodology, which will have periodic reviews.

It is noteworthy that the development of the PES project must necessarily consider at least five Ecosystem Indicators listed here, four of which are mandatory, and at least one can be freely chosen (except where indicated in the Methodology). The Ecosystem Indicators are detailed in the Table below.

Table 4. Ecosystem Indicators.

Theme	Ecosystem Indicator	Sub-item	Is it mandatory?
Carbon	Stored Carbon	N.A.	Yes, mandatory
Fragmentation of ecosystems	Land Use and Land Cover	Native vegetation cover	One of the sub-items is mandatory
		Native vegetation cover beyond the Legal Requirement	
	Connectivity	N.A.	Optional
	Proportionality	N.A.	Optional
Water Resources	Surface Water Quality	N.A.	Optional
	PPA[9] Conservation	N.A.	Yes, mandatory
	Density of Water Springs	N.A.	Optional
Biodiversity	Biodiversity (fauna e flora)	N.A.	Mandatory

[9] PPA refers to Permanent Protection Areas, such as riparian vegetation around lakes and waterstrems. It is defined in Law 12,651/2012.

It is noteworthy that in the production of the RMC (see item 7.1.2), the Ecosystem Indicators selected by the proponent should be presented and justified. Present in table format.

5.2.1 STORED CARBON (MANDATORY)

In areas with conserved native vegetation, the carbon stock is one of the most representative EcS when it comes to avoiding GHG emissions from land use change. In addition, climate change already underway on the planet has a negative impact on carbon stocks, decreasing their resilience, requiring additional efforts in the EnS for the perpetuation of EcS.

Therefore, Stored Carbon will be considered in this Methodology. To obtain the Stored Carbon indicator, the following steps must be followed:

i. Relate the Stored Carbon indicator to the corresponding EcS selected in the item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator;
ii. The area of analysis of the indicator will be the Project Area's Area of Native Vegetation, excluding areas of consolidated use, see item 5.10;
iii. Select carbon pools, see item 5.2.1.1;
iv. Calculate the carbon stock estimate for each carbon pool selected for the Area of Native Vegetation, see item of 5.2.1.2;
v. Get the average carbon stock for the Project Area, see item 5.2.1.3;
vi. Consider the item 5.4 Risk of Loss for the final valuation of the indicator.

5.2.1.1 CARBON POOLS

For the calculation of Stored Carbon, it is necessary to select the carbon pools to be considered in the accounting of carbon stock associated with this indicator. This Methodology considers above and below-ground biomass carbon stocks mandatory for the estimates of average carbon stock in the eligible properties. The other pools are optional, but once presented in the RMC or RMCAR, they cannot be excluded in the subsequent MR.

Present the selection in table form, as shown below, indicating which are the selected pools and justifying the choice of each one considering the specificities of the project.

Table 5. Considered carbon pools.

Carbon pool	Included/Excluded	Justification
Above-ground biomass	Mandatory	Pool with high carbon content accumulated in the aerial part of the vegetation, mainly in the forest biomes.
Below-ground biomass	Mandatory	In some ecosystems, such as the Cerrado biome, the carbon concentrated in the underground portion has a greater accumulation of biomass, being important its consideration.

Carbon pool	Included/Excluded	Justification
Litter	Optional, when requested and/or when acceptable secondary data is available.	Enter justification for the inclusion of the pool.
Dead wood	Included, when requested and/or when acceptable secondary data is available.	Enter justification for the inclusion of the pool.
Soil	Included, when requested and/or when acceptable secondary data is available.	Enter justification for the inclusion of the pool.

5.2.1.2 CARBON STOCK ESTIMATES

The carbon stock in the Project Areas for all carbon pools shall be calculated as the sum of the pools considered (Equation 1), according to the analysis presented in the following items.

Equation 1. Carbon Stock Estimate

$$C_{total} = C_{tree,t} + C_{DW,t} + C_{LI,t} + C_{SOC,t}$$

Where:

Table 6. Parameters of the Carbon Stock Estimate equation.

C_{total}	=	Total stock of carbon dioxide equivalent in the pools considered in the Project Area, in year *t;* tCO_2e
$C_{tree,t}$	=	Carbon stock in tree biomass in the Project Area in year *t*; tCO_2e
$C_{DW,t}$	=	Carbon stock in dead wood biomass in the Project Area, in year *t*; tCO_2e
$C_{LI,t}$	=	Carbon stock in litter biomass in the Project Area, in year *t*; tCO_2e
$C_{SOC,t}$	=	Soil organic carbon stock in the Project Area, in year *t*; tCO_2e

It should be noted that:

- Only the reservoirs selected by the proponent enter the calculation of total carbon stock.

5.2.1.2.1 BIOMASS DATA COLLECTION

To estimate the carbon stock for the selected pools, access to data from the following sources is considered:

Table 7. Guidance for biomass data collection.

Biomass Data Collection	
Primary Data Collection	Forest inventory and/or combined with remote sensing;
Secondary Data Collection	i. Existing data applicable to the local situation (data available in the literature, referring to scientific studies and peer reviewed papers);

	ii. National data (e.g., from the national forest inventory or the national greenhouse gas (GHG) inventory);[10] iii. Data from neighboring countries with similar conditions; iv. Global application data.

Any method used to collect biomass data must be properly justified.

5.2.1.2.2 CARBON STOCK ESTIMATE – TREE BIOMASS (B_{TREE})

Tree biomass is an important component in the total biomass stock of much of the natural vegetation in Brazil, so it is necessary that the best data collection practices are applied to correctly estimate the carbon stored by vegetation type.

To choose the estimation method, the use of well-known and reliable data is requested, followed by the correct estimation methodology for each data source. The following are instructions for each type of analysis.

It is recommended that the proponent technically evaluates the conditions of the vegetation that characterizes the Project Area to verify the use of plot sampling (forest inventory), whose application is considered preferential in the areas of the PSA Carbonflor. However, the use of secondary data from reliable and validated sources is recommended when the application of sample plots becomes a limiting factor for the realization of the project and when the status of the vegetation indicates a high degree of conservation verified through satellite imagery or on-site visit.

The proponent who chooses to use forest inventory may not change the data source at subsequent monitoring periods (RMC, MR and RMCAR), thus inventory data collection will be required. The proponent who uses information from secondary sources can decide to use primary data at any time, and from then on, cannot go back to using secondary data.

5.2.1.2.2.1 FOREST INVENTORY

According to this method, the carbon stock in the trees is estimated based on measurements of sample plots or census (when all the trees in the population are measured). Sample plots should be installed in one or more strata (e.g., vegetation types). Regarding the sampling design, consider:

Table 8. Sampling design parameters.

Sampling Process		Sampling method
Single occasion	• Random sampling • Systematic sampling • Mixed sampling	• Fixed area • Variable area
Multiple occasions	• Independent sampling • Full repeat sampling • Double sampling • Partial repeat sampling	

[10] Brazil. Ministry of Science, Technology and Innovations. Secretariat of Research and Scientific Training. Fourth National Communication of Brazil to the United Nations Framework Convention on Climate Change / Secretariat for Research and Scientific Training. -- Brasilia: Ministry of Science, Technology and Innovations, 2021.620 p. ISBN: 978-65-87432-18-2.

Clearly present the sampling system and the measured variables, providing the relevant references and equations used when defining the sampling design, as well as the rationale of the calculation to define the sample sufficiency.

Area stratification is recommended whenever there is spatial variability in carbon stock, conditioned by environmental factors (e.g., soil, altitude, and phytophysiognomy/vegetation type). At each monitoring event the proponent can add or remove strata if justifications are provided.

The following steps should be observed for the estimation of the carbon stock in tree biomass when applying forest inventory:

Step 1. Determine the dimensions (diameter and height, for example) of the trees within each plot, considering all individuals with diameter at breast height (DBH) ≥ 5 cm.

Step 2. Select or develop an appropriate and validated allometric equation for each phytophysiognomy/vegetation type or for each species or family identified in the inventory. Any selected equation can only be used if applicability has been demonstrated and validated according to the guidelines:

i. The equation is used in the national forest inventory, or in the national GHG inventory;
ii. The equation has been used in the country's forestry sector for ten years or more;
iii. The equation was derived from a data set of at least 30 sampled trees, and the coefficient of determination value (R^2) obtained was not less than 0.85.

Step 3. Determine the value of the plot's above and below-ground biomass (i.e., tree biomass per hectare) as follows (all time-dependent variables refer to the measurement time):

Equation 2. Equation of the Sample Plots method.

$$b_{p,i} = \frac{B_{tree,p,i}}{Area_{plot}} \quad (1)$$

$$B_{tree,p,i} = \sum_{j} \left(B_{tree,j,p,i}\right) \quad (2)$$

$$B_{tree,j,p,i} = \sum_{l} \left(B_{tree,j,p,i,l}\right) * (1 + Rj) \quad (3)$$

Where:

Table 9. Parameters of the Sample Plots method equation.

$b_{p,i}$	=	Above- and below-ground tree biomass per hectare in sample plot p of stratum i; t. ha^{-1}
$B_{tree,p,i}$	=	Above- and below-ground tree biomass in sample plot p of stratum i; t
$Area_{plot}$	=	Sample plot size in stratum i; ha

$B_{tree,j,p,i}$	=	Above- and below-ground tree biomass of the species group and/or phytophysiognomy j in the sampling plot p of stratum i; t.
$B_{tree,j,p,i,l}$	=	Biomass of tree l of the species group or phytophysiognomy j in the sample plot p of stratum i; t.
Rj	=	Root-shoot ratio for trees; t. ha^{-1} . $Rj = e^{\frac{(-1,085+0,9256*lnB_{tree,j,p,i,l})}{B_{tree,j,p,i,l}}}$

Step 4. Determine the average carbon stock in trees within the biomass estimation strata of trees:

Equation 3. Carbon stock in trees.

$$C_{tree} = \frac{44}{12} * CF * A * \sum_{i=1}^{m} w_i * \frac{b_{p,i}}{n_i} \quad (4)$$

Where:

Table 10. Parameters for the Carbon stock in trees equation.

C_{tree}	=	Stock of carbon dioxide equivalent in trees in the strata; t CO_2e
CF	=	Carbon fraction of tree biomass; tC. A default value of 0.47 will be used.
A	=	Area of stratum i; ha
w_i	=	Weight of stratum i in relation to the total area of estimated tree biomass (w_i = Area of the stratum/Project area); dimensionless.
$b_{p,i}$	=	Above- and below-ground tree biomass per hectare in sample plot p of stratum i; t. ha^{-1}
n_i	=	Number of sample plots in stratum i.
$44/12$	=	Molecular weight ratio of CO_2 to carbon, tCO_{2e} t C^{-1}

5.2.1.2.2.2 ESTIMATION WITH SECONDARY DATA

The biomass stock will be estimated by means of secondary data when the conditions for not carrying out a forest inventory are met. Only data from reliable sources and with free access, or made available by the proponent, may be used.

To calculate the carbon stock in tree biomass, steps 3 and 4 described above must be followed and the exemplified equations are valid. When the values of the different compartments are available by the chosen database, it is not necessary to use ratios between the pools and the tree biomass, however, when the other pools are not contemplated by the secondary database, these should be calculated according to the items 5.2.1.2.3, 5.2.1.2.4 and 5.2.1.2.5 below. In the event of change at any steps of the calculations, the change must be presented and justified.

5.2.1.2.2.3 ESTIMATION BY MODELING TREE GROWTH AND STAND DEVELOPMENT

This method is applicable for estimating the projection of carbon stock in tree biomass in areas in medium to advanced successional stage. According to this method, existing data can be used in combination with tree growth models to predict tree growth and the development of stands (natural or planted) over time. Stand parameters such as number of stems per hectare or basal area per hectare, diametric class structure, and species composition at different points in time are projected from presumed good forestry and forest management practices (e.g., planting density, survival rate, thinning and pruning operations and respective calendar).

Tree growth (e.g., diameter or height increment) can be projected by considering tree growth data from past experiences (e.g., age diameter curves, yield tables, yield curves), while considering site-relevant factors (e.g., soil, terrain, slope, aspect, precipitation) and standing parameters.

The estimated projection of carbon stored in tree biomass is not subject to uncertainty control, although project proponents should use the best available data and models that apply to the project site and tree species.

5.2.1.2.3 CARBON STOCK ESTIMATE – LITTER ($C_{LI,t}$)

The carbon pool stored in litter can only be considered when the biomass remains *on site* and is not removed from the project boundaries by any type of anthropogenic activity.

Conservatively, for all strata the carbon stock in litter is estimated as:

Equation 4. Carbon Stock in Litter.

$$C_{LI,t} = DF_{Li} * C_{tree,t}$$

Where:

Table 11. Parameters for Carbon Stock in Litter equation.

$C_{LI,t}$	=	Carbon stock in litter biomass in the Project Area, in year t; t CO_2e
DF_{Li}	=	Conservative factor that expresses the carbon stock in litter as 1% of the carbon stored in the biomass of the trees [11]; percent
$C_{tree,t}$	=	Carbon stock in the biomass of base trees within the Project Area in year t; t CO_2e

A different value for the default factor DF_{Li} can be applied as long as it is justifiable and presented in a transparent and verifiable manner.

[11] A/R Methodological tool. **Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.** Version 03.1. UNFCCC. See: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v3.1.pdf

5.2.1.2.4 CARBON STOCK ESTIMATE – DEAD WOOD ($C_{DW,t}$)

The pool of carbon stored in dead wood can only be considered when the biomass remains *on site* and is not removed from the project boundaries by any type of anthropogenic activity.

Conservatively, for all strata the carbon stock in dead wood is estimated as:

Equation 5. Carbon stock in dead wood.

$$C_{DW,t} = DF_{DW} * C_{tree,t}$$

Where:

Table 12. Parameters for carbon stock in wood equation.

$C_{DW,t}$	=	Carbon stock in dead wood biomass in the Project Area, in year t; t CO_2e
DF_{DW}	=	Conservative factor that expresses the carbon stock in dead wood as 1% of the carbon stored in the biomass of trees[12]; percent
$C_{tree,t}$	=	Carbon stock in the biomass of trees in the Project Area in year t; t CO_2e

A different value for the default factor DF_{DW} can be applied if it is justifiable and presented in a transparent and verifiable manner.

5.2.1.2.5 CARBON STOCK ESTIMATE – SOIL ORGANIC CARBON ($C_{SOC,t}$)

The soil organic carbon (SOC) stock is estimated conservatively by applying the standard value of average soil carbon (ΔSOC) under primary vegetation for each of the soil-vegetation associations described in the Table 15.[13]

Table 13 and Table 14 below should be consulted to identify the vegetation and soil categories to obtain the soil-vegetation association and the respective carbon stocks.

Provide evidence and justifications for choosing the soil and vegetation categories that condition the standard SOC value adopted.

[12] A/R Methodological tool. **Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.** Version 03.1. UNFCCC. See: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v3.1.pdf .

[13] Brasil. Ministério da Ciência, Tecnologia e Inovações. Secretaria de Pesquisa e Formação Científica. Quarta Comunicação Nacional do Brasil à Convenção Quadro das Nações Unidas sobre Mudança do Clima / Secretaria de Pesquisa e Formação Científica. -- Brasília: Ministério da Ciência, Tecnologia e Inovações, 2021.620 p. ISBN: 978-65-87432-18-2.

Table 13. Categories of aggregate vegetation classes in the national territory, adapted from Brazil, 2021[14].

Vegetation Categories	
V1	Floresta Amazônica Aberta [Open Amazon Rainforest]
V2	Floresta Amazônica Densa [Dense Amazon Rainforest]
V3	Floresta Atlântica [Atlantic Forest]
V4	Floresta Estacional Decidual [Seasonal Deciduous Forest]
V5	Floresta Estacional Semidecidual [Semideciduous Seasonal Forest]
V6	Floresta Ombrófila Mista [Mixed Ombrophilous Forest]
V7	Savana Sul [South Savanna]
V8	Savana Amazônica [Amazon Savanna]
V9	Cerrado
V10	Estepe Sul [South Steppe]
V11	Caatinga
V12	Pantanal
V13	Refúgios Ecológicos de Montanhas e Terras Altas [Ecological Refuges of Mountains and Highlands]
V14	Áreas de Formação Pioneira [Pioneering Formation Areas]
V15	Áreas Arenosas e Vegetação Lenhosa Oligotrófica de Áreas Pantanosas [Sandy Areas and Oligotrophic Woody Vegetation of Marshy Areas]

Table 14. Categories of aggregate soil classes in the national territory, adapted from Brazil, 2021[15].

Soil categories	
S1	Solos com argila de atividade alta [Soils with high activity clay]
S2	Latossolos com argila de atividade baixa [Latosols with low-activity clay]
S3	Não Latossolos com argila de atividade baixa [Non-Latosols with low-activity clay]
S4	Solos arenosos [Sandy soils]
S5	Solos hidromórficos [Hydromorphic soils]
S6	Outros Solos [Other Soils]

The carbon stock values presented in Table 15. Carbon stock in soils by soil-vegetation association correspond to the median values presented by Brazil, 2021[16].

[14] Brasil. Ministério da Ciência, Tecnologia e Inovações. Secretaria de Pesquisa e Formação Científica. Quarta Comunicação Nacional do Brasil à Convenção Quadro das Nações Unidas sobre Mudança do Clima / Secretaria de Pesquisa e Formação Científica. -- Brasília: Ministério da Ciência, Tecnologia e Inovações, 2021.620 p. ISBN: 978-65-87432-18-2.

[15] Brasil. Ministério da Ciência, Tecnologia e Inovações. Secretaria de Pesquisa e Formação Científica. Quarta Comunicação Nacional do Brasil à Convenção Quadro das Nações Unidas sobre Mudança do Clima / Secretaria de Pesquisa e Formação Científica. -- Brasília: Ministério da Ciência, Tecnologia e Inovações, 2021.620 p. ISBN: 978-65-87432-18-2.

[16] Brasil. Ministério da Ciência, Tecnologia e Inovações. Secretaria de Pesquisa e Formação Científica. Quarta Comunicação Nacional do Brasil à Convenção Quadro das Nações Unidas sobre Mudança do Clima / Secretaria de Pesquisa e Formação Científica. -- Brasília: Ministério da Ciência, Tecnologia e Inovações, 2021.620 p. ISBN: 978-65-87432-18-2.

Table 15. Carbon stock in soils by soil-vegetation association.

Vegetation Categories	Soil categories					
	S1	S2	S3	S4	S5	S6
	ΔSOC tC/ha					
V1	50.9	47.5	48.9	41.1	43.6	78.7
V2	32.2	51.9	46.9	50.6	52.7	48.1
V3	58.3	52.3	42.9	63.3	35.8	417.8
V4	46.7	30.8	40.0	25.9	32.7	31.8
V5	40.9	44.3	37.4	27.0	53.6	31.6
V6	98.8	102.5	56.8	0.0	85.4	0.0
V7	64.2	90.9	51.6	0.0	74.2	32.8
V8	48.0	19.8	38.1	43.7	34.6	29.0
V9	24.4	43.1	36	19.2	66.5	32.9
V10	66.0	46.6	61.2	0.0	33.8	49.9
V11	24.2	25.8	26.2	15.1	25.1	20.9
V12	33.8	0.0	35.2	35.4	105.2	21.7
V13	34.1	50.4[1]	39.9	0.0	0.0	0.0
V14	73.0	41.3[1]	33.1	50.2	59.2	37.2
V15	50.9[2]	46.8	48.1	61.7	90.5	120.9

(1) Single value reported (2) See particularities described in Brazil, 2021.

Conservatively, for all strata the soil organic carbon stock is estimated as:

Equation 6. Carbon stock in the soil.

$$C_{SOC,t} = \Delta SOC * A$$

Where:

Table 16. Parameters for Carbon stock in the soil equation.

$C_{SOC,t}$	=	Soil organic carbon stock in the Project Area, in year t; t CO_2e
ΔSOC	=	Conservative factor that expresses the average value of soil organic carbon stock by soil-vegetation association; tC ha^{-1}
A	=	Area of stratum i; ha

Other methods of obtaining the soil organic carbon stock should follow the parameters of item 5.11 Methodology deviation.

5.2.1.3 SUMMARY OF CARBON STOCK ESTIMATES

Present the results of the Summary of Carbon Stock Estimates according to the model table presented below, considering all the pools selected by the proponent, in tons of CO_2 equivalent per hectare of the Project Area.

Table 17. Example table for the results of Carbon Stock in the Project Area.

Year	C Stock in above-ground biomass (tC.ha^{-1}.year^{-1})	C Stock in below-ground biomass (tC.ha^{-1}.year^{-1})	C Stock in litter biomass (tC.ha^{-1}.year^{-1})	C Stock in dead wood biomass (tC.ha^{-1}.ano^{-1})	C Stock in soil (tC.ha^{-1}.ano^{-1})*	Average C stock in the Project Area (tC.ha^{-1}.ano^{-1})
Fill in	*Fill in*	*Fill in*	*Fill in*	*Fill in*	*Fill in*	*Fill in*
...	...	...	...	...	...	...

5.2.2 ECOSYSTEM FRAGMENTATION

Deforestation and the conversion of areas of native vegetation into other land uses cause the fragmentation of ecosystems, being defined as the process through which a large area is transformed into small patches, with a smaller total area, isolated by a matrix different from the original habitat[17].

The loss of these habitats generates an environmental imbalance with numerous impacts, such as the reduction of area, loss of habitats, extinction of species (mainly endemic and sensitive), decrease or loss of flow and genetic variability, decrease of richness and abundance of species, increase of edge effect and isolation effect, increase in erosive processes in the soil, changes in the water regime, loss of carbon pools, among others.

It is important to highlight the processes that interfere in the structure of the landscape and can be considered in the study of areas of relevant conservation interest, since they allow the integration of ecosystems and present important metrics in the study of the landscape, such as:

i. Connectivity and isolation
ii. Fragment size and shape
iii. Edge effect
iv. Average isolation

To evaluate fragmentation and its associated indicators, Geographic Information Systems (GIS) tools should be used, which allow the evaluation of the size and shape of the fragments in the study areas defined by the Methodology.

In the subsequent items, three indicators that deal with the fragmentation of ecosystems will be evaluated: (i) Land Use and Land Cover, for native vegetation, (ii) Connectivity and (iii) Proportionality. These indicators will support the attribution of ecological value of the Ecosystem Indicators and evaluation of the fragmentation of the given scenario. According to the characteristics of the fragment, information is obtained about the services present in the region. Larger fragments, for example, have greater value for conservation, as well as mature forests, core areas, etc.

[17] WILCOVE et al. 1986 apud Hentz et al., 2015. See: https://www.conhecer.org.br/enciclop/2015b/multidisciplinar/avaliacao%20da%20fragmentacao.pdf

5.2.2.1 LAND USE AND LAND COVER – NATIVE VEGETATION COVER (ONE OF THE SUB-ITEMS IS MANDATORY)

The analysis of land use and land cover provides information about the types of environments and habitats that can define a given region, having influence on the EcS that can be generated in such a place.

Therefore, this Methodology will evaluate the land use and land cover in the Project Area, with its vegetation fragments and its surroundings from the perspective of evaluation of native vegetation cover within the Area of Influence. It is understood that the native vegetation cover in the properties is important for the generation and maintenance of the EcS and points to the availability of provision of EnS by the owner. Thus, the Methodology considers the presence of Native Vegetation Cover as an indicator of provided EnS.

Also, as provided for in Law No. 12,651/2012, PPA and LR are areas of conservation of native vegetation determined by law and authorized by the Brazilian PES Law (Law No. 14,119/2021) and by Law No. 12,651/2012, to receive payment for the generated EcS. Thus, the Methodology also guides an evaluation in this sense.

Therefore, two sub-indicators were created, (i) one that deals with the native vegetation cover, and (ii) another that considers the additional effort of the landowner to maintain native vegetation beyond the required by law on their property. It is important to note that one of these indicators is mandatory, and in case the property is in areas where the LR (Legal Reserve) is 20%, only one of them can be used.

To obtain the indicators of Land Use and Land Cover:

i. Relate the indicators of Land Use and Land Cover – Native Vegetation Cover with the corresponding EcS indicated in the item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicators.
ii. The area of analysis of the indicator will be the Area of Influence, considering the buffer and the rural properties that are contained in the selected surrounding area, see item 5.10.1.

To calculate the **Native Vegetation Cover Indicator**, one should:

i. Obtain the classes of wooded and/or forested vegetation, or other types of native vegetation that characterize the project, based on the most recent mapping of land use and land cover which best suits the scale of the analysis. Recommended data: mapping of land use and land cover carried out by the MapBiomas project, mapping of the National Vegetation by IBGE and state mapping efforts.
   The calculation of the native vegetation cover can be surveyed for each property area, using GIS tools. Perform the *intersection* between the vegetated areas and the surveyed areas of the properties and for the vegetated areas within the Project Area.
ii. Obtain the percentage of native vegetation cover (%) calculated as the native vegetation on the property divided by the total area of the property.
iii. Assign a score according to the table below:

Table 18. Score relative to the indicator of native vegetation cover.

Indicator	Description	Score
Native Vegetation Cover Percentage	NVC ≤ 20%	1
	20% < NVC ≤ 40%	2

Indicator	Description	Score
(NVC)	40% < NVC ≤ 60%	3
	60% < NVC ≤ 80%	4
	80% < NVC ≤ 100%	5

To calculate an **Indicator for Native Vegetation Cover beyond the Legal Requirement,** one should consider:

i. As described in the item 5.10.2.2, the properties participating in the PSA Carbonflor must have their LR and PPA conserved, as good providers of EcS by presenting native vegetation coverage at least equivalent to that required by law.
ii. Obtain the ratio between the area of native vegetation in the Project Area and the area required by law (e.g., knowing that in the Atlantic Forest the legal requirement is 20%, a property that has 50% of its area as native vegetation has a ratio of 50%/20% = 2.5) and compare it to the same ratio of the properties in the Area of Influence.
iii. Assign values according to the table below:

Table 19. Score relative to the indicator of native vegetation cover beyond the legal requirement.

Indicator	Description			Score
	Atlantic Forest, Pantanal, Pampas, Caatinga and Cerrado outside the Legal Amazon (LR 20%)	Cerrado in the Legal Amazon (LR 35%)	Amazon (LR 80%)	
Ratio of Native Vegetation Cover Beyond Legal Requirement (NVCBLR)	NVCBLR ≤ 1,00	NVCBLR ≤ 1,00	NVCBLR ≤ 1,00	1
	1,00 < NVCBLR ≤ 2,00	1,00 < NVCBLR ≤ 1,46	1,00 < NVCBLR ≤ 1,06	2
	2,00 < NVCBLR ≤ 3,00	1,46 < NVCBLR ≤ 1,93	1,06 < NVCBLR ≤ 1,13	3
	3,00 < NVCBLR ≤ 4,00	1,93 < NVCBLR ≤ 2,39	1,13 < NVCBLR ≤ 1,19	4
	4,00 < NVCBLR ≤ 5,00	2,39 < NVCBLR ≤ 2,86	1,19 < NVCBLR ≤ 1,25	5

It should be noted that:

- Ecological value and characterization of indicators should be attributed according to their importance in the fragmentation of the ecosystem.
- Cartographic products should be presented as appropriate to illustrate the scenarios.
- Disregard any classes of PPAs that do not come from natural hydrography, such as: PPAs of Slopes Greater than 45 degrees; Artificial reservoir resulting from damming of watercourses; top of hills; or PPAs in Anthropized Area not declared as Consolidated Area.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.

5.2.2.2 CONNECTIVITY

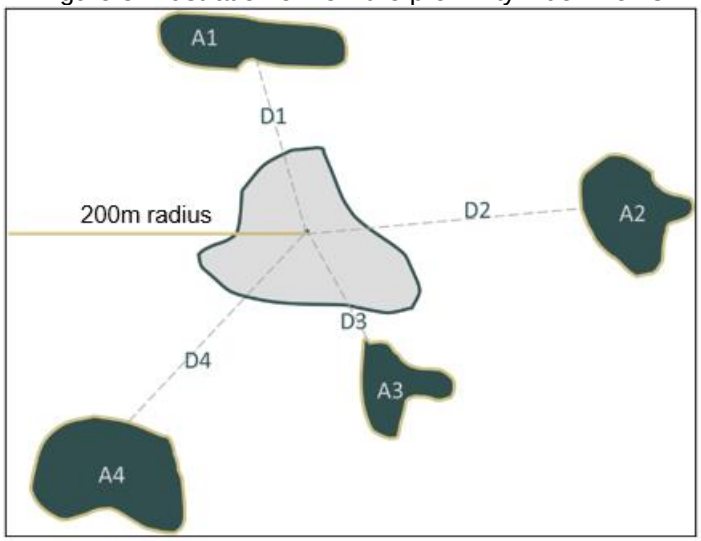
The functionality of an ecosystem depends, in part, on the ability of animals to move through a continuum of native vegetation. Highly interconnected areas have high connectivity, while areas with isolated fragments have low or limited connectivity. The distance between the remnants of native vegetation in each region has a direct impact on the connectivity of the area. The fragmentation and, consequently, the reduction of the connectivity of forested areas and other vegetated areas, impairs the conservation of biodiversity and the ecosystem, as well as the generation of EcS, since the intraspecific and interspecific flows are impaired by the decrease of ideal places for the displacement in the landscape. The degree of fragmentation has a direct relationship with the isolation of the fragments[18, 19, 20].

Thus, this Methodology considers Connectivity as an Ecosystem Indicator capable of assisting in the attribution of environmental quality to the habitat provider of EcS.

To evaluate the connectivity of vegetation fragments within the Area of Influence, it is recommended to use Geographic Information Systems (GIS) tools such as V-LATE, Patch-Analyst and Patch Grid or LECOS, VECLI and FRAGSTATS. These extensions and software can help identify the proximity and isolation of vegetation fragments.

Thus, the proximity index generated in the software is used as an indication of the connectivity between the fragments, since it considers the distance and the areas of the neighboring patches in a radius determined by the user (Figure 3).

Figure 3. Illustration of how the proximity index works.



A (1, 2, 3 and 4) = Areas found; D (1, 2, 3 and 4) = Distance between the analyzed patch and the other patches found

[18] See: ANDRÈN, H. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos, v. 71, n. 3, p. 355-366, Dec. 1994.
[19] See: METZGER, J. P.; DÉCAMPS H. The structural connectivity threshold: an hypothesis in conservation biology at the landscape scale. Acta Ecologica, v. 18, p. 1–12, 1997.
[20] See: PARDINI, R. et al. The role of forest structure, fragment size and corridors in maintaining small mammal abundance and diversity in an Atlantic Forest landscape. Biological Conservation, 124: 253-266, 2005.

It is suggested to use three distinct radiuses for the tests (200m, 500m and 1,000m) for each scenario.

The Proximity Index is equal to the sum of the areas of the habitat patches, divided by the sum of the distances of the nearest patches (edge to edge), according to the equation below.

Equation 7. Proximity Index.

$$PROX = \sum_{s=1}^{n} \frac{a_{ijs}}{h_{ijs}^2}$$

Where:

Table 20. Parameters for the Proximity Index equation.

$PROX$	=	Proximity Index
a_{ijs}	=	area of the fragments
h_{ijs}	=	distance between polygons of vegetation measured from edge to edge, within the given radius

Therefore, to obtain a **Connectivity Indicator** the Methodology determines:

i. Relate the Connectivity indicator to the corresponding EcS indicated in item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator.
ii. The area of analysis of the indicator will be composed of the portions of native vegetation mapped in the buffer in the Area of Influence. In this case, the selected properties in the surroundings should not be considered, see item 5.10.1.
iii. Calculate the proximity index for the Area of Influence for the following scenarios:
    a. *Scenario 1*: considering the fragments of native vegetation in the Project Area; and
    b. *Scenario 2*: absence of the Project Area (simulate that there is no native vegetation in the Project Area).
iv. Test the proximity index (above) with the selected radiuses in the two scenarios described above.
v. Classify the connectivity result into five quantiles and make a weighted average where the lowest connectivity is assigned the value 1, and the highest connectivity the value 5. For each scenario and each radius, count the frequency of fragments in each quantile and make a weighted average of the score with the number of fragments.
vi. Verify the change in the total connectivity of the landscape considering and excluding the fragments of native vegetation of the Project Area, that is, comparing scenarios 1 and 2, as exemplified in the Table 21.
vii. Provide the interpretations regarding the connectivity corresponding to the proposed scenarios and justify the established score, as well as characterize the fragmentation of the ecosystem resulting from the process.

Table 21. Table for calculating the connectivity index.

Scenarios	Average connectivity of the fragments according to the selected radius		
	200 m	500 m	1.000 m
Scenario 1: Considering fragments of native vegetation from the Project Area	*Fill in*	*Fill in*	*Fill in*

Scenarios	Average connectivity of the fragments according to the selected radius		
	200 m	500 m	1.000 m
Scenario 2: Removing fragments of native vegetation from the Project Area	*Fill in*	*Fill in*	*Fill in*
Gain with Project Area (scenario 1 – scenario 2)	*Fill in*	*Fill in*	*Fill in*

The following table provides the distribution of the indicator score from the comparative analysis of the scenarios.

Table 22. Score relative to the connectivity indicator.

Indicator	Description	Score
Variation in Connectivity (Con)	Significant decrease in connectivity	1
	Moderate decrease in connectivity	2
	Small change in connectivity	3
	Moderate increase in connectivity	4
	Significant increase in connectivity	5

It should be noted that:

- In the case of highly conserved and connected landscapes, often the removal of a plot alone does not affect global connectivity. Thus, the use of this indicator should be evaluated and justified accordingly.
- Cartographic products should be presented as appropriate to illustrate the comparative scenarios.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.
- For the execution of this index, the mapping of forest formations or native vegetation is used. It is also advised that if the data used was not elaborated by the proponent, then the most updated, refined and revised data available should be chosen, prioritizing more recent data consistent with the scale of analysis. Examples of recommended data: mapping of land use and land cover carried out by the MapBiomas project, Mapping of the National Vegetation by IBGE and also state maps.

5.2.2.3 PROPORTIONALITY

To characterize the fragments found in the Project Area and its surroundings in terms of size and shape, the Methodology defines the Proportionality indicator to determine the scenario of the fragments that are contained in the Area of Influence.

To obtain the **Proportionality Indicator**:

i. Relate the Proportionality indicator to the corresponding EcS indicated in item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator;
ii. The area of analysis of the indicator will be the Area of Influence, considering the buffer and the rural properties that are contained in the selected surrounding area, see item 5.10.1;
iii. With the support of GIS tools, obtain the number of fragments of native vegetation and the measurement of their area per property in the Area of influence and in the Project Area;

iv. Determine the fragment size classes according to the distribution of the average areas of the fragments, justifying the values inserted in such division;
v. Assign a score to the Project Area as shown in the table below;
vi. Assign ecological value to the classes of fragments relating edge effect, shape, size, and others that the proponent deems appropriate.

Table 23. Score relative to the proportionality indicator.

Indicator	Description	Score
Proportionality (Prop) (Justify the classification)	Very small	1
	Small	2
	Medium	3
	Large	4
	Very large	5

It should be noted that:

- Cartographic products should be presented as appropriate to illustrate the scenarios.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.
- For this indicator, the same rigor of data used to obtain land cover and mapping mentioned for the indicators of Native Vegetation Cover should be followed (item 5.2.2.1) and Connectivity (item 5.2.2.2).

5.2.3 SURFACE WATER QUALITY

Among the possible services provided by an ecosystem are those related to water. The consumption of water by humans and animals is considered one of its most noble use, which is only possible when the water is of adequate quality. Considering the importance of water for human and animal consumption, an indicator regarding water quality was established.

To obtain the **Water Quality Indicator**:

i. Relate the Water Quality indicator with the corresponding EcS indicated in item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator;
ii. The area of analysis of the indicator will be the Project Area, see item 5.10;
iii. Information should be provided to characterize the ecosystem in question.

The main approach to assess water quality in Brazil is through the Water Quality Index (*Índice de Qualidade da Água – IQA*), recognized by the National Water Agency (*Agência Nacional das Águas* – ANA) and used by several Brazilian states.[21] The IQA ranges from 0 to 100 and is calculated by the weighted product of nine parameters: Dissolved oxygen, thermotolerant coliforms, pH, Biochemical oxygen demand ($BOD_{5,20}$), temperature, total nitrogen, total phosphorus, turbidity and total solids. The equation for calculating the IQA and the weights of each parameter are presented below.

[21] Available at: http://pnqa.ana.gov.br/indicadores-indice-aguas.aspx#_ftn1

Equation 8. Calculation of the IQA.

$$IQA = \prod_{i=1}^{n} q_i^{w_i}$$

Where:

IQA	=	Water Quality Index, a number between 0 and 100
q_i	=	quality of the i-th parameter, a number between 0 and 100, obtained from the respective "mean curve of quality variation", as a function of its concentration or measure.
w_i	=	weight corresponding to the i-th parameter, a number between 0 and 1, assigned according to its importance for the overall conformation of quality.

For w_i:

Equation 9. Condition of w_i.

$$\sum_{i=1}^{n} w_i = 1$$

Where:

n	=	number of parameters that go into the calculation of the IQA

The following table presents the weights that should be used.

Table 24. Table of water quality parameters.

Water Quality Parameter	Weight (w)
Dissolved oxygen	0,17
Thermotolerant coliforms	0,15
pH	0,12
Biochemical Oxygen Demand - $BOD_{5,20}$	0,10
Water temperature	0,10
Total nitrogen	0,10
Total phosphorus	0,10
Turbidity	0,08
Total residue	0,08

For the calculation of the IQA, measurements must be made of the nine parameters mentioned in the main water courses that intersect with the Project Area or that have a spring/source in the Project Area but that leave the Project Area. The determination of the main watercourses should be done in one of the following ways:

i. Watercourses whose flow rate equal to more than 50% of the total flow of the courses of the Project Area;
ii. In case there is no information on the water flow, at least 70% of the courses present in the official hydrographic database of the state in which the Project Area is located.

These measurements should be made on site or by sample collection, within the Project Area, at the downstream points of the waterways. The analyses must be performed by a laboratory with ABNT NBR ISO/IEC 17025:2017 accreditation.

From the values obtained for each parameter, the quality of each parameter (qi) can be obtained from the mean curves of quality variation, presented in Annex II. .

From the "qi" and "w" of each parameter, the IQA of each watercourse should be calculated. The following step is to calculate the average of the IQAs, obtaining the final IQA (IQA_f). The water quality indicator score is based on the IQA_f, according to Table 25.

Table 25. Score relative to the Surface Water Quality Indicator.

Indicator	Description	Score
Water Quality (IQA)	$IQA_f \leq 36$	1
	$36 < IQA_f \leq 51$	3
	$51 < IQA_f \leq 79$	4
	$79 < IQA_f \leq 100$	5

It should be noted that:

- Cartographic products should be presented as appropriate to illustrate the scenarios.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.

5.2.4 PPA CONSERVATION (MANDATORY)

PPAs are good sources of EcS in that they provide great support for habitat development and promote connectivity in the landscape. Thus, the Methodology seeks indicators that aim to attribute value to the contributions of this environment.

The diagnosis can be made by analyzing the conservation of the PPAs in the Area of Influence.

To obtain the **PPA Conservation Indicator**:

i. Relate the PPA Conservation Indicator with the corresponding EcS indicated in item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator;
ii. The area of analysis of the indicator will be the Area of Influence, considering the buffer and the rural properties that are contained in the selected surrounding area, see item 5.10.1.
iii. Obtain Brazilian PPA data from verifiable sources, such as the FBDS database, state and federal platforms, as well as mapping performed by a trained professional.
iv. Obtain the classes of wooded and/or forested vegetation, or other types of native vegetation that characterize the project, based on the most recent mapping of land use and land cover which best suits the scale of the analysis. Suggested Data: mapping of land use and land cover carried out by the MapBiomas project, Mapping of the National Vegetation by IBGE, and state mappings.

v. Using GIS tools, intersect the base(s) of PPAs with the area of native vegetation to determine the conserved area of these PPAs.
vi. Obtain the percentage of native vegetation cover in PPA (%) calculated as the native vegetation in the PPA (actual PPA area) divided by the total area of the PPA (mandatory PPA area).
vii. Assign score according to the table below.
viii. Provide characterization and ecological value determining the importance of the indicator in the verified scenario.

Table 26. Score for the PPA Conservation Indicator.

Indicator	Description	Score
Percentage of native vegetation cover in PPA (APPC): Actual PPA / Mandatory PPA	APPC ≤ 70%	1
	70% < APPC ≤ 80%	3
	80% < APPC ≤ 90%	4
	90% < APPC ≤ 100%	5

It should be noted that:

- Cartographic products should be presented as appropriate to illustrate the scenarios.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.

5.2.5 DENSITY OF WATER SPRINGS

The number of springs in each area has a direct relationship with the conservation status of the ecosystem in which they are inserted. Properties with more conserved springs contribute more to the water provision service and its quality than properties that do not have springs, or where the PPAs are degraded. Thus, this Methodology takes into account the number of springs present in the Project Area and its surroundings as an indicator of environmental quality and consequently, of conservation.

To calculate the **Density of Water Springs Indicator**:

i. Relate the Density of Water Springs Indicator with the corresponding EcS indicated in item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator.
ii. The area of analysis of the indicator will be the Area of Influence, considering the buffer and the rural properties that are contained in the selected environment, see item 5.10.1.
iii. Through GIS tools, count the number of springs within the Project Area and compare with the properties contained in the Area of Influence.
iv. For comparison and normalization, the number of springs should be divided by the total area of each property, thus arriving at a coefficient of "springs/ha".
v. List all properties (Area of Influence and Project Area together) from the highest to the lowest density of springs, numbering them from 1 (highest density) to T (*T* being the total number of properties considered in the analysis of the indicator).
vi. Count the total of properties that have zero density (*Z),* that is, that do not have any spring in their property.
vii. Subtract *Z* (total number of properties with density equal to zero) from *T* (total number of properties), arriving at the total number of properties containing one or more springs (*D*):

Equation 10. Total properties with non-zero spring density.

$$D = T - Z$$

viii. Sort the properties from highest to lowest density, as described below:

a. Divide the total number of properties with non-zero density (*D*) by 4, arriving at the value *m* (classification interval):

Equation 11. Determination of the classification interval.

$$m = \frac{D}{4}$$

b. Round *m* to the nearest integer;
c. Starting from the property of highest density of springs (property set to 1, as item v), classify the first *m* with a score of 5. Sort the next *m* with a score of 4, the *m* next with a score of 3, and the last *m* properties with non-zero density with score 2. Thus, the *D* properties with non-zero density will have scores ranging from 5 to 2, with the property *D,* which has the lowest non-zero density, having a score of 2;
d. Consider all those who have zero density (*Z*) with a score of 1;
e. Generate a table with this information, mandatorily inserting the columns:

- CAR number;
- Location of the property (Project Area or Area of Influence);
- Density (springs/ha);
- Ranking, according to item v, ranging from 1 (higher density property) to *T* (lower density property);
- Score, ranging from 5 to 1, with a score of 1 being assigned only to properties with zero density (totaling Z properties with a score of 1).

ix. Compare the frequency of property densities in the Area of Influence with those in the Project Area.
x. Score the Project Area as shown in the table below.
xi. Assign ecological value and characterization regarding the importance of this indicator in the ecosystem that is inserted.

Table 27. Score relative to the density of springs indicator.

Indicator	Spring densities of Project Area and Area of Influence	Score
Spring density (SD) of the Project Area and Area of Influence	SD = 0	1
	Low	2
	Average	3
	High	4
	Very High	5

It should be noted that:

- Cartographic products should be presented as appropriate to illustrate the scenarios.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.

5.2.6 BIODIVERSITY [FLORA AND FAUNA] (MANDATORY)

In general, the term biodiversity refers to biological diversity, that is, to the set of all species of living beings existing in each region or time, as well as the set of genes that compose them, the interspecific and intraspecific relationships, and the ecosystem in which they are inserted[22].

Biodiversity influences the provision of Ecosystem Services in its various classes: (i) as a support, influencing ecological processes, such as soil formation, primary production, nutrient cycling, population regulation, among others, (ii) as regulation, since an ecosystem in balance assists in climate regulation, maintenance of water resources, pest control and pollination - fostering the perpetuation of plant species, (iii) as provision services, because biodiversity by itself can be considered as an ecosystem service, when we consider medicinal plants, seed supply, food from various cultures, in addition to being able to be a (iv) cultural service, with species, mainly vertebrates, being recognized for their charisma, aesthetic, religious and spiritual appeal[23],[24],[25].

Biodiversity indicators are very useful when they are clear in their definitions, applications, and implications, and when they are easily measurable and able to detect changes over time[26]. Biodiversity indicators should summarize data on complex environmental issues to indicate the general state and trends of biodiversity. In the impossibility of directly measuring the species present in a natural ecosystem, indirect indicators of biodiversity can be a useful tool for assessing habitat quality.

Thus, the Methodology determines the Biodiversity Indicator considering the main factors that can influence the quality of a habitat.

In this sense, biodiversity can be measured directly in each area through species richness, where the number of species of fauna, flora and microorganisms that occur in each area is counted. Another relevant factor that should be considered is the abundance of the species, which refers to the population status of the species, more specifically to the number of individuals of a given species. A well-established population provides the maintenance of the genetic variability of the species, making its maintenance and reproduction viable. When there is no genetic viability in a population, with a low abundance of individuals, the tendency is for this species to decrease or disappear in the area, causing an imbalance throughout the ecosystem. Similarly, overpopulations of species also pose a risk to the balance of the ecosystem.

Additionally, the trophic chain plays a fundamental role in maintaining a healthy ecosystem and its biodiversity. In this way, the presence of a key species represents fundamental connections for the maintenance of the web of relationships between the species in its chain, which feeds an ecosystem in balance. Among the possible key species, the top predators, seed dispersing animals, beings present in the environment that are part of the IUCN Red List, among others that clearly demonstrate their significance in maintaining the ecological balance of the forest, should be considered as indicators of forest quality maintenance.

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[22] WWF Brazil, see: https://www.wwf.org.br/natureza_brasileira/questoes_ambientais/biodiversidade/#:~:text=O%20termo%20biodiversidade%20%2D%20ou%20diversidade,industrial%20consumida%20pelo%20ser%20humano .
[23] Mace et al., 2012. See: https://www.sciencedirect.com/science/article/abs/pii/S0169534711002424
[24] Constanza et al., 2017. See: https://www.sciencedirect.com/science/article/abs/pii/S2212041617304060
[25] Borma et al., 2022. See: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021RG000766
[26] Oak 2019. Available at: https://pantheon.ufrj.br/bitstream/11422/13622/1/LucasSilvaCarvalho-min.pdf

Furthermore, the achievement of equilibrium in forest environments involves the process of ecological succession, where gradual changes occur in the composition and structure of the forest, involving modifications in the physical environment, by the interactions of biotic and abiotic components, to increase the structural and biological complexity of the ecosystem[27]. The progression of succession entails changes in the dynamics of vegetation, with the diversification of life forms over time and the replacement of species with similar and broad ecological amplitudes, by groups with narrow limits and complementary needs, in addition to the increase in the number of interspecific dependencies and the floristic and structural composition among the groups that represent the community.

In this sense, the identification of successional stages of a forest becomes an important tool for measuring habitat quality since it allows the evaluation of the evolution of the dynamics of forests and their biodiversity over time[28].

A well-developed ecosystem subsidizes the richness and abundance of pollinators, among which bees' figure as the most efficient pollination agents[29], whose diversity is associated with floristic diversity[30] and the variety and complexity of forest strata[31,32]. Pollination is an important EcS, essential for the reproduction of many plants, including several agricultural crops and for biodiversity itself, so that the biodiversity indicators considered in this Methodology are indirectly related to pollination, since this ecological function contributes to the genetic variability and perpetuation of plant species, which will serve as shelter and food resource for several species of fauna. In this sense, primary and secondary data of bee species, when existing in the area of application of the Methodology, will be considered to increase the biodiversity indicator, according to subsequent items.

To obtain the **Biodiversity Indicator**:

i. The proponent must relate the Biodiversity Indicator with the corresponding EcS indicated in item 5.1.2. Present in table format. Describe which of the listed EcS can be measured with the indicator;
ii. The area of analysis of the indicator will be the Project Area, see item 5.10.
iii. Data obtained according to the guidelines presented below in section 5.10.2.4 should be used. The lists of species of fauna and flora and the cartographic products resulting from the characterization of the area (see item 5.10.2.4) should be used as a basis for the composition of the Biodiversity Indicator of the Project Area, since they will have information about the sub-indicators proposed bellow.
iv. The following tables demonstrate the sub-indicators selected to act as indirect indicators of biodiversity, linked to the structure and quality of local vegetation and fauna. The score must be given by the proponent to make a pertinent report, and a photographic record with date and geographical coordinates must be requested of the landowner, ensuring the veracity of the information filled in the table.
v. Information should be provided to characterize the relevance of this indicator to the ecosystem in question.

[27] Townsend et al., Foundations in Ecology. 3. ed. Brazil: Artmed, 2010. 557p.
[28] Longhi et al., 2005. See: https://www.scielo.br/j/cflo/a/qp7J4kPjq7m3rFSxZWsXKYP/
[29] McGregor SE. 1976. Insect pollination of cultivated crop plants. Washington, DC: Agriculture Research Service United States, Department of Agriculture
[30] Ramalho, 2009. See: https://www.scielo.br/j/rbent/a/69zG6FVpVtjcLVq8TDvYGgf/abstract/?lang=pt
[31] Martins, 2015. See: https://www.scielo.br/j/rbzool/a/tV97ZfKtDWsC4hqfwK8BTxz/?lang=pt
[32] Viana, 2006. See: http://periodicos.uefs.br/index.php/sitientibusBiologia/article/download/8194/6800/32701

To assign value to the indicators, this Methodology provides for the verification of habitat quality *on site* performed by the figure of the Monitoring Agent, see item 6.1.1. The score will be measured by the proponent's team, in which the higher the value obtained, the better the habitat quality.

The flora sub-indicators were created through adaptations of classifications of successional stages present in current Brazilian laws, considering essential aspects to evaluate the conservation conditions of the analyzed areas. The fauna indicators consider ecological aspects relevant to the health of the ecosystem and the official lists of endangered animals for species classification and indicator scoring.

It is recommended:

- The recording of the interior of the fragment with the presence of objects, such as a colored ribbon, to signal the focus area of attention of the images.
- Evidence of well-established populations should be recorded *on site* on the properties by means of photographic records containing date and geographical coordinates, in order to ensure the veracity of the information. The proof that the species that make up the local fauna use the project area for their vital tasks, such as feeding, reproduction, as dormitories, among others, brings significant value to the importance of maintaining and conserving the area.
- Photographic records of wildlife sightings in the area, evidence such as footprints, bird nests, containing date and geographic coordinates.

Table 28. Score related to the Biodiversity Indicator – Vegetation.

Indicator	Vegetation structure	Level	Score
Biodiversity – Vegetation	Physiognomy (vegetation type)	Physiognomy that varies from savanna to low forest, and herbaceous stratum and small trees may occur.	1
		Forest physiognomy, presenting trees of various sizes.	3
		Closed forest physiognomy, tending to occur continuous distribution of canopies, and the canopy may or may not present emerging trees.	5
	Forest stratification	Woody strata ranging from open to closed, presenting plants with varying heights. There is no canopy formation and defined understory.	1
		Presence of plant species of different heights, composing the beginning of formation of several strata, and each stratum presents itself with coverage ranging from open to closed. The surface of the upper layer is mostly uniform and emergent trees appear.	3
		Well-defined forest stratification, with trees, shrubs, terrestrial herbs, vines, epiphytes, etc., whose abundance and number of species vary according to climate and location. The upper canopies are usually horizontally wide	5
	Diametric distribution of tree individuals	Average diameter of the trunks at breast height (DBH = 1.30 m from the ground) is up to 10 cm, presenting a small woody product, and the diametric distribution of the woody forms presents a small amplitude	1

Indicator	Vegetation structure	Level	Score
		Average DBH can reach up to 20 cm. The diametric distribution of the trees presents moderate amplitude, with a predominance of small diameters, which can generate a reasonable woody product;	3
		The average DBH of the trunks is always greater than 20 cm. The diametric distribution has great amplitude, providing a good woody product.	5
	Presence of epiphytes	Epiphytes, when present, are scarce	1
		Epiphytes appear in a somewhat greater number of individuals and species (e.g., lichens, mosses, orchids, and bromeliads)	3
		Epiphytes are present in a large number of species and with great abundance.	5
	Presence of plant litter	The litter when present, can be continuous or not, forming a thin layer barely decomposed.	1
		The litter may present variations in thickness, according to the season of the year. However, its presence can be easily detected.	3
		Litter is present, varying as a function of time and location, is easily detected and presents intense decomposition	5
	Plant Diversity	Biological diversity is low, occurring around ten dominant tree or shrub species.	1
		Biological diversity is significant, and in some cases, there may be the dominance of a few species, usually of rapid growth.	3
		Biological diversity is very large due to the complexity, structure, and number of species.	5

Table 29. Score relative to the Biodiversity Indicator – Disturbance Factors.

Indicator	Disturbance factors	Level	Score
Biodiversity – Disturbance factors	Fire Frequency in the area	High – every 1 to 2 years	1
		Medium – every 3 to 5 years	3
		Low – every 5 to 10 years	5
	Presence of cattle or any domesticated animal inside the fragment of native vegetation	High – 51 to 100%	1
		Medium – 21 to 50%	3
		Low – 0 to 20%	5
	Presence of vines	Vines, herbaceous or woody, in high abundance, covering almost all (71% to 100%) tree species present on the edge of the fragment.	1
		Vines, herbaceous or woody, in moderate abundance, partially covering (50% to 70%) the tree species present on the edge of the fragment.	3
		Absence of vines covering the trees on the edge of the fragment, when present inside, are usually woody.	5
	Presence of invasive grasses	High – 51 to 100%	1
		Medium – 21 to 50%	3
		Low – 0 to 20%	5

Indicator	Disturbance factors	Level	Score
	Presence of exotic trees	High – 51 to 100%	1
		Medium – 21 to 50%	3
		Low – 0 to 20%	5
	Presence of selective wood cutting in the area	High – 51 to 100%	1
		Medium – 21 to 50%	3
		Low – 0 to 20%	5

Table 30. Score relative to the Biodiversity Indicator – Fauna.

Indicator	Fauna	Level	Score
Biodiversity – Fauna	Key/top-of-chain species records	No records	1
		1 or more records	5
	Presence of globally or nationally endangered species	Vulnerable	1
		Endangered	3
		Critically endangered	5
	Evidence from well-established populations	1 to 3 species	1
		3 to 5 species	3
		5 or more species	5

The indicators should have their score highlighted in the table and should be added together to determine the final score. In the case of the indicator of the presence of endangered species, the highest degree of threat should be considered as the single value of the indicator. The biodiversity indicator will have a weight of 3 in the Matrix of Ecosystem Indicators (see item 5.3), since it contemplates flora, fauna, and disturbances.

It should be noted that:

- Cartographic products should be presented as appropriate to illustrate the scenarios (see section 5.10.2.4)
- Images and corroborating reports should be included in the relevant Reports.
- The entire method of obtaining the indicator must be described in a clear and verifiable manner.

5.3 MATRIX OF ECOSYSTEM INDICATORS

Once the Ecosystem Indicators have been measured in the previous items, the Methodology provides for the creation of a Matrix of Ecosystem Indicators. This matrix aims to show the quality of services provided by the Project Areas eligible for the PES. The following table presents a summary of all the indicators that can be measured, as well as their respective scores and weights assigned in the context of evaluation of each indicator in the previous items.

Table 31. Indicators, description, scores, and weight.

Indicator	Measurement Method	Score variation	Weight
Stored Carbon (I_{SC})	Carbon stock in tCO2e	N.A.	N.A.
Land Use and Land Cover: Native Vegetation Cover (I_{NVC})	Percentage of native vegetation cover in the Project Area	1 to 5	1
Land Use and Land Cover:	Ratio between native vegetation cover and legal requirement.	1 to 5	1

Indicator	Measurement Method	Score variation	Weight
Native Vegetation Cover Beyond Legal Requirement (I_{NVCBLR})			
Connectivity (I_{Con})	Variation in landscape connectivity with and without the Project Area.	1 to 5	1
Proportionality (I_{Prop})	Average size of fragments in the Project Area versus Area of Influence.	1 to 5	1
Surface Water Quality (I_{SWQ})	Score defined by the average of the Water Quality Indexes of the watercourses in the Project Area	1 to 5	1
PPA Conservation (I_{APPC})	Effective PPA area versus mandatory PPA area.	1 to 5	1
Spring density (I_{SD})	Average spring density in the Project Areas versus Area of Influence.	1 to 5	1
Biodiversity (I_{BD})	Vegetation and fauna status, and disturbance potential	15 to 75	3
Total		**22 to 110**	**10**

Next, the proponent must normalize the score of the Project Area by joining all the indicators, thus, the Matrix of Ecosystem Indicators will serve for an adjustment in the calculation of the conversion to Carbon (see item 5.6).

As mentioned earlier, the PES project must consider at least **five** Ecosystem Indicators. Four are mandatory, and the I_{SC} does not enter the Matrix of Ecosystem Indicators. Therefore, the three required for the formula are I_{NVC}, I_{APPC}, I_{BD}, and, at the very least, it is necessary to choose one more (see specific items for limitations).

The Matrix of Ecosystem Indicators can be calculated using Equation 12. The sum of the selected indicators will give a score that will be normalized to a scale from 0 to 1.

Equation 12. Matrix of Ecosystem Indicators.

$$Matrix\ of\ Ecosystem\ Indicators\ (\%) = 100\ x\ \frac{I_{NVC} + I_{NVCBLR} + I_{Con} + I_{Prop} + I_{SWQ} + I_{APPC} + I_{SD} + 3\ x\ I_{BD}}{2 + n}$$

Where:

Table 32. Parameters of the equation of the Matrix of Ecosystem Indicators.

Indicator	Acronym	Scoring Parameter	
Native Vegetation Cover*	I_{NVC}	=	NVC Score / 5
Native Vegetation Cover Beyond Legal Requirement1	I_{NVCBLR}	=	NVCBLR Score / 5
Connectivity	I_{Con}	=	Connectivity Score / 5
Proportionality	I_{Prop}	=	Proportionality Score / 5
Surface Water Quality	I_{SWQ}	=	SWQ Score / 5
Conservation of PPAs*	I_{APPC}	=	PPA Conservation Score / 5
Density of springs	I_{SD}	=	Density of Springs Score / 5
Biodiversity*	I_{BD}	=	Biodiversity Score / 75
n	n	=	Number of quantified EcS indicators

* Mandatory indicator;
[1] It can only be used together with I_{NVC} if the Project Area is in areas where the Legal Reserve is at least 35%

It should be noted that:

- For each additional indicator measured, in addition to the five that are mandatory, the score of the Matrix of Ecosystem Indicators can be increased by 2%, provided that the sum does not exceed 100%.
- As mentioned in item 5.6, the Stored Carbon (I_{SC}) will be used in conjunction with the other indicators.
- With the evolution of the Methodology, new indicators and their adjusted weights may be added.

5.4 RISKS OF LOSS

The assessment of Risks of Loss consists of observing, according to the activities developed in the Project Area and surroundings, what would be the threats and risks to the generation of Ecosystem Services and the maintenance of Environmental Services provided during the duration of the PES project.

The risks and threats to EnS are related to environmental disturbances in the Project Area and the Native Vegetation Area of the project and may involve, disturbances to flora, fauna, water quality, deforestation, biomass burning, invasion and fire, among others.

In this item, it is necessary to list and describe, as appropriate, the disturbances identified for the Project Area. And when the identified risk materializes in ecosystem degrading actions, the activities generating disturbance should be reported with their respective area in table format.

5.4.1 STORED CARBON – STOCK WITH RISK OF LOSS

If there is materialization of any risk, one should consider the Stock with Risk of Loss, which represents the stock of carbon at risk of being lost by external factors, which influences the loss of biomass, as well as implying losses for the supply of EcS and EnS of the project.

As the Stored Carbon will serve as the basis for the calculation of all other related EcS, for identified disturbances that threaten the total carbon stock in the Project Area, the corresponding discount in the carbon stock count calculated in item 5.2.1.2 should be considered. Such discount must use the stock value deprecated to the disturbance multiplied by the affected area. Thus, it is recommended that the following items be considered for analysis.

i. Observe and monitor the vectors of deforestation, fire and other vectors of disturbance of provide Environmental Services in the Native Vegetation Area;
ii. Provide a description of the measures taken to mitigate potential losses, if any;
iii. Present cartographic product indicating location and characteristics of the loss scenario when it exists.
iv. When, if any, incidence of illegal logging occurs in the Project Area, and the total accumulated in extracted biomass does not exceed the percentage of 5% of the total biomass stock, it can be considered as zero.

Carbon stock losses in the Project Area must be evidenced and accounted for, in order to specify the discounts in the estimate of the Carbon stock indicator for the disturbances identified in the Project Area. The estimate is obtained using the following formula.

Equation 13. Stock with risk of loss.

$$Stock\ with\ risk\ of\ loss = \sum C_{i,loss} * a_{i,risk}$$

Where:

Table 33. Parameters of the equation of Stock with risk of loss.

$Stock\ with\ risk\ of\ loss$	=	Carbon stock lost because of deforestation activities and other risk vectors in stratum i in year t; t CO_2e
$C_{i,loss}$	=	Carbon stock of vegetation prior to the disturbance and consequent loss of vegetation in stratum i in year t, t CO_2e/ha
$a_{i,risk}$	=	Lost area associated with the detected disturbance; ha. $year^{-1}$

Other methods of estimating lost carbon stock caused by disturbance vectors in the Project Area must follow the parameters of the item 5.11.

5.4.2 STORED CARBON – POST LOSS

To obtain the volume of tons of CO_2 equivalent available for the final measurement of C+ in the Project Area, the carbon stock provided by conservation in the Project Area (C_{total}) must be considered by deducting all losses from the Risk of Loss considered by the proponent, that is, the amount of the Stock with Risk of Loss, according to the equation below.

Equation 14. Stored Carbon Equation (post loss).

$$Stored\ Carbon\ (post\ loss) = C_{total} - Stock\ with\ risk\ of\ loss$$

Where:

Table 34. Parameters of the equation of stored carbon (post loss).

$Stored\ Carbon\ (post\ loss)$	=	Carbon stock discounting losses; t CO_2e
C_{total}	=	From Equation 1; t CO_2e
$Stock\ with\ risk\ of\ loss$	=	From Equation 13; t CO_2e

The post-loss carbon stock must be quantified for measurement pertinent to C+ emission.

5.5 SAFETY RESERVE

This Methodology establishes a Safety Reserve for the application of the PES project, which corresponds to a percentage of C+ accounted for the Project Area that cannot be sold annually. One-tenth of the Safety Reserve can be sold every ten years of the project. Thus, in a 30-year project only 30% of the Safety Reserve is sold, 10% of the Safety Reserve every 10 years. For a 100-year project, by selling one tenth of the Safety Reserve every ten years, at the end of the project the entire reserve will have been commercialized.

The Safety Reserve is insurance against unforeseen events that may happen in the Project Area and that may compromise the continuity of the provision of EnS, such as fires, invasions, withdrawal, among others. In this way, the reserve acts as a risk mitigation measure.

The Safety Reserve percentage, for this Methodology, follows a pattern of increment according to the Valuation Period adopted by the proponent. The formula below dictates the delimitation of this factor.

Equation 15. Calculation of the Safety Reserve (%).

$$Safety\ Reserve\ (\%) = 10 + \left(\frac{(100 - Valuation\ Period\ )}{3}\right)$$

Where:

Table 35. Parameters of the Calculation of the Safety Reserve equation (%).

$Safety\ Reserve\ \ (\%)$	=	Percentage of the Stock that must be separated as a Safety Reserve; %
$Valuation\ Period$	=	Duration of the project; Years

A different percentage for the Safety Reserve can be applied, if it is justifiable, presented in a transparent and verifiable way. Any change in the Safety Reserve must be accepted and approved by the developer of the Methodology and must be included in section 5.11 Methodology deviation.

To calculate the volume of the Safety Reserve in terms of tCO_2e, simply multiply the Safety Reserve (%) by the Stored Carbon factor (post loss).

Equation 16. Calculation of the Safety Reserve (tCO_2e).

$$Safety\ Reserve\ (tCO_2e) = Safety\ Reserve\ (\%) * Stored\ Carbon\ (post\ loss)$$

Where:

Table 36. Parameters of the Safety Reserve Calculation (tCO2e) equation.

$Safety\ Reserve\ (tCO_2e)$	=	Stock that must be separated as a Safety Reserve; tCO_2e
$Stored\ Carbon\ (post\ loss)$	=	From Equation 14; tCO_2e

5.5.1 MARKETABLE CARBON

The Safety Reserve must be considered for the marketing of C+ in the PES Project. Thus, the Stored Carbon (post loss) calculated in item 5.4.2 should discount this factor, as presented in the equation below.

Equation 17. Calculation of Marketable Carbon (total).

$$Marketable\ Carbon\ (total) = Stored\ Carbon\ (post\ loss) - Safety\ Reserve$$

Where:

Table 37. Parameters of the Marketable Carbon Calculation equation.

$Marketable\ Carbon\ (total)$	=	Carbon stock, discounting losses, and Safety Reserve; tCO_2e
$Stored\ Carbon\ (post\ loss)$	=	From Equation 14; tCO_2e
$Safety\ Reserve\ (tCO_2e)$		From Equation 16; tCO_2e

5.6 CONVERSION TO CARBON

PSA Carbonflor considers that an ecosystem fully covered by native vegetation cover is an environment conducive to the existence of important sources that generate Ecosystem Services. It also considers the mitigation of climate change as one of the objectives to be achieved with the application of PES projects.

Thus, since carbon storage is a primary EcS regarding climate change, the Methodology considers the conservation EnS as a precursor of the EcS encompassed in this ecosystem. By paying for this service of maintenance of native vegetation, the payer avoids the conversion of native ecosystems and its respective consequences (emissions, habitat loss, etc.), besides generating and increasing other EcS. Furthermore, forest degradation caused by climate change only tends to accelerate if there are no conservation efforts in rural properties.

Consequently, the conservation effort is responsible for maintaining and improving the EnS over time, and the application of a PES project in the properties contributes to the

mitigation of climate change through the various services listed throughout this Methodology.

A forest degradation factor was considered by comparing two future projections: the optimistic scenario versus the BAU or trend scenario for 2100 in relation to the impacts of climate change. That is, the improvement promoted in an optimistic scenario where the EcS are preserved is the result of this conservation effort, while in a BAU scenario the EcS are degraded by climate change, and we will not be able to achieve our climate chang mitigation golas, such as limitng global warming to 1.5ºC by the end of the century. Thus, the emission of C+ in 100 years is limited.

To define the degradation factor, we considered the Representative Concentration Pathways (RCPs) - a set of scenarios that cover ranges of radiative forcing values (difference between the solar radiation absorbed by the Earth and the returned radiated energy) for the year 2100, which are used in the modeling of climate change (Van Vuuren et al, 2011).[33] According to Popp et al, 2017[34], the vegetation cover in the optimistic scenario (RCP 2.6) would be 600 million hectares larger than the trend scenario, corresponding to 14.8% of the total coverage in 2020 (FAO, 2020).[35] That is, if nothing is done, there will be 15% less forest cover in the world than if all measures were taken to reduce climate change. But PES is a factor that directly contributes to claimate change mitigation, avoiding this forest cover loss. Thus, conservatively, the degradation factor related to Climate Change was defined as 10% in this version of PES Carbonflor.

In this context, to consider the contribution of PES projects to the climate change scenario, the PES Methodology develops Ecosystem Indicators that assist in the measurement of EcS, to convert them into carbon credits to (i) highlight the primary role of this EcS and (ii) insert them in the consolidated carbon market. The conversion is made with the equation:

Equation 18. Equation for converting EcS to C+.

$$C+ = \frac{Marketable\ Carbon\ (total)}{100}\ x\ Matrix\ of\ Ecosystem\ Indicators\ [\%]\ x\ Degrad.\ proj.\ CC\ [\%]$$

Where:

Table 38. Parameters for the conversion to carbon equation.

C +	=	Number of carbon credits generated annually by the project during its period that can be up to 100 years; tCO2e
Marketable Carbon (total)	=	Marketable Carbon Stock (total) of the Project Area to be converted into C+ [tCO2e], value estimated in item 5.5.1.
Matrix of Ecosystem Indicators[%]	=	Sum of the score determined in the item 5.3 of the Matrix of Ecosystem Indicators divided by the maximum score.
Degrad. proj. CC[%]	=	Degradation projection due to climate change - Estimated data of the difference in forest cover between realistic and trend scenario for 2100.

Through the formula presented above we can arrive at the amount of C+ (tCO_2e) that can be marketed per year, and which is directly related to the performance linked to the provision of EcS in each Project Area and limited by forest degradation estimated until 2100 due to climate change.

[33] Available at: https://link.springer.com/article/10.1007/s10584-011-0148-z
[34] Available at: https://www.sciencedirect.com/science/article/pii/S0959378016303399
[35] Available at: https://www.fao.org/3/ca8642en/ca8642en.pdf

It is important to note that shorter projects will only be able to sell a fraction of the credits, equivalent to the duration of the project and not the totality of the credits. A 30-year project will only be able to market 30% of the C+ stock for its entire duration.

5.7 PROJECT CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT (SDG)

To contribute systematically to climate change mitigations, this Methodology seeks to foster the Sustainable Development Goals (SDGs).[36] The following figure shows the SDGs.

Figure 4. Excerpted from United Nations – Sustainable Development Goals.

Therefore, the contributions of the project regarding the SDGs should be presented, listing them and demonstrating what actions will be carried out for the purposes of achieving the SDGs, as well as what the expected results are, in table format, as shown in Anexo III. example Table for the justification "Project Contributions to Sustainable Development"

It is important to emphasize that the PES project must contemplate at least the following SDGs: 13 (action against global climate change) and 15 (terrestrial life), as well as at least one SDG of social aspect, as selected in the table below.

Table 39. SDGs of social aspect.

1	No poverty
2	Zero hunger
3	Good health and well-being
4	Quality education
5	Gender equality
6	Clean water and sanitation
8	Decent work and economic growth
10	Reduced inequalities
11	Sustainable cities and communities
16	Peace, justice and strong institutions
17	Partnerships for the goals

[36] Available at: https://brasil.un.org/pt-br/sdgs

Any SDGs that are listed in the Table to be produced should be aligned with the conservation efforts of landowners, such as partnerships with universities for research, which could be associated with SDG 17. Actions of research, environmental education, social inclusion, and community participation in the defense of forests should be listed[37].

5.8 PROPERTY SELECTION CRITERIA

The eligibility criteria of the Methodology for the selection of properties that are candidates for participation in the project are:

i. Existence of conserved native vegetation, according to the biome;
ii. Properties containing only exotic vegetation are not eligible;
iii. Proof of completed registration at ECCON Data platform;
iv. No overlap with Fully Protected Conservation Units, according to the definitions outlined in Article 8 of Law No. 9,985/2000[38];
v. No overlap with the lands of traditional populations, such as indigenous peoples and quilombolas;
vi. History of vegetation cover of at least 10 years prior to PSA Carbonflor Adhesion;
vii. Documentation regularity according to items 5.8.1.
viii. Provision of owner's statement indicating that there is no overlap with another PES project (except for water PES) or carbon project in the Project Area.
ix. Verification of the existence of PES projects registered in the National Registry of Payment for Environmental Services (CNPSA), determined by Law No. 14,119/2021.

5.8.1 ELIGIBILITY CRITERIA

The eligibility criteria of the properties already selected are divided into (i) documentation criteria and (ii) location criteria, as shown in the table below. It must be demonstrated in the Report on methodology compliance (RMC), with a description of each document and proof of its regularity and applicability.

Table 40. Guidelines – eligibility criteria (documentation and location).

Documentation Criteria	
Documents of the holder	• Justify the applicability of this document. • Provide documents of the holders. If you are an individual, copy of the CPF/RG/CNH. If it is a company, the CNPJ and copy of the social contract. • Characterize them in the item 5.10.2.2.
CAR	• Justify the applicability of this document. • Present an extract of the CAR and, preferably, the shapefile used for the declaration. • Characterize them in the item 5.10.2.2.
Property Registration or	• Justify the applicability of this document. • Obtain, preferably, the registration issued no more than 90 days ago. If there is no registration, obtain transcription, term of possession or

[37] In a forthcoming review of the methodology, it is intended to quantify this effort and value it so that it is included in C+ accounting.
[38] As established by Law 14.119/2021, in its article 9, item III, the Private Reserves of Natural Heritage ("RPPNs") are eligible for environmental services in private properties, as well as the areas of buffer zones and ecological corridors covered by native vegetation, under the terms of Law No. 9,985, of July 18, 2000.

Term of Possession	other document that demonstrates, with legal certainty, the ownership of the property. • Characterize them in the item 5.10.2.2.
CCIR	• Justify the applicability of this document. • Provide updated CCIR. • Characterize them in the item 5.10.2.2.
Certificate of civil proceedings[39]	• Justify the applicability of this document. • Make the document available. • Characterize them in the item 5.10.2.2.
Certificate of criminal proceedings[40]	• Justify the applicability of this document. • Make the document available. • Characterize them in the item 5.10.2.2.
Certificate of municipal and state taxes[41]	• Justify the applicability of this document. • Make the document available. • Characterize them in the item 5.10.2.2.
Certificate of Debts of the Federal Revenue Service[42]	• Justify the applicability of this document. • Make the document available. • Characterize them in the item 5.10.2.2.
Certificate of Labor Processes[43]	• Justify the applicability of this document. • Make the document available. • Characterize them in the item 5.10.2.2.
Negative certificate of embargo of Ibama[44]	• Justify the applicability of this document. • Make the document available. • Characterize them in the item 5.10.2.2.
Location Criteria	
Overlap with Protected Areas	List the overlapping elements. The following are mandatory: • Cavities and caves • Geological site • Archaeological Sites • Indigenous Territories • Quilombola Territories • Protected Areas Characterize them in the item 5.10.2.2
PPA and LR	• Substantiate the applicability of PPAs and LRs in accordance with Law No. 14.119/2021 • Characterize them in the item 5.10.2.2
History of vegetation cover in the last 10 years	• Substantiate the investigation of the vegetation cover in the minimum period of 10 years prior to the beginning of the Valuation Period. • Characterize them in the item 5.10.2.2

It is noteworthy that among the documentation criteria, this Methodology requires at least the presentation of (i) Property Registration or Term of Possession and (ii) CAR, with the other documents mentioned above at the discretion of the proponent.

[39] This certificate demonstrates the absence of civil proceedings on behalf of a person or company. Issue in the Court of Justice of the State where the property is located.
[40] This certificate demonstrates the absence of criminal proceedings on behalf of a person or company. Issue in the Court of Justice of the State where the property is located.
[41] This certificate demonstrates the absence of tax and tax debts in the name of a person or company.
[42] This certificate demonstrates the absence of debts to the IRS in the name of a person or company. Issue on the IRS website.
[43] This certificate demonstrates the absence of labor lawsuits on behalf of a person or company. Issue in the Regional Labor Court where the property is located.
[44] The embargo, made by IBAMA, is a punitive and preventive practice to inhibit unauthorized deforestation, enabling the recovery of the ecosystem. The Negative Certificate is important to attest to the regularity in terms of vegetation suppression.

5.9 ADHESION AND VALUATION PERIOD

The Adhesion corresponds to the date where the landowner shows his commitment to the provision of the Environmental Service of conservation and others considered in the PES project, that is, the date of signature of the letter of intent[45]. When applying for PSA Carbonflor the Environmental Service provider must still sign a contract that begins its commitment to comply with the Methodology and determines the elaboration of reports regarding the Methodology.

The Valuation Period is the period in which the EcS will be measured and the EnS will be valued, which may be retroactive to the signing of a contract, limited to 5% of the Valuation Period, if there is formal and known evidence of activities aimed at interrupting deforestation, and of maintenance or increase of Ecosystem Services and the provision of Environmental Services. A retroactive date can be considered, which begins with reference to the first MR. It will be applicable in the measurement of EcS related to the carbon stock (see item 5.2.1).

In this case, the retroactive date may be considered for the accounting of carbon-oriented Ecosystem Services, thus being valid for counting the average carbon stock. The Valuation Period, which should have a minimum duration of 30 years and an ideal maximum of 100 years, is the period in which the monitoring of the EcS will occur.

5.9.1 PROJECT PERIODS

This is the duration of the project, for which payments will be made for the Environmental Services provided, according to the particularities of each type of project and the choice of the proponent.

Once the parameters presented in item 5.9 have been determined, the temporal variables adopted for the PES project under development should be described and justified.

Present the temporal information in table format as the example below.

Table 41. Project Period Example Table.

Dates	Valuation Period	Monitoring Period
Start Date	Beginning of the provision of proven environmental service, starting from the Date of Adhesion. (dd/mm/yyyy).	Date established by the proponent after the RMC has been completed (dd/mm/yyyy).
End Date	Minimum of 30 years and ideal maximum of 100 years after the date of adhesion. (dd/mm/yyyy)	Date of the end of the Valuation Period. (dd/mm/yyyy).

If the Valuation Period begins on the Adhesion date prior to the signing of the contract, i.e., retroactively, the Valuation Period is limited to the date of the beginning of the environmental commitment (Letter of Intent or other proof). Formal evidence also must be presented that addresses the retroactive start of EnS provision.

[45] The letter of intent is the signed commitment of conservation, either the means of document obtained with government agencies or obtained through the registration in ECCON Data.

5.10 PROJECT BOUNDARIES

It is necessary to define spatial boundaries for which the Ecosystem Service can be considered, and the Payment for Environmental Services accounted for. The table below guides the demonstration of such limits.

If the Project Area is composed of more than one property, the calculation of the Ecosystem Indicators may be done as a weighted average of the Ecosystem Indicators of each property, when applicable, or the properties may be grouped into a single polygon for which the Ecosystem Indicators will be calculated.

Table 42. Guideline table for delimitation of project spatial boundaries

Spatial Boundaries	
Project Area	• Present the documentary basis and coordinates that allowed the delimitation of the area (e.g., CAR, georeferenced registrations, descriptive memorial, etc.) • Present pertinent information that demonstrates the configuration of the Project Area to be considered. • Present a map characterizing the Project Area • Present characterization in the items of "Characterization of the Project Area" and "Project Boundaries" in the planned reports.
Native Vegetation Area	• Present the native vegetation cover inserted within the Project Area, discounting the alternative uses of the soil. • Present a map of phytophysiognomies/vegetation types present in the area. • Present characterization in the item "Project Boundaries" in the planned reports. • The database of phytophysiognomies/vegetation types must be recent and come from official primary or secondary sources (such as BDIA/IBGE).
Area of Influence	Delimitation of the Area of Influence must follow the instructions described in the item 5.10.1

5.10.1 AREA OF INFLUENCE

The Area of Influence will serve the purpose of creating a comparative region in the surroundings of the Project Area for verification of Ecosystem Indicators and consequent attribution of values to the EcS generated.

The delimitation of the Area of Influence must follow the following parameters:

i. Independently of the area of the project, a buffer of at least 1 km must be generated around the boundaries of the properties that make up the Project Area so that the buffer has an area at least proportionally equal to the Project Area;
ii. The rural properties registered in the SICAR platform[46] that are contained within or intersect the buffer generated according to item 'i' above must be selected.

The use of the Area of Influence for the calculations of each indicator will be specified in the respective items. The item corresponding to each indicator will indicate which configuration of the Area of Influence should be used for the relevant analyses, be it buffer, SICAR properties, or both.

[46] Available at: https://www.car.gov.br/#/

Areas of Influence obtained differently must be duly justified and accepted by the Methodology.

5.10.2 CHARACTERIZATION OF THE PROJECT AREA

This item guides the characterization of the Project Area to subsidize the following stages of development of the Methodology. This item guides the content of the Report on Methodology Compliance.

It is considered that the Project Area may be composed of areas belonging to more than one property, all of which must meet the eligibility criteria, and which together will configure the Project Area.

5.10.2.1 LOCATION

The location of the Project Area should be characterized according to the parameters indicated in the table below:

Table 43. Project Area location parameters.

Parameters	Description	Textual font
Biome	Point out biome(s) in which the Project Area is inserted.	Official and up-to-date government sources. Such as state platforms; IBGE; MMA and others.
Area name	Present the name(s) of the property(s) and ownership.	Real estate documentation provided by the Landowner.
Municipalities	Point out municipality(s) in which the Project Area is inserted.	Official and up-to-date government sources. Such as state platforms; IBGE and others.
Hydrography	Characterize the hydrographic region in which the Project Area is inserted. Mention watershed, management units, and waterways.	Official and up-to-date government sources. Such as state platforms; IBGE and others.
Socioeconomic	Characterize the socioeconomic region in which the Project Area is inserted. Mention predominant economic activities; economic indicators; and development indicators.	Official and up-to-date government sources. Such as state platforms; IBGE.

The cartographic products below must be presented, as appropriate. Cartographic sources should follow the same rigor as textual sources: verifiable, transparent data published by government entities, or peer-reviewed scientific articles.

- Location Map;
- Hydrography Map;
- Map of Socioeconomic Indicators.

The proponent may submit other maps as they consider appropriate.

5.10.2.2 COMPLIANCE WITH ELIGIBILITY CRITERIA

Describe and support how the Project Area meets each of the eligibility criteria listed in item 5.8.1. The table below guides the development of this item.

Table 44. Guideline for meeting eligibility criteria (documentary and location).

Documentary Criteria	
CAR	Provide a description of all relevant CARs. Mention area information, relevant dates, issuing body, among others, and any information that the Landowner(s) deems pertinent.
	Use documents provided by the Landowner, national source (SICAR), and state sources of CARs.
Property Registration	Present in table format, containing the name of the area (farm or property), what documentation is referenced, date of documentation, extent in hectares and the Landowner, as well as a column of pertinent observations;
Other documents	Please provide a description of all collected documents. Mention area information, relevant dates, issuing body, among others, and any information that the Landowner(s) deems pertinent.
Location Criteria	
Overlap with protected areas	Seek updated geospatial data from official sources, such as state and federal government platforms, CECAV, CPRM, IPHAN, FUNAI, INCRA, MMA, among others to perform the mandatory overlaps (listed below) and others selected by the proponent. • Cavities and caves • Geological sites • Archaeological Sites • Indigenous Lands • Quilombola Territories • Integral Protection Conservation Units
	Present cartographic products with the result of the overlaps and describe them.
PPA and LR	Present a description of identified PPAs and LRs relating to the identified properties and property registrations.
	Present cartographic products of the location of PPAs and LRs, when appropriate.
History of vegetation cover in the last 10 years	Through historical data of land use and occupation, present a comparative, using cartographic products, of the vegetation cover in the properties that compose the Project Area in the 10 years prior to the beginning of the Valuation Period.
	Use updated and official data sources such as state geospatial data platforms, IBGE, INPE, among other state and federal databases, as well as well-established reference databases such as Google Earth, MapBiomas, geoprocessing analysis of satellite images, among others.

In summary, the cartographic products below must be presented, as appropriate.

- Map of Overlap with protected areas;
- Map of PPA and LR;
- Comparative maps of historical land use in the 10 years prior to the beginning of the Valuation Period.

5.10.2.3 LAND USE AND LAND COVER

Describe how the land use and land cover occurs in the Project Area, according to the parameters shown below.

Table 45. Land use characterization parameters.

Parameters	Description
Use of Primary Data	Field survey or interviews of all points of interest that may affect the properties that will form the Project Area. Search geolocated data of each element.
Use of Secondary Data	Survey of all points of interest that may affect the properties that will form the Project Area through Satellite Imagery, Google Earth, MapBiomas and others.

The cartographic products below must be presented.

- Map of Land Use and Land Cover in the Project Area. (Containing all Land uses on the property(s) composing the Project Area, such as roads, buildings, open areas, protected areas, etc.).

5.10.2.4 FAUNA AND FLORA

In this item, the general environmental characteristics of the biotic environment of the Project Area should be presented, including attributes of the local fauna and flora. The data can be obtained according to the parameters below.

Flora

The characterization of the vegetation should take place through Primary Data, validated in the field, as well as through Secondary Data, through information contained in scientific articles of academic institutions and reference publications, and in official public databases. The characterization through Secondary Data should also include the support of remote sensing and geoprocessing techniques.

Below, the parameters that should be considered for the collection of Primary and secondary data regarding vegetation.

Table 46. Vegetation survey parameters.

Parameters	Description
Use of Primary Data	Field survey of all points of interest that may affect the properties that will form the Project Area. Search geolocated data of each element.
Use of Secondary Data	Raise all points of interest that may affect the properties that will form the Project Area through Satellite Imagery, Google Earth, MapBiomas and others.

Such characterization of the Project Area should contain, at a minimum, but not limited to, the attributes described in the table below.

Table 47. Vegetation characterization attributes.

Attributes	Description	Textual Source (Secondary Data)	Primary Data
Biome	Point out biome(s) in which the Project Area is inserted.	Official and up-to-date government sources, such as state platforms; IBGE; MMA and others.	Field validation through the observation of plant species and forest structure typical of the biome.
Phytophysiognomy	Characterize the phytophysiognomies/ vegetation types present in the Project Area.	Official and up-to-date government sources, such as state platforms; IBGE; MMA and others.	Field validation through the observation of plant species and forest structure typical of the biome and phytophysiognomy.
Ecological Succession Stage	Characterize the stage of ecological succession in the Project Area.	Satellite images, geoprocessing techniques and bibliographic references that can support successional stage estimation.	Field validation through the observation of plant species and forest structure typical of the biome and phytophysiognomy that indicate the ecological succession.
Degree of Conservation of Vegetation	Characterize the degree of conservation of vegetation in the Project Area.	Satellite images, geoprocessing techniques and bibliographic references that can support the estimation of the degree of conservation of the fragment, as well as the presence of risk factors (invasions, deforestation, fires, etc.)	Field validation through the observation of plant species and forest structure typical of the biome and phytophysiognomy that indicates the conservation of the fragment, including the presence of endemic and threatened species. Validation of disturbance factors.
Formation of continuous corridors of vegetation	Verify the continuity and connection of vegetation fragments, with a focus on identifying ecological corridors and their importance for the landscape of the region.	Satellite imagery and geoprocessing techniques that can support the estimation of the degree of conservation and continuity of the fragment and connections with adjacent fragments.	Field validation through the observation of the forest structure, continuity, and connection of the fragment, with support of drone and satellite images.

The characterization of the vegetation will have the purpose of providing a diagnosis about the vegetation interest area, focusing on recognizing the environmental health of the ecosystem and its protected conservation status, ensuring significant benefits to the climate, communities and biodiversity.

The following cartographic products should be presented, referring to the vegetation of the Project Area, as appropriate.

- Map of Biome and Phytophysiognomy;
- Land Use and Land Cover Map, including vegetation;
- Map containing Project Area and surrounding landscape, including identified potential disturbance factors.

Fauna

The characterization of the fauna should consider Secondary Data, through literature review in search of information contained in scientific articles, inventories, management plans, and other reference publications and in official databases such as Scielo and Google Scholar.

The search should be performed by taxonomic groups (mastofauna, herpetofauna, etc.), since most studies are conducted separately. To detect the regional fauna, one should look for information in the municipalities to which the Project Area belongs and neighboring municipalities, considering the similarity of habitat and vegetation types present in the surroundings.

A list of species of possible occurrence for the Project Area should then be presented, containing, minimally:

i. Scientific name;
ii. Popular name;
iii. Taxonomic classification;
iv. Threat status (based on national and global lists);
v. Consulted sources.

Furthermore, it is recommended to insert any other relevant information, concerning habitat, ecological function, trophic guild, and other ecological aspects of the species found.

Chance encounters with the local fauna during field-visits carried out *on site* by the Monitoring Agent should also be considered in the lists. Encounters with specimens of the fauna can be recorded occasionally during displacements, field expeditions and even through third parties (residents etc.) and can be considered as Primary Data. Such data should be incorporated into the list of species, provided that there is identification by a specialist. It is recommended to differentiate, in the list, this type of record as "occasional meeting" or "registration by third parties" when indicated by someone outside the project. In addition, if the property has carried out its own research or through partnerships with scientific institutions and/or researchers, the data obtained may be aggregated as primary data, if there is agreement of all parties.

5.10.2.5 DEVELOPED ACTIVITIES

Describe all the activities developed in the Project Area, minimally addressing:

- Economic activities;
- Cultural activities;
- Socio-environmental activities;

Official textual sources from government or from the landowner's accounts should be used. Present photographs, graphics and cartographic products as needed.

5.10.2.6 PROVIDED ENVIRONMENTAL SERVICES

Describe all the EnS provided in the Project Area, especially those related to forest conservation, addressing all the efforts of the Environmental Service Provider in the provision of these services.

Official textual sources from government or from owner's accounts should be used. Present photographs, graphics and cartographic products as needed.

5.11 METHODOLOGY DEVIATION

Describe and justify any methodological deviations applied to the project activity, providing evidence to demonstrate the following:

- The deviation does not have a negative impact on the conservative estimation and measurement of EcS and related indicators.
- The deviations refer only to the criteria and procedures of estimation, monitoring or measurement, and do not relate to any other part of the Methodology.

6 MONITORING

This item guides (i) the monitoring methods determined by the Methodology and (ii) the determinations of the Monitoring Plan that should compose the PES project.

6.1 MONITORING METHODS

It should be noted that regardless of the method selected for monitoring, it is necessary to adopt procedures and protocols of good practices, to gather comprehensive documentation of all measurements and data collection, processing, post-processing, classification and evaluation of the collected data. The procedures should be described and detailed enough to allow replication of the sampling, aiming at the control and quality assurance of data management.

6.1.1 MONITORING AGENT

The Monitoring Agent, with regard to environmental monitoring, has the function of collecting information on site that supports the development and verification of the Ecosystem Indicators and Ecosystem Services present in the Project Area.

Among the established functions are:

i. Sending georeferenced information, in text formats, forms, photographs, among others, that support the collection of data and monitoring of the Project Area.
ii. Provide information requested by the proponent for validation of the Biodiversity Indicators, according to the instructions of the item 5.2.6.
iii. Monitor the progress of the PES project and report the occurrence of disturbance events and Risks of Loss to the project.

6.1.2 REMOTE SENSING

Through GIS, remote sensing techniques can be used to monitor the Project Area throughout the Valuation Period, and also as support for the performed calculations of Ecosystem Indicators for validation of the EcS during the PES project.

The Remote Sensing assessment should follow the following guidelines:

Table 48. Remote sensing data used for RMC and MR.

Use of Data	
Satellite Images	The use of satellite images, with a resolution of 30 meters (LandSat or Sentinel), or higher, up to 2 meters (CBERS4A or others), allows specific analysis and calculations of fire events, change in land use, unscheduled vegetation suppressions, and identification of deforested areas. It also allows mapping and the use of tools that cover vegetation indices, such as Normalized Difference Vegetation Index ("NDVI") and Enhanced Vegetation Index ("EVI"), among other techniques that can be applied together for a comprehensive analysis of the area.
Secondary Data	Remote sensing techniques can be combined with Secondary Data from projects made available by official agencies, such as INPE, IBGE, MapBiomas, SOS Mata Atlântica, among others, for better correspondence and detection of events that may occur in the area in a more realistic way.
Drones	Drones with high-resolution RGB cameras can be used to monitor vegetation cover, being an important tool for analysis of large areas and / or remote areas and of difficult access. Furthermore, when associated with lidar sensors, which emit laser beams in the near-infrared (IR) band, they make it possible to model the surface of the terrain three-dimensionally and quantify the tree biomass, favoring the estimates of forest carbon stock.
Application	
Monitoring of forest cover in the Project Area	This is surveillance monitoring. Remote Sensing assists in the verification of adverse events that generate changes in land use, forest cover, and any disturbance that generates impact on carbon storage. This monitoring should be carried out periodically by the proponent, who should store this information to report in the next MR.
Monitoring the Risks of Loss	This is surveillance monitoring. Remote Sensing assists in the verification of possible land use conversion displacements in the surroundings of the properties that make up the Project Area. This monitoring should be carried out periodically by the proponent, who should store this information to report in the next MR.

6.1.3 FOREST INVENTORY

If the forest inventory method has been adopted in the Carbon Stock Estimate, the proponent may consider the same sampling design (allocation of plots) for the monitoring events.

See the method in item 5.2.1.2.2.1 of this Methodology.

6.1.4 DEMONSTRATION OF NON-DECREASE METHOD

The non-decrease demonstration method is based on the approaches suggested by the IPCC, and procedures, methodologies and tools approved by the UNFCCC, more specifically, the methodological tool *AR-TOOL14 - Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, Version 04.2.*[47]

This method is considered efficient when there is a need to present a Monitoring and Certification Report at a time when the increase in biomass in the project since the previous verification may not be large enough to justify the cost of conducting a forest inventory.

Thus, the Methodology applies the method of "demonstration of non-decrease" to establish the Carbon Stocks in the monitoring events of the Project Area, assuming that all the analyses and estimates of the Carbon Stock, in the pools under verification, will be conducted through good monitoring practices, within the 90% confidence interval, as well as the estimates at time zero.

In this monitoring method, each phytophysiognomy/vegetation type identified in the Project Area should be considered as a stratum. For each stratum where the revisited estimate is within the 90% confidence interval in relation to the RMC estimate (t=0), the initial inventory estimate will take precedence and can be considered the same.

In strata whose revisited estimate is outside (i.e., greater than or less than) the 90% confidence interval with respect to the RMC estimate (t=0), the new inventory estimate takes precedence and will be used for the subsequent period.

This method is applicable only in the estimates directed to the monitoring of the Project Area. It is possible to demonstrate that the biomass of trees in one or more strata did not decrease in relation to the biomass of trees estimated in the AR. To verify the hypothesis, it must be considered that:

i. No logging has occurred in the strata since the previous estimate;
ii. The strata were not affected by any disturbance (e.g., pest, fire) that could decrease the carbon stock in the trees;
iii. The treetop cover in the strata has remained the same since the previous estimate.

For analysis and confirmation of the listed conditions, remote sensing techniques applied to each case or event may be used, allowing for spatial analysis integrated with other Secondary or Primary Data.

Once the three conditions in the Project Area have been confirmed, the non-decrease method can be considered valid.

For demonstration, all monitoring reports must prove such criteria.

[47] A/R Methodological tool. **Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities.** Version 04.2. UNFCCC. Available at: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.2.pdf

The "demonstration of non-decrease" method will take precedence during the execution of the monitoring periods, since it can substantially reduce the cost of collecting sample data necessary to achieve a level of uncertainty within the desired limit for the estimates of the carbon stock in the Project Area.

As for the validation of the estimates of the stocks of biomass above and below ground (tree biomass) by the method of demonstration of non-decrease, then the other carbon pools can be considered to follow the same trend due to the correlation between them.

If the criteria listed for the application of the non-decrease method are not met, the deduction calculations equivalent to the RMC Stock calculations will be applied for all pools.

6.2 MONITORING PLAN

The objective of the Monitoring Plan is for the proponent to select the methods for monitoring the evolution of the Ecosystem Indicators during the Valuation Period of the project in the Project Area and, thus, to verify the effectiveness of the provision of Environmental Services.

Project Area monitoring encompasses ongoing activities to monitor the area to detect land use change or occurrences of disturbances such as fire, vegetation suppressions, or other activities that may influence the quantification of EcS over time.

The Ecosystem Indicators will be subject to periodic verification, carried out through targeted methods, to integrate the Monitoring Plan.

The process and timeline that will be adopted by the proponent for the monitoring of Ecosystem Indicators during this monitoring period should be described, including details on the following:

- The organizational structure, responsibilities and competencies of the personnel who carried out the monitoring activities;
- The methods used to measure, record and store data on monitored parameters;
- The procedures used for the handling of any internal audit carried out and any identified non-conformities;
- The implementation of sampling approaches, including levels of accuracy achieved, sample sizes, location of sample plots, stratification, and frequency of measurement;
- Where applicable, demonstrate that the required level of confidence or accuracy has been met;
- Where applicable, the functions and reports of the Monitoring Agent(s).

The table below presents the monitoring modules that must be carried out in PSA Carbonflor, when applicable, as well as the responsible parties. It is noteworthy that monitoring is mandatory and results in the MR.

Table 49. PSA Carbonflor Monitoring Guideline.

Monitoring	Activity	Periodicity	Report
Monitoring the Implementation of the PES Project	Surveillance and Verification	Constant	MR
Vegetation Cover Monitoring	Surveillance	Annual	

Monitoring	Activity	Periodicity	Report
Risk of Loss Monitoring	Surveillance	Annual	
Monitoring of changes in Ecosystem Indicators	Verification of the values obtained	1 to 5 years	

- **Monitoring the Implementation of the PES project:** Continuous monitoring of the internal processes and operations of management of the property(s) that make up the Project Area. Prevention and reporting of deforestation events or other occurrences of disturbances found by the team on site to the management team of PSA Carbonflor, for proper records and methodological calculations. Include evidence in the Monitoring Report.
- **Monitoring of vegetation cover:** Annual monitoring through geoprocessing techniques to verify changes in the coverage of native vegetation in the Project Area. Include evidence in the Monitoring Report.
- **Risk of Loss Monitoring:** Annual monitoring through geoprocessing techniques to investigate possible risks and threats to EnS. Include evidence in the Monitoring Report.
- **Monitoring of changes in Ecosystem Indicators:** measurement of Ecosystem Indicators, applying one or a combination of the monitoring methods presented in item 6.1. After the execution of the monitoring activities, the results should be reported in the MR, together with the other monitoring modules.

In this item, it is necessary to list the monitoring to be carried out, the monitoring activities, the periodicity and to name those responsible. Present in table form, as shown above. Each monitoring module follows the appropriate monitoring method and is guided by this Methodology.

6.3 VERIFICATION OF ECOSYSTEM AND ENVIRONMENTAL SERVICES

Item regarding the results of the Monitoring Plan. Evidence of the results obtained through the monitoring of Ecosystem Indicators and the provision of Environmental Services in the Project Area should be described and provided.

All monitoring methods that the proponent deems necessary and appropriate, according to guidelines made throughout the Methodology, should be used to demonstrate the results pertinent to the monitoring period in question. The results shall be duly demonstrated and justified.

This item guides the elaboration of the Monitoring Report, whose instructions are indicated in item 7.1.3.

The importance of describing any occurrence that interferes with the project is highlighted, such as:

- Information on events that may impact carbon storage and the generation of other EcS;
- Where applicable, describe how project risk factors, including those related to Risk of Loss, are being monitored and managed by the project;
- Any other changes (e.g., for project proponents and other interested parties).

7 PRODUCTS OF THE METHODOLOGY

Two types of reports are expected during the project period: Report on methodology compliance (RMC), Monitoring Report (MR). In the event that the RMC is delivered together with the MR, in the first monitoring period, a Report on methodology compliance and Monitoring Report (RMCAR) can be delivered, which is the combination of the RMC and MR, minimizing the duplication of efforts to describe the Project Area.

Table 50. Products of the Methodology.

Report	RMC	MR	RMCMR
Description	Methodology application report determining (i) characterization, (ii) measurement criteria and (iii) monitoring methodology	Report that reaffirms the adequacy of the assumptions determined in the RMC and attests to the results of the periodic monitoring.	Report that includes the combination of the RMC and the result of the first monitoring and its respective MR for cases in which there is valuation prior to the signing of the contract.
Frequency	N.A.	Intervals of 1 to 5 years, according to the suitability identified by the proponent from the **issuance of the RMC.**	N.A.
Condition	The document must be produced **after the signing of commitment with the PES through a contract** and may consider the valuation since the Adhesion to the PES, limited to a period corresponding to 5% of the Valuation Period.	It can only be issued after the RMC, when monitoring activities are performed for a given period.	The simultaneous occurrence is only possible when there is a valuation prior to the signing of the contract to be accounted for in the first RMC.

The verification of adequacy to the Methodology is the independent evaluation of the project by the regulatory and managing institution of PSA Carbonflor (ECCON) that determines whether the project complies with the rules and guidelines established by the PSA Carbonflor Methodology. In turn, monitoring is the periodic, independent evaluation of the Ecosystem Indicators, EcS and EnS that occurred as a result of project activity during a given period.

The Monitoring Report can only be prepared after the first follow-up event, executed in accordance with the rules and guidelines established by the Methodology.

7.1.1 GENERAL REQUIREMENTS

Below are listed general and specific requirements for the reports:

i. Adequacy to the methodology can occur before the first monitoring or at the same time as the first monitoring. The product will be a Report on methodology compliance and Monitoring Report (RMCAR).

ii. The applicable report must clearly evidence possible material errors, omissions, and false statements, both for compliance with the Methodology and for monitoring.
iii. The materiality threshold with respect to associated error, omissions, and misrepresentations relative to the total reported measured EcS should be five percent (5%) for small projects and one percent (1%) for large projects.
iv. When a Landowner or a Project Area presents a scenario of deviation from the Methodology, its immediate exclusion is necessary or, if there is sufficient technical, legal, and methodological basis, the Methodology can be revised.

7.1.2 REPORT ON METHODOLOGY COMPLIANCE (RMC)

The Report on Methodology Compliance (RMC) is the document that will describe a project carried out in a Project Area, based on the PSA Carbonflor Methodology.

An executive summary should be presented at the beginning with the most important information of the Project.

7.1.2.1 RMC CONTENTS

The RMC must have the items described in the table below, which are presented in the following items.

Table 51. RMC Contents.

Item	Description
Introduction	Brief description of the project and its objectives, according to the scope of generation of Ecosystem Services through the provision of the Environmental Service of conservation of PSA Carbonflor.
PSA Carbonflor Guidelines	Reiterate, when applicable, the guidelines set for the purpose of contextualizing the project. See item 4
Proponent	Present the company or organization responsible for the preparation of the RMC, following the guidelines of the Methodology.
Involved entities	It should contain a description of any companies and/or organizations involved in the RMC in the modalities of: i. financing; ii. elaboration of technical parts; iii. offering products.
Strategic Audience	It must define which people or interest groups will be impacted and may impact actions that take place before, during and after the implementation of the Project.
Project Contribution to Sustainable Development	In the context of climate change mitigation proposed by the Methodology, list and describe the contributions of the project, according to the instructions of the item 5.7.
Definitions of Methodology Eligibility Criteria	According to the instructions of item 5.8.1, the proponent must list and justify the eligibility criteria adopted in accordance with legislation and standards.
Project Periods	According to the instructions of item 5.9, specifically 5.9.1, describe and justify the parameters that determine the periods considered in the PES project under development.
Project Boundaries	According to the instructions of item 5.10, describe and characterize the pertinent project boundaries. • Project Area • Native Vegetation Area • Area of Influence

Item	Description
Characterization of the Project Area	According to the instructions of item 5.10.2, characterize the Project Area and its particularities to contextualize the area of application of the PES project. Detail the sub-items: i. Location ii. Meeting the eligibility criteria iii. Land Use and Land Cover iv. Fauna and Flora v. Developed Activities vi. Environmental Services Provided
Ecosystem Services	According to the instructions given in items 5.1.1 and 5.1.2, discuss the EcS that will be selected by the proponent and that contemplate the Project Area.
Selected Ecosystem Indicators	According to the instructions in item 5.2, select the Ecosystem Indicators and justify the choice of each.
Monitoring Plan	According to instructions of the items 6, 6.1, and 6.2 determine the monitoring methods and methodology for the monitoring plan that will be applied in future Monitoring Reports (MR).
Appendices and Annexes	As necessary, the proponent shall include appendices and annexes relating to the project.

7.1.3 MONITORING REPORT (MR)

The Monitoring Report (MR) is the document that will describe the results obtained by the project carried out in a Project Area, based on the Methodology and the determinations established by the proponent in the respective AR.

An executive summary should be presented at the beginning with the most important information of the Project.

7.1.3.1 MR CONTENTS

The Monitoring Report should include the items described in the table below, which are presented in the following items.

Table 52. MR Contents.

Item	Description
Summary	Brief description of the project and its objectives according to determinations established in the AR, containing, minimally: relevant references used, indication of the location of the area, biome to which it belongs and other pertinent information that contextualizes the project.
Monitoring Period	Indicate the monitoring period that will be described in the report, in which the activities were developed and the EnS are being verified.
Verification of Ecosystem Indicators	The Ecosystem Indicators selected in the RMC should be developed and evaluated to obtain the score of the Project Area during the monitoring period evaluated, according to the instructions contained in items 5.2.1 and 5.2.6. Also observe the instructions in item 6.3.
Matrix of Ecosystem Indicators	After the description and demonstration of the Ecosystem Indicators, the Matrix of Ecosystem Indicators should be presented in this item to summarize the scores of all indicators and normalize the scores for future C+ calculations, according to the instructions in item 5.3.
Verification of Environmental Services	Item to demonstrate the results of monitoring and verification that the provided EnS were effective.

Item	Description
	The proponent must find the best way to present the results of the Monitoring Plan (item 6.2) determined in the AR. Also observe the instructions in item 6.3. This item must include any influences of Risks of Loss according to Methodology (see item 5.4)
Safety Reserve	Determination of the percentage of carbon stock defined by the project to make up the Safety Reserve, through the analyses described in item 5.5. Perform the appropriate carbon stock discounts according to the guidelines of the Methodology (see item 5.5.1).
Conversion to C+	In this section the following topics will be analyzed: the data resulting from the analysis of the indicators, the conversion into carbon, the deduction of losses and Safety Reserve (when applicable) and the final stock of C+ of the project in the monitoring period.
Final Estimates	After all calculations and conversions pertinent to the Methodology determinations, the proponent must present the final C+ values corresponding to the monitoring period referred to in the report in question.
Deviation from Methodology	When applicable, describe the methodological deviations adopted by the project, as well as the justification for the changes and the expected impacts (positive and negative) in the face of the deviation adopted, according to the instructions in item 5.11.
Conclusions	Considerations regarding the results obtained in the considered monitoring period.
Appendices and Annexes	As necessary, the proponent shall include the appendices and annexes relative to the project.

7.1.4 REPORT ON METHODOLOGY COMPLIANCE AND MONITORING REPORT (RMCAR)

If the Report on Methodology Compliance and Monitoring Report is applicable, the proponent may make a single report (RMCMR).

7.1.4.1 RMCAR CONTENTS

The RMCAR must have the items described in the table below, which are presented in the following items.

Table 53. RMCAR Contents.

Item	Description
Report on Methodology Compliance	Establish the division of RMC items.
Introduction	Brief description of the project and its objectives, according to the scope of generation of Ecosystem Services through the provision of the Environmental Service of conservation of PSA Carbonflor.
PSA Carbonflor Guidelines	Reiterate, when applicable, the guidelines set for the purpose of contextualizing the project. See item 4
Proponent	Present the company or organization responsible for the preparation of the RMC, following the guidelines of the Methodology.
Entities involved	It should contain a description of any companies and/or organizations involved in the RMC in the modalities of: iv. financing; v. elaboration of technical parts; vi. offering products.
Strategic Audience	It must define which people or interest groups will be impacted and may impact actions that take place before, during and after the implementation of the Project.

Item	Description
Project Contribution to Sustainable Development	In the context of climate change mitigation proposed by the Methodology, list and describe the contributions of the project, according to the instructions of item 5.7.
Definitions of Methodology Eligibility Criteria	As per instructions in item 5.8.1, the proponent must list and justify the eligibility criteria adopted in accordance with legislation and standards.
Project Periods	According to the instructions in item 5.9, specifically 5.9.1, describe and justify the parameters that determine the periods considered in the PSA project under development.
Project Boundaries	According to the instructions in item 5.10, describe and characterize the pertinent project boundaries. • Project Area • Native Vegetation Area • Area of Influence
Characterization of the Project Area	According to the instructions in item 5.10.2, characterize the Project Area and its particularities to contextualize the area of application of the PES project. Detail the sub-items: vii. Location viii. Meeting the eligibility criteria ix. Land Use and Land Cover x. Fauna and Flora xi. Developed Activities xii. Environmental Services Provided
Ecosystem Services	According to the instructions given in items 5.1.1 and 5.1.2, discuss the EcS selected by the proponent that contemplate the Project Area.
Selected Ecosystem Indicators	According to the instructions in item 5.2 and 5.3, select the Ecosystem Indicators and justify the choice of each.
Monitoring Plan	According to instructions of items 6, 6.1 and 6.2, determine the monitoring methods and methodology for the monitoring plan that will be applied in future Monitoring Reports (MR).
Monitoring Report	Establish the division of MR items.
Monitoring Period	Indicate the monitoring period that will be described in the report, in which the activities were developed and the EnS are being verified.
Verification of Ecosystem Indicators	The Ecosystem Indicators selected in the RMC should be developed and evaluated to obtain the score of the Project Area during the monitoring period evaluated, according to the instructions contained in items 5.2.1 and 5.2.6. Also observe the instructions in item 6.3.
Matrix of Ecosystem Indicators	After the description and demonstration of the Ecosystem Indicators, the Matrix of EcS Indicators should be presented in this item to summarize the scores of all indicators and normalize the scores for future C+ calculations, according to the instructions in item 5.3.
Verification of Environmental Services	Item to demonstrate the results of monitoring and verification that the provided EnS were effective. The proponent must find the best way to present the results of the Monitoring Plan (item 6.2) determined in the AR. Also observe instructions in item 6.3. This item must include any influences of Risks of Loss according to Methodology (see item 5.4)
Safety Reserve	Determination of the percentage of carbon stock adopted by the project to make up the Safety Reserve, through the analyses described in item 5.5. Perform the appropriate carbon stock discounts according to the guidelines of the Methodology (see item 5.5.1).
Conversion to C+	In this section the following topics will be analyzed: the data resulting from the analysis of the indicators, the conversion into carbon, the deduction of losses and Safety Reserve (when applicable) and the final stock of C+ of the project in the monitoring period.
Final Estimates	After all calculations and conversions pertinent to the determinations of the Methodology, the proponent must present the final C+ values corresponding to the monitoring period treated in the report in question.

Item	Description
Deviation from Methodology	When applicable, describe the methodological deviations adopted by the project, as well as the justification for the changes and the expected impacts (positive and negative) in the face of the deviation adopted, according to the instructions in item 5.11.
Conclusions	Considerations regarding the results obtained in the monitoring period considered.
Appendices and Annexes	As necessary, the proponent shall include the appendices and annexes relating to the project.

8 REFERENCE LEGISLATION

For the elaboration of the Methodology, the rules and definitions brought by the following norms are considered:

- Reports of the Intergovernmental Panel on Climate Change – IPCC;
- Base text of the United Nations Framework Convention on Climate Change – UNFCCC.

Other references to legislation can be seen in the Table 54.

Table 54. Reference legislation

Norm	Summary
Law No. 12,187/2009	Establishes the National Policy on Climate Change – PNMC.
Decree No. 9,578/2018	Consolidates normative acts issued by the federal Executive Branch that provide for the National Fund on Climate Change, which is addressed by Law No. 12,114, of December 9, 2009, and the National Policy on Climate Change, which is addressed by Law No. 12,187, of December 29, 2009.
Decree No. 10.144/2019	Establishes the National Commission for the Reduction of Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Increase of Forest Carbon Stocks – REDD+.
MMA Ordinance No. 288/2020	Establishes the National Program for Payments for Environmental Services – Floresta+, under the Ministry of the Environment.
MMA Ordinance No. 518/2020	Establishes the Forest+ Carbon modality.
Law No. 14.119/2021	Establishes the National Policy for Payment for Environmental Services (PES).
Decree No. 10,828/2021	Regulates the issuance of a Rural Product Certificate, related to the activities of conservation and recovery of native forests and their biomes, which is addressed in item II of § 2 of article 1 of Law No. 8,929, of August 22, 1994.
Decree No. 11.550/2023	Provides for the Interministerial Committee on Climate Change.
Acre – State Law No. 2,308/2010	Creates the State System of Incentives for Environmental Services – SISA, the Program of Incentives for Environmental Services – ISA Carbono and other Programs of Environmental Services and Ecosystem Products of the State of Acre and provides other measures.
Acre – State Law No. 2.025/2008	Creates the State Program for Certification of Family Productive Units of the State of Acre.
Bahia – State Law No. 13,233/2015	Establishes the State Policy for Payment for Environmental Services, the State Program for Payment for Environmental Services and provides other measures.

Norm	Summary
Federal District – Law No. 5,955/2017	Establishes the District Policy on Payments for Environmental Services and the District Program for Payment for Environmental Services.
Espírito Santo – State Law No. 9,864/2012	Provides for the reformulation of the Program for Payment for Environmental Services and PES in the State established by Law No. 8,995/2008.
Espírito Santo - SEAMA Ordinance No. 20-R/2013	It provides for the rules for the recognition of land use modalities as generators of environmental services that can receive rewards and/or financial support and the criteria and percentages of bonuses.
Goiás – State Decree No. 9,130/2017	It provides for the State Program for Payment for Environmental Services – PEPSA – and provides other measures.
Goiás – State Law No. 18.104/2013	It provides for the protection of native vegetation, establishes the new Forest Policy of the State of Goiás and provides other measures.
Maranhão - State Law No. 11,578/2021	Establishes the Policy for the Reduction of Greenhouse Gas Emissions from Deforestation and Forest Degradation, Forest Conservation, Sustainable Forest Management and Increase of Forest Carbon Stocks (REDD+), Environmental Asset Management and Payments for Environmental Services (PES) of the State of Maranhão, called the REDD+ and PES Jurisdictional System.
Mato Grosso – State Law No. 9,878/2013	Creates the State System for Reducing Emissions from Deforestation and Forest Degradation, Conservation, Sustainable Forest Management and Increasing Forest Carbon Stocks – REDD+ in the State of Mato Grosso and provides other measures.
Mato Grosso – State Law No. 8,580/2006	It provides for the state policy to support projects for the generation of carbon credits and provides other measures.
Mato Grosso do Sul – State Law No. 5,235/2018	It provides for the State Policy for the Preservation of Environmental Services, creates the State Program for Payment for Environmental Services (PESA), and establishes a Management System for this Program.
Mato Grosso do Sul – SEMAGRO Resolution No. 717/2020	Establishes the PES Program - modality Multiple Use Scenic Rivers of Payment for Environmental Services to encourage the conservation of native vegetation, ecological restoration and the adoption of sustainable production systems in rural properties.
Minas Gerais – State Decree No. 45.229/2009	Regulates measures of the Public Power of the State of Minas Gerais regarding the fight against climate change and management of greenhouse gas emissions and provides other measures.
Minas Gerais – State Law No. 20.922/2013	It provides for forest policies and biodiversity protection in the State.
Minas Gerais - IEF Ordinance No. 28/2020	Establishes guidelines for registration of planting and harvesting of forests planted with native and exotic species in the State of Minas Gerais.
Minas Gerais – State Decree No. 48.127/2021	Regulates, in the State, the Environmental Regularization Program, provided for in Federal Law No. 12,651, of May 25, 2012, and in Law No. 20,922, of October 16, 2013, and provides other measures.
Paraíba – Ordinary Law n° 10.165/2013	It provides for the State Policy for Payment for Environmental Services, authorizes the establishment of the State Fund for Payment for Environmental Services, and provides other measures.
Paraná – State Law No. 17.134/2012	Establishes the Payment for Environmental Services, especially those provided by the Biodiversity Conservation, part of the Paraná Bioclimate Program, as well as provides for Biocredit.
Paraná – SEMA Resolution No. 80/2015	Establishes guidelines and standards for the execution of Payment for Environmental Services projects for Private Natural Heritage Reserves (RPPN) in the State of Paraná.

Norm	Summary
Pernambuco – State Law No. 15,809/2016	Establishes the State Policy for Payment for Environmental Services, creates the State Program for Payment for Environmental Services and the State Fund for Payment for Environmental Services.
Rio de Janeiro – Resolution CERHI nº 227/2020 Rio de Janeiro – State Law No. 5,690/2010	It provides for the State Register of Payment for Environmental Services – PRO-PSA. Establishes the State Policy on Global Climate Change and Sustainable Development.
Rondônia – State Law No. 4,437/2018	Establishes the State Policy of Climate Governance and Environmental Services - PGSA and creates the State System of Climate Governance and Environmental Services - SGSA, within the State of Rondônia and provides other measures.
Santa Catarina – State Law No. 15.133/2010	Establishes the State Policy of Environmental Services and regulates the State Program of Payment for Environmental Services in the State of Santa Catarina, established by Law No. 14,675/2009.
São Paulo – Resolution SMA nº 89/2013	Establishes the guidelines for the execution of the Project of Payment for Environmental Services for the Private Reserves of Natural Heritage – RPPN, within the scope of the Forest Remnants Program.
São Paulo – SMA Resolution No. 86/2017	Establishes the Project of Payment for Environmental Services for the Protection of Native Vegetation – PSA PROTEÇÃO, within the scope of the Climate and Biodiversity in the Atlantic Forest Project.
São Paulo – State Law No. 13,798/2009	Establishes the State Policy on Climate Change - PEMC.
São Paulo – Decree No. 66,549/2022	Regulates the application, within the State of São Paulo, of Federal Law No. 14,119, of January 13, 2021, establishes the State Policy for Payment for Environmental Services - PEPSA, the State Program for Payment for Environmental Services - PPSA and the State Registry of Payment Projects for Environmental Services.

ANNEX I. TABLE OF EXAMPLE OF ECS FROM THE CICES CLASSIFICATION

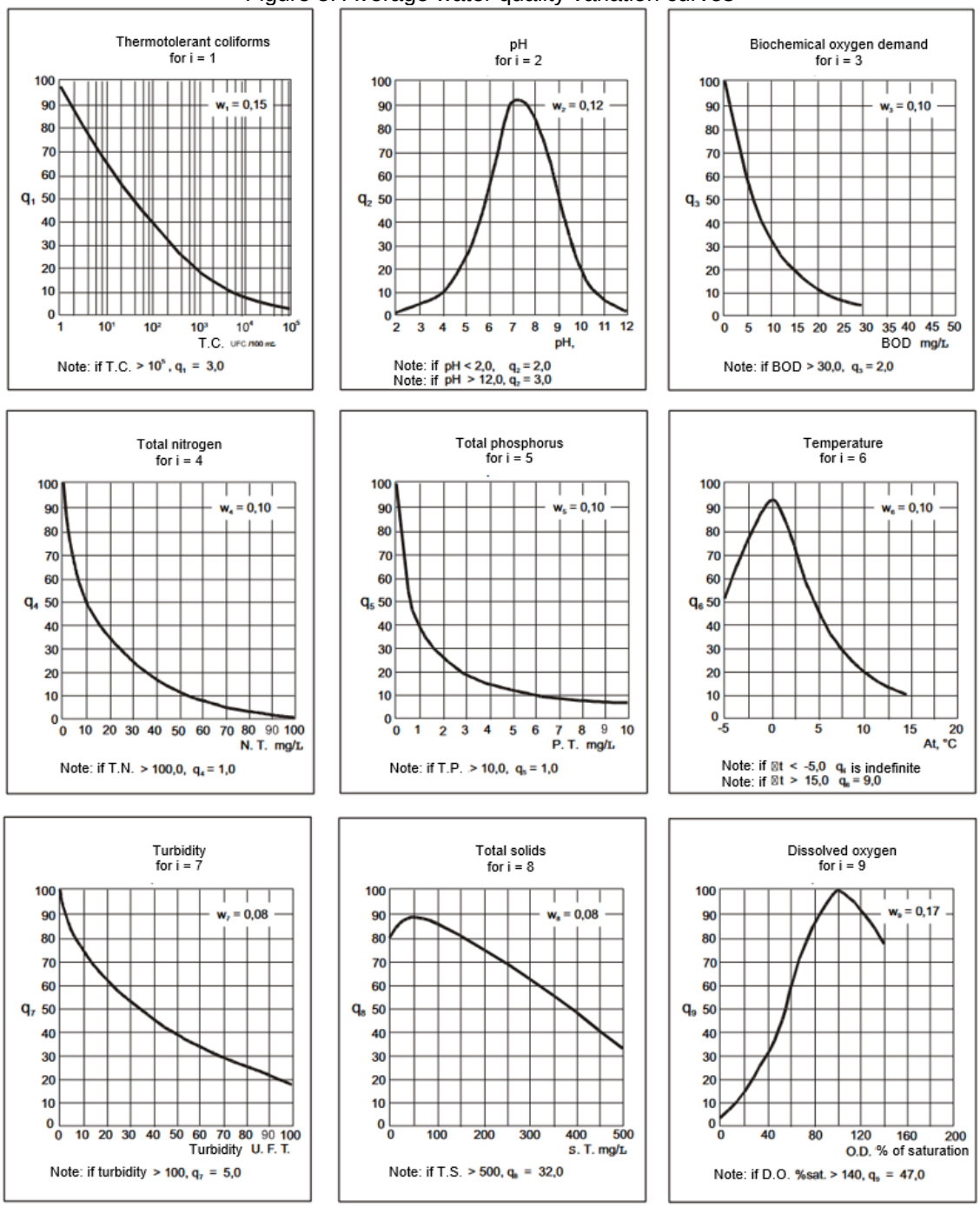
Table 55. Example table of EcS from the CICES classification

Section	Division	Group	Class	*Description of the SE*	*Example of gain*
Provisioning	Genetic material from all biota (including seed, spore or gamete production)	Genetic material from plants, algae or fungi	Seeds, spores and other plant materials collected for maintaining or establishing a population	Seed collection	Seeds or spores that we can harvest
			Higher and lower plants (whole organisms) used to breed new strains or varieties	Plants. fungi or algae that we can use for breeding	Population of plant algae or fungi species used to in breeding programs
			Individual genes extracted from higher and lower plants for the design and construction of new biological entities	Genetic material from wild plants. fungi or algae that we can use	Harvestable share of population of plant species used to extract genes
		Genetic material from animals	Animal material collected for the purposes of maintaining or establishing a population	Animals used for replenishing stock	Spat for fish and shellfish farms
			Wild animals (whole organisms) used to breed new strains or varieties	Wild animals that we can use for breeding	Population of animals used in breeding programs
		Genetic material from organisms	Individual genes extracted from organisms for the design and construction of new biological entities	The genetic information that is stored in wild animals that we can use	Harvestable share of population of a given species used to extract genes
Regulation	Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Control of erosion rates	Controlling or preventing soil loss	The capacity of vegetation to prevent or reduce the incidence of soil erosion Or Macroalgae, microphytobenthos, macrophytes and biogenic reef structures (epifauna and infauna) all contribute through sediment stabilization
			Buffering and attenuation of mass movement	Stopping landslides and avalanches harming people	The capacity of forest cover to prevent or mitigate the extent and force of snow avalanche
			Hydrological cycle and water flow regulation (Including flood control, and coastal protection)	Regulating the flows of water in our environment	The capacity of vegetation to retain water and release it slowly, among others

		Lifecycle maintenance, habitat and gene pool protection	Pollination (or 'gamete' dispersal in a marine context)	Pollinating our fruit trees and other plants	Providing a habitat for native pollinators
			Seed dispersal	Spreading the seeds of wild plants	Acorn dispersal
			Maintaining nursery populations and habitats (Including gene pool protection)	Providing habitats for wild plants and animals that can be useful to us	Important nursery habitats include estuaries, seagrass, kelp forest, wetlands, soft sediment, hard bottom, shell bottom and water column habitats. Floating seaweed clumps (macroalgae) form rafts under which juvenile fish aggregate e.g., in the North Sea in pelagic habitats
		Regulation of soil quality	Weathering processes and their effect on soil quality	Ensuring soils form and develop	Inorganic nutrient release in cultivated fields
			Decomposition and fixing processes and their effect on soil quality	Ensuring the organic matter in our soils is maintained	Decomposition of plant residue; N-fixation by legumes
		Atmospheric composition and conditions	Regulation of chemical composition of atmosphere and oceans	Regulating our global climate	Sequestration of carbon in tropical peatlands
			Regulation of temperature and humidity, including ventilation and transpiration	Regulating the physical quality of air for people	Evaporative cooling provided by urban trees
Provisioning	Water	Surface water used for nutrition, materials or energy	Surface water for drinking	Drinking water from sources at the ground surface	Volume and characteristics of water from a natural spring
			Surface water used as a material (non-drinking purposes)	Surface water that we can use for things other than drinking	Temperature and volume of water that can be used for cooling or irrigation
			Freshwater surface water used as an energy source	Hydropower	Hydraulic potential (Head)

ANNEX II. AVERAGE WATER QUALITY VARIATION CURVES

Figure 5. Average water quality variation curves



Source: CETESB, 2021[48]

[48] Available at: https://cetesb.sp.gov.br/wp-content/uploads/sites/12/2022/11/Apendice-E-Indices-de-Qualidade-das-Aguas.pdf

ANEXO III. EXAMPLE TABLE FOR THE JUSTIFICATION "PROJECT CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT"

Table 56. Example table for the justification "Project Contributions to Sustainable Development"[49]

SDG[50]	Description	Project Contributions	Expected results
13 – Climate Action	13.3 Improve education, increase awareness and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Implementation of biannual programs and workshops with the local community of the PES Project region. Dissemination of the Project and its category, with clarification of the doubts of the local population. Local monitoring agents program.	Expand the knowledge of the regional population on the modality of financial return for the conservation of vegetation. Awareness of the urgency of climate action. Reduction of the displacements of the Project developers in the field. Reduction of the carbon footprint in the monitoring stage.
1 – No Poverty	1.5 – By 2030, build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to extreme climate-related events and other economic, social, and environmental shocks and disasters.	The Project aims to insert conservation landowners in the forest carbon market, consequently increasing the income of landowners who, in the past, had no direct monetary gain for the conservation of their areas. From the conservation of forests, the maintenance of the local climate is guaranteed, preventing events such as erosions and landslides from occurring.	Increased income of conservationist landowners. Protect, through the maintenance of forests, vulnerable communities from extreme weather events.
6 – Clean water and sanitation	6.6 – By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	The Project, by encouraging the conservation of forests, contributes to the protection of water bodies such as rivers, lakes, or aquifers, ensuring the maintenance of the quality and availability of the resource.	Ensure the protection of water bodies based on the conservation of forests.

[49] The table is an example of measures to be taken to ensure the Sustainable Development Goals. For each Project, the social, environmental and investment individualities in the contributions to be made should be analyzed. The table of each Project should then be developed, considering these particularities.
[50] SDG classification is available at: https://sdgs.un.org/goals .