BioCarbon Biodiversity Standard
BBS Methodology

BBS0001
Terrestrial Ecosystem and Biodiversity Conservation Activities

BioCarbon Cert®

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Acronyms and abbreviations

BBS	BioCarbon Biodiversity Standard
CAI	Core Area Index
CBD	Convention on Biological Diversity
CONTAG	Contagion index
D_{GS}	Gini-Simpson Diversity Index
DMG	Margalef Diversity Index
D_{si}	Simpson Dominance Index
HCV	High Conservation Values
IUCN	International Union for Conservation of Nature
MSU	Minimum Spatial Unit
OC	Objects of Conservation
PAFRAC	Perimeter-Area Fractal Dimension
PLAND	Percentage of Landscape
SIDI	Simpson's Diversity Index (SIDI) – Landscape level
TS	Threatened species

1 Introduction

Ecosystems and biodiversity are essential for providing the goods and services that support life on Earth. They play a critical role in regulating climate, mitigating extreme weather events, and sustaining livelihoods for communities worldwide. However, these ecosystems and biodiversity are facing a triple planetary crisis: climate change, loss of nature, and pollution. Human activity is the primary driver of this crisis (WWF, 2024).

In response to these global challenges and in line with global conservation goals (KMGBF, 2022; NPI, 2024), BioCarbon Cert® has developed the BIOCARBON BIODIVERSITY STANDARD (BBS). This standard provides a comprehensive and innovative approach to the issuance of biodiversity credits, enabling the capitalization of the results of initiatives aimed at tackling pressures on biodiversity. It also promotes the conservation, restoration, and sustainable use of ecosystems as a fundamental strategy for their long-term conservation.

The BBS incorporates a landscape-based approach as an integrative unit for the design of conservation, restoration, and sustainable use strategies, adopting a holistic approach that considers various levels of biodiversity (taxa, species, populations, and communities) enabling comprehensive management of complex ecosystems. Initiative holders are required to demonstrate and quantify biodiversity conservation outcomes related to the abundance, diversity, integrity, and resilience of species, ecosystems, and natural processes, in accordance with the applicable biodiversity conservation outcome pathway under the BBS.

Furthermore, the BBS encompasses Nature-Based Solutions (NBS), acknowledged as a pivotal component of climate action and biodiversity conservation. These solutions involve actions to protect, restore, use, and sustainably manage ecosystems. These combined efforts effectively address social and environmental challenges, providing numerous benefits such as improved human well-being, enhanced ecosystem services, and increased resilience and biodiversity (UNEP, 2020).

This methodological document establishes the requirements for the quantification of BioCredits under the BBS. Initiative holders shall apply this methodology in conjunction with the applicable requirements of the BBS to ensure rigor, transparency, and traceability in the quantification of biodiversity conservation outcomes.

2 Objectives

This methodological document (hereinafter referred to as "Methodology") applies to the quantification of BioCredits generated by biodiversity conservation Initiatives under the BBS.

In this context, this Methodology:

(a) establishes the criteria for quantifying BioCredits representing biodiversity conservation outcomes resulting from preservation, ecological restoration, and sustainable use activities;
(b) outlines the methodological requirements for identifying a biodiversity baseline for biodiversity conservation Initiatives;
(c) establishes the methodological requirements for demonstrating the additionality of biodiversity conservation outcomes in accordance with the applicable outcome pathway under the BBS;
(d) establishes methodological requirements to ensure that preservation, ecological restoration, and sustainable use activities and their specific actions are consistent with the conservation objectives and the applicable biodiversity conservation outcome pathway;
(e) describes the requirements for the monitoring and follow-up of activities for the conservation, restoration or sustainable use of biodiversity with their respective specific actions.

3 Version and validity

This document constitutes the draft for public consultation of Version 4.1 of the BBS0001 Methodology – Terrestrial Ecosystem and Biodiversity Conservation Activities and is issued for public consultation.

This public consultation version is not yet in force and does not supersede the current applicable version of the Methodology. It is made available for stakeholder review and comment in accordance with BioCarbon's applicable document-development and public consultation procedures.

Comments received during the public consultation period will be reviewed and considered by BioCarbon and may result in modifications to the Methodology prior to its final approval and publication.

The definitive Version 4.1 will enter into force on the date established by BioCarbon upon publication, subject to any applicable transition provisions. Until that date, Initiative holders shall apply the version of the Methodology applicable to their Initiative in accordance with the BBS and BioCarbon's transition rules.

4 Scope

This Methodology establishes the methodological requirements for:

(a) defining the geographic boundaries of biodiversity conservation Initiatives;
(b) establishing the biodiversity baseline;
(c) characterizing the drivers of landscape transformation and biodiversity loss;
(d) demonstrating the additionality of biodiversity conservation outcomes;
(e) defining biodiversity conservation objectives and the corresponding preservation, ecological restoration, and sustainable use activities; and
(f) applying the indicators, metrics, valuation approaches, and calculation procedures required to quantify BioCredits.

This Methodology applies exclusively to terrestrial ecosystems within landscape-based conservation contexts.

It provides the methodological framework for the quantification of biodiversity conservation outcomes arising from eligible conservation activities under the BBS.

This Methodology is limited to the following biodiversity conservation activities:

(a) *Preservation*

Actions that lead to maintaining the natural state of biodiversity and ecosystems, landscapes, by limiting or eliminating human intervention.

The specific preservation actions may include a). isolation of areas and establishment of ecological protection zones; b). isolation or protection of forest fragments and native vegetation remnants; c). surveillance, monitoring and control programs; and d) reduction or regulation of terrestrial extractive or disturbance activities (e.g. hunting, logging, land clearing or wildlife trade).

(b) Ecological restoration

Management processes for restoration of degraded ecosystems and prevention of future damage.

Specific restoration actions may include a). restoration of a degraded area in terms of function, structure or composition; b). restoration of the productivity and/or ecosystem services of the original ecosystem; c). Restoring the use of the ecosystem and/or ecosystem services different from those of the original ecosystem; d). Removing the agents causing the degradation of the ecosystem.

(c) Sustainable use

Activities involving the use of components of biological diversity in a manner and at a rate that does not lead to their long-term decrease.

Specific sustainable use measures may include a) regulated harvesting practices consistent with sustainable terrestrial resource management; b) limitation on entry and/or actions of the public/tourists to a landscape or ecosystem; c) limitation of heavy or destructive machinery/tools and/or other forms of technology that may cause collateral damage to other elements of the landscape or ecosystem; d) recycling/rotation of soil nutrients; e) composting; f) sustainable agriculture; g) limitation of agrochemicals or fertilizers.

5 Applicability conditions

This Methodology is applicable to biodiversity conservation Initiatives implemented in terrestrial ecosystems that generate eligible biodiversity conservation outcomes in accordance with the applicable outcome pathway under the BBS and meet the following conditions:

The Initiative holder:

(a) aims to preserve, restore, or sustainably use biodiversity in situ;

(b) demonstrates that in situ conservation is the main objective on which the biodiversity conservation Initiative activities and specific actions are based.

Conservation activities shall address more than one species and habitat and shall be designed to support ecosystem conservation objectives at a landscape scale, without jeopardizing the ecosystem or landscape or any of its biological components.

6 General terms

The following general terms apply to this Methodology:

(a) "Shall" is used to indicate that the requirement shall be complied with;

(b) "Should" is used to indicate that, among several possibilities, one course of action is recommended as particularly suitable;

(c) "May" is used to indicate that it is permitted.

7 Normative references

The following references are indispensable for the application of this Methodology:

(a) Convention on Biological Diversity. United Nations (1992);

(b) Any applicable national policies and action plans related to the use and management of biological diversity, or those that modify or update them;

(c) Environmental legislation that dictates norms on the management of biological diversity or that which modifies or updates it;

(d) The BioCarbon Biodiversity Standard, in the latest applicable version;

(e) The guidelines, other orientations and/or guidelines defined by BIOCARBON CERT™ within the scope of biodiversity conservation initiatives.

8 Terms and definitions

Terms defined in the BBS shall have the meaning assigned to them in the most recent applicable version of the Standard. The definitions below apply specifically for the purposes of this Methodology.

Biodiversity (Biological diversity)

The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems (CBD, 1992).

Biodiversity baseline

The biodiversity baseline corresponds to the assessment of biodiversity conditions within the geographic boundaries of the Initiative prior to or at the beginning of the quantification period, in accordance with the applicable requirements of the BBS. The biodiversity baseline shall be established based on the land cover present within the Initiative boundaries, together with the assessment of relevant physical and biotic components.

Class

Refers to categories that describe the type of surface in a landscape (e.g. forests, grasslands, agricultural areas, urban areas, water bodies, etc.). Each class represents a cover type with specific ecological properties. Each class within the landscape may be composed of one or more patches of the same class.

Direct driver

Direct drivers of biodiversity loss are natural or anthropogenic forces that directly affect biodiversity, ecosystem structure and function, or ecological processes, and may result in ecosystem transformation, degradation, or biodiversity loss.

Ecological restoration

According to the Society for Ecological Restoration (SER), ecological restoration is the process of supporting the recovery of an ecosystem that has been degraded, damaged or destroyed (SER, 2025). This process seeks to reestablish the health, integrity and sustainability of the ecosystem, promoting its capacity to maintain itself self-sufficiently over time. The actions carried out within the framework of ecological restoration guarantee the conservation of species and the continuous provision of goods and services.

Ecosystem

A set of biological communities (e.g. plants, animals and microorganisms) interacting with each other and with the physical components of the environment and abiotic (e.g. soil, water, air), forming a dynamic system of energy flows, nutrient cycles and ecological processes (CBD, 1992). An ecosystem includes Landscape.

For the application of this methodology, eligible ecosystems are limited to terrestrial ecosystems.

Habitat

The place or type of site where an organism or population naturally occurs (CBD, 1992).

In situ conditions

The conditions where genetic resources exist within ecosystems and natural habitats, and. in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties (CBD, 1992).

In situ conservation

The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties (CBD, 1992).

Landscape

Heterogeneous spatial unit, contained within the ecosystem, and which determines the geographical limits of the initiative, in which various class types (habitats and/or land uses) are identified.

Monitoring

For the purposes of this Methodology, monitoring includes the collection, management, and archiving of the data required to apply the BioCredit quantification metrics. Monitoring shall be conducted in accordance with the monitoring plan and the applicable requirements of the BBS.

Objects of Conservation (OC)

Objects of Conservation are the biodiversity components selected in accordance with the conservation objectives of the Initiative and considered in the quantification of BioCredits. They may include species or taxa such as vascular and non-vascular plants, birds, amphibians, reptiles, mammals, and other ecologically relevant groups. Functional groups, such as large herbivores or soil invertebrates, may also be included.

The selection of Objects of Conservation shall be justified based on their ecological and functional relevance and shall consider, as applicable, characteristics such as conservation status, vulnerability, ecological role, and cultural value.

The identification of Objects of Conservation shall be based on the assessment of the functional, physical, and biotic components of the ecosystem, together with the biodiversity baseline and the local and regional context. Their selection shall be consistent with the conservation objectives and the applicable biodiversity conservation outcome pathway of the Initiative.

Patch

Patches are fragments that compose a class within a landscape and are clearly differentiated from their surroundings in terms of their physical and ecological characteristics. Patches may be connected or isolated in the landscape and their shape and size may vary.

Population

A population comprises individuals of the same species and a specific geographic area. Populations interact with other populations of the same type, with populations of other species and with physical aspects of their territory.

NOTE: This term is used in a specific sense in the IUCN Red List Criteria. “Population is defined as the total number of individuals of the taxon. Within the context of a regional assessment, it may be advisable to use the term global population for this. In the Guidelines the term population is used for convenience, when reference is made to a group of individuals of a given taxon that may or may not interchange propagules with other such entities” (UICN, 2012).

Species

Species are groups of individuals or natural populations that are actually or potentially interbreeding, reproductively isolated from other similar groups by their physiological properties (producing incompatibility between parents or sterility of hybrids, or both).

Sustainable use

"Sustainable use" means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations (CBD, 1992).

Taxon

A taxon corresponds to organisms that, once described, have been assigned a scientific name (or Latin name) [1].

Underlying cause

Underlying causes are factors that reinforce the direct causes of ecosystem changes. They include social, political, economic, technological and cultural variables, which constitute the initial conditions in the existing structural relationships between human and natural systems. These factors influence the decisions made by the agents and help to explain why the phenomenon of changes in land use occurs, with the consequent loss of biodiversity.

9 General framework

This Methodology forms part of the BioCarbon Biodiversity Standard (BBS) framework and shall be applied together with the BBS and other applicable BioCarbon normative documents.

[1] Rodríguez-Melo, M. 2022

10 General requirements

10.1 Geographic boundaries of the conservation initiative

The boundaries of the conservation initiative consist of the sites on which biodiversity conservation activities are carried out. The Minimum Spatial Unit (MSU) is represented in terms of surface area and corresponds to 1 hectare (10,000 m^2).

The initiative holder shall demonstrate that the areas within the geographic boundaries of the initiative correspond to the categories of vegetation or land cover considered by the land cover and land use identification system applicable to the country in which the activities of the conservation initiative are implemented (EEA, 2020). The land cover identification and land use shall be carried out at a scale of 1:10,000 or finer, considering the diversity of the landscape in each MSU.

All the geographic information related to the boundaries of the conservation initiative shall be represented in a Geographic Information System, for the duration of the conservation initiative. This should be done following appropriate methodologies for information systems and land cover analysis.

For example, geographic information should be handled following the quality standards of ISO 19111:2019, which defines the conceptual schema for the description of referencing by coordinates, the minimum data required to define coordinate reference systems and the additional descriptive information (coordinate reference system metadata)

The initiative holder shall provide verifiable evidence demonstrating that the area within the boundaries of the initiative is eligible. This includes:

(a) Defining the geographic boundaries of the biodiversity conservation initiative;

(b) Specify the extent and location of the areas, classified according to types of land cover and/or land use;

(c) Conservation status and biodiversity in terms of ecosystem composition, structure and function.

The following sources may be used, as applicable, as complementary verifiable evidence, without replacing the geographic, legal, land-tenure, or other documentation required under the BBS:

(a) Images and cartography: aerial photographs or satellite images complemented with cartographic information of references taken in the field, using validated methodologies;

(b) Field studies and official records: land use permits or concessions, land use plans or information from local records such as cadastre, land registry, land use or land management records;

(c) Participatory evaluation: Written testimony developed through participatory rural appraisal methodologies may be used, where appropriate, as complementary evidence.

10.2 Temporal limits and quantification periods

The temporal limits of a biodiversity conservation Initiative shall be defined in accordance with the BBS and shall include the Initiative start date, the quantification period, and the applicable monitoring periods.

The start date corresponds to the date on which biodiversity conservation activities commence within the geographic boundaries of the Initiative.

The quantification period corresponds to the period during which eligible biodiversity conservation outcomes may be quantified under this Methodology. It shall begin on the date on which the biodiversity baseline is established, in accordance with the BBS.

BioCredits shall be quantified on the basis of biodiversity conservation outcomes demonstrated for defined monitoring periods. Monitoring periods shall be established in accordance with the monitoring requirements of this Methodology and the BBS.

The duration and any extension of the Initiative shall be governed by the applicable requirements of the BBS.

10.3 Biodiversity baseline

The biodiversity baseline shall be established through an evaluation of the structure and composition of the ecosystem. The assessment shall include relevant physical and biotic aspects, as well as information related to climate and other determinants of biodiversity and landscape conditions. This assessment shall be conducted for all identified land cover and/or land use types within the geographic boundaries of the Initiative.

The biodiversity baseline shall represent biodiversity conditions within the geographic boundaries of the Initiative prior to or at the beginning of the quantification period, in accordance with the applicable requirements of the BBS.

Primary information supported by appropriate field methodologies should be used where available. Where secondary information is used, it should be obtained from reliable and verifiable sources.

In addition to the applicable requirements of the BBS, the baseline characterization under this Methodology shall include:

(a) Detailed assessments of ecosystem structure and composition for all land cover and/or land use categories representative of the baseline condition;

(b) Maps delimiting the areas according to the types of land cover and land use present;

(c) Assessment of High Conservation Values (HCVs), using applicable HCV Network and/or FSC guidance, or other appropriate methodologies.

The following sources of information can be used to establish the biodiversity baseline:

(a) Aerial photographs, satellite images;

(b) Basic cartography, topographic maps, thematic cartography, geological maps, soil maps;

(c) Bibliographic documents of specific works developed in the area or zone where the biodiversity conservation initiative is located;

(d) Models based on field measurements.

10.4 Characterization of drivers of transformation and biodiversity loss

The Initiative holder shall assess the relevant natural and anthropogenic drivers of landscape transformation and biodiversity loss. Such drivers may include, inter alia, habitat degradation, land-use change, deforestation, wildfires, overexploitation of resources, pollution, invasive species, mining activities, and infrastructure development.

To characterize direct drivers of transformation and underlying causes, a qualitative rating matrix (Table 1) indicating the extent and frequency with which drivers of biodiversity loss have occurred should be used.

Table 1. Drivers of transformation and biodiversity loss

Driver	Extent			Frequency		
	High	Medium	Low	High	Medium	Low
1.						
2.						
3.						
....						
n						

In the case of underlying causes, the initiative holder shall qualitatively categorize (using Table 2) the intensity and frequency with which estimates of the underlying causes of biodiversity loss have been present.

Table 2. Underlying causes of biodiversity loss

Underlying cause	Extent			Frequency		
	High	Medium	Low	High	Medium	Low
1.						
2.						
3.						
....						
n						

10.5 Additionality analysis

The Initiative holder shall demonstrate that the biodiversity conservation outcomes quantified under this Methodology are additional in accordance with the applicable biodiversity conservation outcome pathway and the relevant baseline or counterfactual, as established under the BBS.

The additionality analysis shall demonstrate a clear causal relationship between the Initiative activities and the biodiversity conservation outcomes claimed and shall be supported by objective and verifiable evidence.

11 Conservation objectives and activities

Based on the information recorded in Section 10 of this Methodology, the Initiative holder shall establish and justify the conservation objectives and the corresponding preservation, ecological restoration, or sustainable use activities and specific actions. Conservation objectives shall be consistent with the biodiversity conservation outcomes expected under the applicable outcome pathway.

Conservation objectives should be related, where applicable, to the High Conservation Values (HCVs) identified within the geographic boundaries of the Initiative. The use of a Theory of Change (TOC) or equivalent causal framework is recommended to describe the logical relationships between conservation activities, specific actions, and the expected biodiversity conservation outcomes.

The Initiative holder can use the FSC Guidance for Demonstrating Impacts on Ecosystem Services (FSC, 2018), which includes basic elements of a theory of change and a quality checklist.

Additionally, other guidelines could be implemented. Stakeholder consultations and interviews are also crucial to identify the specific needs of local communities and indigenous peoples in terms of ecosystem and biodiversity conservation activities. This is applicable in cases where local communities and/or indigenous peoples live within the geographic boundaries of the initiative.

12 Sampling effort

Sampling effort refers to the amount and spatial extent of sampling required to adequately characterize the biodiversity components assessed under this Methodology. Sampling effort shall be appropriate to the ecological conditions, spatial heterogeneity, taxonomic groups assessed, and conservation objectives of the Initiative.

Sampling adequacy may be evaluated using species accumulation curves or other scientifically justified approaches. Species accumulation curves represent the number of species observed in relation to cumulative sampling area or effort and may be used to assess whether additional sampling results in progressively fewer new species records. Where such curves are used, the point at which the curve approaches an asymptote may support the determination of an adequate sampling area or effort.

The Initiative holder shall demonstrate that the sampling effort is sufficient to adequately represent the biodiversity components assessed under this Methodology. Appropriate sampling design, field techniques, and quality-control procedures shall be applied to minimize sampling error and ensure the accuracy, representativeness, and reliability of the data collected. The approach used to determine sampling adequacy shall be documented and scientifically justified.

13 Metrics for the quantification of BioCredits

This Methodology establishes an integrated multi-metric model for the assessment and quantification of biodiversity conservation outcomes, based on characteristics of biological communities and landscape condition and dynamics.

The model integrates indicators related to biological communities and landscape characteristics to quantify BioCredits associated with eligible biodiversity conservation outcomes in terrestrial ecosystems. The multi-metric assessment considers biodiversity composition, structure, condition, and relevant landscape characteristics.

Each metric shall be calculated in accordance with the Monitoring Plan (Section 15). The combination of these interrelated, but non-redundant, metrics allows biodiversity conditions and changes to be identified more sensitively and accurately than through univariate approaches. Each metric provides specific information on ecosystem status, ecological function, and resilience. The applicable metrics shall be calculated for each monitoring period for which biodiversity conservation outcomes are quantified under this Methodology (Annex 1).

The multi-criteria assessment recognizes the interrelationships among biodiversity components, landscape characteristics, and ecological conditions, supporting rigorous and verifiable quantification of BioCredits.

Unless otherwise specified, i denotes a species, j denotes a landscape class, k denotes a patch within class j, c denotes an HCV category, o denotes an Object of Conservation, and NP_j denotes the number of patches belonging to class j.

All species and individual counts used in the equations of this Section shall comply with the sampling effort standardization requirements established in Section 15.1.

13.1 Alpha diversity index (α)

Alpha diversity is the species richness in a community that is considered homogeneous, representing richness at the local level. Under this Methodology, alpha diversity shall be assessed at the landscape level, in accordance with the definition of Landscape established in Section 8.

To measure alpha diversity, there are several indices related to the number of species (richness) or to structural data, such as abundances and dominances.

13.1.1 Richness indexes

Specific Richness (number of species)

Specific richness corresponds to the total number of distinct species recorded within a defined area, without considering the abundance of each species. Under this Methodology, specific richness shall be determined for each applicable class j, based on the species recorded across the sampling units associated with that class. It is calculated using Equation 1.

$$D_{R_j} = S_j \qquad \text{Equation 1}$$

Where:

D_{R_j}	=	Specific richness in class j
S_j	=	Total number of distinct species identified in class j
j	=	Index for the applicable landscape class

Margalef Diversity Index (D_{MG_j})

It is a measure of specific diversity. It relates the number of species to the total number of individuals. In general, values below 2.0 represent areas with low biodiversity; values above 5.0 are considered indicative of high biodiversity.

This index is based on the number of species and their abundances, observed in the different classes present in the landscape. Classes refer to the different categories that describe the type of surface in a landscape (e.g. forests, grasslands, agricultural areas, urban areas, water bodies, etc.). The diversity index is calculated using Equation 2.

$$D_{MG_j} = \frac{S_j - 1}{\ln(N_j)} = \alpha_{M_j} \qquad \text{Equation 2}$$

Where:

D_{MG_j}	=	Margalef Diversity index in class *j*
S_j	=	Total number of distinct species identified in class j
N_j	=	Total number of individuals recorded in class j
α_{M_j}	=	Margalef-based alpha value for class j

Where $N_j = 1$, the Margalef Diversity Index is undefined because $\ln(N_j) = 0$. In such cases, the index shall be reported as not applicable, and a conservative value of zero shall be used for α_{M_j} in Equations 3–6.

Alpha Area (α_{A_j})

To incorporate the spatial dimension of each class, the Margalef index value is weighted by the area of class *j*. This produces the **Alpha Area**, which integrates biodiversity and spatial extent. The Alpha Area is calculated using Equation 3.

$$\alpha_{A_j} = (\alpha_{M_j})(A_j) \qquad \text{Equation 3}$$

Where:

α_{A_j}	=	Alpha Area in class j (m^2)
α_{M_j}	=	Margalef diversity index in class *j*
A_j	=	Area in class j (m^2)

Average alpha ($\overline{\alpha}$)

The Average Alpha represents the mean of the Alpha Area values across all applicable classes. The Average Alpha is calculated according to Equation 4.

$$\overline{\alpha} = \frac{\sum_{j=1}^{NC} \alpha_{A_j}}{NC}$$ Equation 4

Where:

$\overline{\alpha}$	=	Average alpha (m^2)
α_{A_j}	=	Alpha Area in class *j* (m^2)
NC	=	Total number of classes

Average Area ($\overline{A}$)

Similarly, the mean area of the landscape classes is calculated using Equation 5.

$$\overline{A} = \frac{\sum_{j=1}^{NC} A_j}{NC}$$ Equation 5

Where:

$\overline{A}$	=	Average area of the landscape classes; m^2
A_j	=	Area in class j; m^2
NC	=	Total number of classes

Alpha (α)

Finally, the landscape-level alpha is obtained by dividing the Average Alpha by the Average Area. This operation removes the area units and produces a normalized biodiversity value representative of the landscape. It is calculated using Equation 6.

$$\alpha = \frac{\overline{\alpha}}{\overline{A}}$$ Equation 6

Where:

α	=	Landscape-level alpha; dimensionless
$\overline{\alpha}$	=	Average alpha; m^2
$\overline{A}$	=	Average area of the landscape classes; m^2

13.1.2 Modified Whittaker-type beta component (β)

Beta diversity describes variation in species composition among the classes present within the landscape. Under this Methodology, the beta component is derived through a modified Whittaker-type decomposition that relates total species richness in the landscape to the landscape-level alpha value calculated using Equation 6.

The formulation is adapted from the conceptual relationship among alpha, beta, and gamma diversity proposed by Whittaker (1972). However, because the landscape-level alpha used in this Methodology is an area-weighted, Margalef-based value rather than mean local species richness, the resulting beta value is a model-specific component and shall not be interpreted as the conventional Whittaker beta index. It is calculated using Equation 7.

$$\beta = \frac{S_L}{\alpha} - 1 \qquad \text{Equation 7}$$

Where:

β	=	Modified Whittaker-type beta component
S_L	=	Total number of distinct species recorded across the entire landscape
α	=	Landscape-level alpha, calculated using Equation 6

Where $\alpha=0$, the modified Whittaker-type beta component is undefined. In such cases, β shall be reported as not applicable, and γ shall be set equal to S_L for the purposes of Equation 23, consistent with the definition of the gamma diversity component established in Equation 8.

13.1.3 Gamma diversity component (γ)

Under this Methodology, gamma diversity represents total species richness across all applicable classes within the geographic boundaries of the Initiative. The gamma component is derived algebraically from the landscape-level alpha and the modified Whittaker-type beta component using Equation 8.

Gamma diversity under the modified Whittaker-type decomposition

Because Equation 7 defines β as $S_L/\alpha-1$, Equation 8 yields $\gamma=S_L$. Accordingly, the gamma component corresponds to total species richness at the landscape level within the modified Whittaker-type decomposition.

$$\gamma = \alpha \times (\beta + 1) \qquad \text{Equation 8}$$

Where:

γ	=	Gamma diversity component, corresponding to total species richness at the landscape level
α	=	Landscape-level alpha, calculated using Equation 6
β	=	Modified Whittaker-type beta component, calculated using Equation 7

13.2 Structure

13.2.1 Proportional abundance

Classified as dominance and equity indexes since they consider the number of individuals per species.

Simpson Dominance Index (D_{si})

This index measures the degree of dominance of species in landscape units. It is useful for evaluating how the dominance of certain species affects the state of biodiversity in an area. Simpson's index takes as a parameter the number of individuals per species in the landscape. It is calculated using Equation 9.

$$D_{si} = \sum_{i=1}^{S} \left(\frac{n_i^2 - n_i}{N^2 - N} \right) \qquad \text{Equation 9}$$

Where:

D_{si}	=	Simpson Dominance Index
n_i	=	Number of individuals of the same species
N	=	Total number of individuals in the landscape
S	=	Total number of species

The Simpson Dominance Index determines the probability that two individuals taken at random from a sample are of the same species. Therefore, this is a probability value. It ranges from 0 to 1. A high value (close to 1) indicates that the community is dominated by one or a few species, while a low value (close to 0) suggests that the species are evenly distributed. Values close to zero represent lower dominance, and values close to 1 represent higher dominance.

Gini-Simpson Diversity Index

The Gini-Simpson Diversity Index is a measure of species diversity that accounts for the relative abundance of individuals among species within a community.

The index represents the probability that two individuals randomly selected from the community belong to different species. Higher values indicate greater diversity, whereas lower values indicate greater dominance by one or a few species. It is calculated as the complement of the Simpson Dominance Index, using Equation 10.

$$D_{GS} = 1 - D_{si} \quad \text{Equation 10}$$

Where:

D_{GS}	=	Gini-Simpson Diversity Index
D_{si}	=	Simpson Dominance Index, calculated using Equation 9

Where $N \leq 1$, the Simpson Dominance Index and the Gini-Simpson Diversity Index are undefined. In such cases, the indices shall be reported as not applicable, and an adjusted value of zero shall be used for D_{GS} solely for the application of Equation 23.

Shannon-Wiener Diversity Index

The Shannon-Wiener Diversity Index (H′), also known as the Shannon Diversity Index, is a measure of species diversity that accounts for both species richness and the relative abundance of individuals among species.

This index estimates species abundance under the assumption that all species are represented in the samples and that all individuals were randomly sampled. This index considers not only the number of species present (richness), but also the distribution of individuals among these species (evenness). It is calculated using Equation 11.

$$H' = -\sum_{i=1}^{S} p_i ln(p_i) \quad \text{Equation 11}$$

$$p_i = \frac{n_i}{N}$$

Where:

H'	=	Shannon-Wiener Diversity Index
p_i	=	Proportional abundance, i.e., the number of individuals of the species among the total number of individuals in the landscape.
S	=	Total number of species in the landscape
n_i	=	Number of individuals of species *i* in the landscape
N	=	Total number of individuals per landscape

Pielou's Evenness Index (J')

The Pielou index, also known as Pielou's equity index (J') is a measure used to evaluate the equity in the distribution of individuals among species in a class.

This index is based on the Shannon-Wiener diversity index and provides a way to understand how individuals are distributed among different species. That is, based on the values of the Shannon-Wiener index, the Pielou index represents a relationship between the observed diversity and the maximum expected diversity value.

It expresses equity as the ratio of observed diversity to the maximum expected diversity. It takes values between 0 and 1. Values close to 0 indicate an uneven distribution in species abundance, with one or a few species dominating the community. While values close to 1 indicate a very equal distribution of individuals among species. It is calculated using Equation 12.

$$J' = \frac{H'}{H'_{max}}$$

Equation 12

$$H'_{max} = lnS$$

Where:

J'	=	Pielou Index (equity)
H'	=	Shannon-Wiener Diversity Index
H_{max}	=	Maximum value of Shannon index

S = Total number of species

Where only one species is present ($S = 1$), $Hmax' = ln(S) = 0$, and Pielou's Evenness Index is undefined. In such cases, the index shall be reported as not applicable, and an adjusted value of zero shall be used solely for the application of Equation 23.

13.3 Other diversity indicators

The assessment of threatened species and High Conservation Values (HCVs) complements the assessment of diversity indices (composition and structure), calculated at the geographic boundaries of the conservation initiative (landscape).

13.3.1 Threatened species

The Initiative holder shall assess whether threatened species (according to the IUCN Red List™) (IUCN, 2024) are present within the geographic boundaries of the Initiative and, where present, shall identify their applicable threat category and the conservation actions associated with those species.

"*The IUCN Red List of Threatened Species™ is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species. It is based on an objective system for assessing a species' risk of extinction if conservation action were not taken*" (IUCN, 2012).

According to IUCN (2024) "*More than 41,000 species are threatened with extinction. That is still 28% of all assessed species*". Consequently, determining whether species under some degree of threat are found within the geographic limits of biodiversity conservation initiatives makes it possible to link conservation actions with reducing pressures on species to prevent extinction processes.

The categories defined by the IUCN relate the risk of extinction to a certain degree of threat. The categories are found in Table 3.

Table 3. Categories IUCN™ Red List

Categories	Symbol	Definition
EXTINCT	EX	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its

Categories	Symbol	Definition
		historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EXTINCT IN THE WILD	EW	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CRITICALLY ENDANGERED	CR	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED	EN	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VULNERABLE	VU	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED	NT	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN	LC	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category
DATA DEFICIENT	DD	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information

Categories	Symbol	Definition
		is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
NOT EVALUATED	NE	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Source: IUCN RED LIST CATEGORIES AND CRITERIA (2012).

This hierarchical structure, from the initial assessment of all species through data adequacy and evaluation, to their final classification into one of the categories described above, is illustrated in Figure 1.

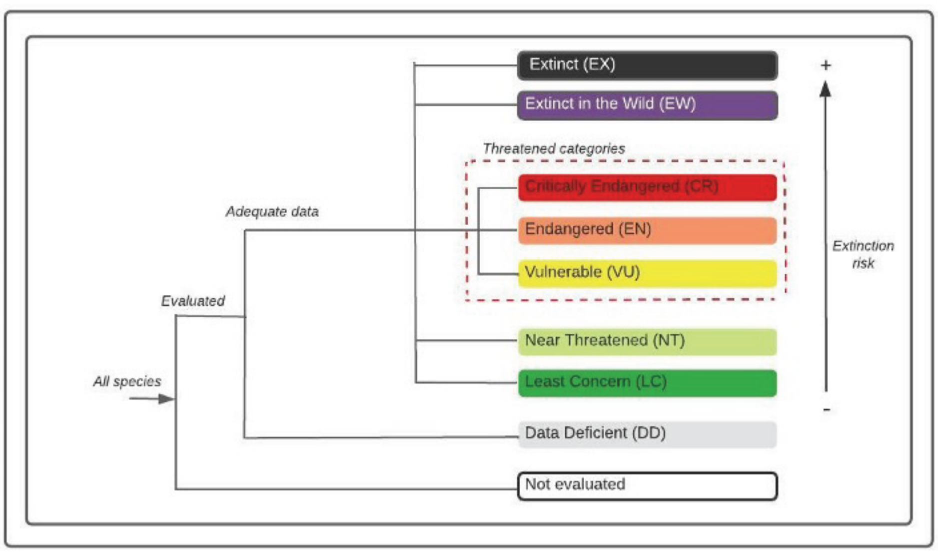

Figure 1 . Structure of species Red List threat categories and criteria. Source IUCN (2012).

In the IUCN document there is a description of the nature of the categories, as follows:

"*Extinction is a chance process. Thus, a listing in a higher extinction risk category implies a higher expectation of extinction, and over the timeframes specified more taxa listed in a* *higher category are expected to go extinct than those in a lower one (without effective conservation action). However, the persistence of some taxa in high-risk categories does not necessarily mean their initial assessment was inaccurate.*

All taxa listed as Critically Endangered qualify for Vulnerable and Endangered, and all listed as Endangered qualify for Vulnerable. Together these categories are described as 'threatened'. The threatened categories form a part of the overall scheme. It will be possible to place all taxa into one of the categories".

The result of the threatened species assessment should be a list of species present within the geographic boundaries of the conservation initiative, where the risk category is established.

If a species is not on the IUCN Red List, other national, regional or local databases may be used, mentioning the sources of information used to define the species' threat criteria.

For the purposes of this Methodology, TS is a conservation-status score derived from the applicable categories listed in Table 6. The inclusion of Near Threatened, Least Concern, and Data Deficient does not classify those categories as threatened.

13.3.2 High Conservation Values (HCV)

The Initiative holder shall assess the presence or absence of High Conservation Values (HCVs) within the Initiative area and document the results of the assessment (FSC, 1996; HCV Network, 2025). Where HCVs are identified, the applicable categories shall be determined in accordance with the criteria established in this Section.

According to the HCV Network (2025), "*an HCV is an exceptionally significant or critically important biological, ecological, social or cultural value.*"

Holders of biodiversity conservation initiatives should submit a rigorous assessment of HCVs, interpreting the results based on the precautionary principle (CBD, 1992). To conduct the HCV assessment, it is recommended to use what is described in the FSC Standard version 5.0 (Principle 9: high conservation values) (FSC, 2023).

The identification of HCVs consists of interpreting the HCV definitions in the context of the Initiative area and determining whether and where such values are present (Table 4).

Table 4. High Conservation Values

HCV 1	Species diversity. Concentrations of biological diversity including endemic species, and rare, threatened or endangered* species that are significant at global, regional or national levels.
HCV 2	Landscape-level ecosystems and mosaics. Intact forest landscapes and large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.
HCV 3	Ecosystems and habitats. Rare, threatened, or endangered ecosystems, habitats or refugia.
HCV 4	Critical ecosystem services. Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.
HCV 5	Community needs. Sites and resources fundamental for satisfying the basic necessities of local communities or Indigenous Peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or Indigenous Peoples.
HCV 6	Cultural values. Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or Indigenous Peoples, identified through engagement with these local communities or Indigenous Peoples.

Source: BioCarbon, 2025 and FSC (2023).

All of this is done through an HCV assessment, which consists of stakeholder consultation, analysis of existing information and collection of additional information where necessary.

HCV assessments should result in a clear report of the presence or absence of values, their location, status and condition, and to the extent possible should provide information on habitat areas, essential resources, and critical areas that maintain those values. This will be used to develop management recommendations to ensure that HCVs are maintained or even enhanced.

To determine the number of HCV categories identified within the Initiative area, each HCV category shall be assigned an indicator value equal to one where the category is identified and zero otherwise. The total number of identified HCV categories shall be calculated using Equation 13.

$$N_{HCV} = \sum_{c=1}^{6} I_c \qquad \text{Equation 13}$$

Where:

N_{HCV}	=	Number of HCV categories identified within the Initiative area
I_c	=	1 where HCV category c is identified, and 0 otherwise
c	=	Index for the six HCV categories

13.4 Landscape diversity[2]

Landscape ecology addresses the interactions between the spatial patterns of ecosystems and the ecological processes occurring within them. This approach evaluates how landscape structure and composition influence species distribution and abundance, as well as ecosystem dynamics.

A key concept in this assessment is that of *landscape patches*, which refers to the combination of different types of habitats and ecosystems present in an area. These patches include forests, grasslands, water bodies, urban areas and other cover types. The arrangement and connectivity of these elements determine species mobility, resource availability and, in general, the ecological functionality of the landscape.

Landscape ecology is also concerned with the effects of human activities, such as agriculture, urbanization and deforestation, on the structure and composition of natural landscapes. These changes can fragment habitats, reduce biodiversity and alter key ecological processes.

In this context, the assessment of landscape diversity is essential to understand how the different components interact with each other and how these interactions affect biodiversity and ecosystem integrity.

Landscape diversity should be calculated from a land cover and land use map, classifying each type of cover or use within the conservation initiative area. To estimate

[2] Descriptions and equations based on and modified from Fragstats Spatial Pattern Analysis Program for Categorical Maps (McGarigal et al., 2023).

landscape indices, the use of spatial modeling tools such as FragScape, Fragstat, GRASS GIS, Patch Analyst, V-Late or other appropriate models that allow for the quantification of landscape metrics is recommended.

When analyzing landscape diversity, the following aspects should be considered:

(a) Landscape Composition: Refers to the variety and abundance of classes, patches and ecosystems present in the landscape. This component focuses on identifying which elements are present and in what relative proportion.

(b) Landscape Structure: Refers to the spatial organization of patches and cover categories within the landscape, as well as the spatial relationships between them. Structure includes metrics such as connectivity, shape and size of patches, as well as distances between them and their configuration in space.

Understanding and monitoring landscape diversity allows us to identify key areas for conservation, assess the impacts of human activities, and design strategies to maintain or restore the ecological functionality of ecosystems in the context of conservation initiatives.

13.4.1 Percentage of landscape (PLAND)

Landscape percentage quantifies the proportional abundance of each patch type in each area. Like total class area, this measure is crucial for understanding landscape composition in various ecological applications. However, because PLAND is a relative measure, it is more appropriate for comparing landscape composition between areas of different sizes than class area.

PLAND approaches 0 when the corresponding class becomes progressively scarce in the landscape. PLAND = 100 when the entire landscape is composed of a single patch type; that is, when a single class is present. It is calculated using Equation 14.

$$PLAND_j = \frac{\sum_{k=1}^{NP_j}(a_{kj})}{A} \times 100 \qquad \text{Equation 14}$$

Where:

$PLAND_j$	=	Percentage of landscape occupied by class j (%)

a_{kj}	=	Area of patch k of class j (m²)
A	=	Total landscape area (m²)
NP_j	=	Number of patches of class j

and,

$$P_j = \frac{PLAND_j}{100} = \frac{\sum_{k=1}^{NP_j}(a_{kj})}{A}$$ Equation 15

Where:

P_j	=	Proportion of the landscape occupied by class j (decimal)

13.4.2 Perimeter-Area Fractal Dimension (PAFRAC)

It is a metric that describes the complexity of patch shapes in a landscape, evaluating the relationship between the perimeter and the area of a patch. This metric provides information on the heterogeneity of the landscape and on ecological dynamics, such as habitat fragmentation and connectivity between patches. It is calculated using Equation 16.

Equation 16

$$PAFRAC = \frac{2\left[N\ \sum_{j=1}^{NC}\sum_{k=1}^{NP_j}(ln\ p_{kj})^2 - \left(\sum_{j=1}^{NC}\sum_{k=1}^{NP_j} ln\ p_{kj}\right)^2\right]}{N\sum_{j=1}^{NC}\sum_{k=1}^{NP_j}(ln\ p_{kj})\,(ln\ a_{kj}) - \left(\sum_{j=1}^{NC}\sum_{k=1}^{NP_j} ln\ p_{kj}\right)\left(\sum_{j=1}^{NC}\sum_{k=1}^{NP_j} ln\ a_{kj}\right)}$$

$$N = \sum_{j=1}^{NC} NP_j$$

Where:

$PAFRAC$	=	Perimeter-Area Fractal Dimension
N	=	Total number of patches in the landscape
NC	=	Total number of classes in the landscape
NP_j	=	Number of patches of class *j* included in the calculation
p_{kj}	=	Perimeter of patch k of class *j*; m

a_{kj}	=	Area of patch k of class *j*; m²
j	=	Index for the landscape class
k	=	Index for a patch within class *j*
ln	=	Natural logarithm

PAFRAC shall be calculated only where at least ten patches are available and patch areas vary. Where these conditions are not met, PAFRAC shall be reported as not applicable. For the purposes of Equation 23, the adjusted PAFRAC value shall be set to zero unless another scientifically justified and approved shape metric is applied.

13.4.3 Contagion Index (CONTAG)

The Contagion Index is a measure used in landscape ecology and planning to assess the spatial distribution of patch types within a landscape. This index indicates the tendency of a patch type to be associated with other patches of the same type. A high value suggests that patches of the same type are clustered together, which may have implications for habitat connectivity and biological diversity. Conversely, a low value indicates a greater dispersion of patches, which may affect species dynamics and ecosystem resilience. It is calculated using Equations 17 and 18.

$$q_{mn} = P_m\left(\frac{g_{mn}}{\sum_{r=1}^{NC} g_{mr}}\right) \quad \text{Equation 17}$$

$$CONTAG = \left[1 + \frac{\sum_{m=1}^{NC}\sum_{n=1}^{NC} q_{mn}\, ln(q_{mn})}{2\ln(NC)}\right] \times 100 \quad \text{Equation 18}$$

Where:

q_{mn}	=	Joint adjacency probability for classes m and n, calculated using Equation 17
$CONTAG$	=	Contagion rate
P_m	=	Proportion of the landscape occupied by class m, calculated using Equation 15
g_{mn}	=	Number of cell adjacencies between classes m and n
NC	=	Total number of classes in the landscape

Where fewer than two classes are present or CONTAG cannot be validly calculated, CONTAG shall be reported as not applicable, and an adjusted value of zero shall be used for the application of Equation 23.

13.4.4 Core Area Index (CAI)

A measure used to describe the quality and integrity of a habitat in each area or landscape patch. This index helps assess the amount of "core area" within a patch, which is generally considered the part of the habitat that is least susceptible to negative edge effects (such as invasion by non-native species, increased predation, or more extreme temperature fluctuations).

Before calculating the CAI, the Initiative holder shall define and document the edge depth used to delineate the core area of each applicable habitat or land-cover class. The selected edge depth shall be scientifically justified based on the ecological characteristics of the habitat, the relevant edge effects, and the Objects of Conservation, as applicable. Where different edge depths are applied to different habitat or land-cover classes, each value and its scientific basis shall be documented.

The selected edge depth shall be applied consistently to the biodiversity baseline and all monitoring periods to ensure comparability of the calculated results. Any change in the edge depth shall be scientifically justified, documented, and assessed for its effect on the CAI.

The CAI at the patch level is calculated using Equation 19.

$$CAI_{kj} = \frac{a_{kj}^{core}}{a_{kj}} \times 100 \qquad \text{Equation 19}$$

Where:

CAI_{kj}	=	Core Area Index of patch k of class j; %
a_{kj}^{core}	=	Core area of patch k of class j; m²
a_{kj}	=	Area of patch k of class j; m²

Once the Core Area Index has been calculated at the patch level, the Area-weighted Mean Core Area Index shall be calculated at the landscape level. This index represents the percentage of the total area of all applicable patches that is comprised of core area, giving each patch a weight proportional to its area. It is calculated using Equation 20.

$$CAI_{AM} = \frac{\sum_{j=1}^{NC}\sum_{k=1}^{NP_j} a_{kj}^{core}}{\sum_{j=1}^{NC}\sum_{k=1}^{NP_j} a_{kj}} \times 100 \qquad \text{Equation 20}$$

Where:

CAI_{AM}	=	Area-weighted Mean Core Area Index at the landscape level; %
a_{kj}^{core}	=	Core area of patch k of class *j*; m²
a_{kj}	=	Total area of patch k of class *j*; m²
NP_j	=	Number of patches of class j included in the calculation
NC	=	Total number of applicable classes in the landscape
j	=	Index for the landscape class
k	=	Index for a patch within class *j*

13.4.5 Simpson's Diversity Index (SIDI)

This index focuses on the proportion of different types of patches and is less sensitive to the presence of rare types of patches, making it a useful option when you want to assess overall diversity without rare types influencing the result too much.

The value of Simpson's Diversity Index represents the probability that two pixels randomly selected from a given landscape correspond to different classes. Higher values indicate greater landscape diversity, whereas lower values indicate dominance by one or a few classes. It is calculated using Equation 21.

$$SIDI = 1 - \sum_{j=1}^{NC} P_j^2 \qquad \text{Equation 21}$$

Where:

$SIDI$	=	Simpson's Diversity Index
P_j	=	Proportion of the landscape occupied by class *j,* calculated from Equation 15 as $PLAND_j/100$
NC	=	Total number of classes in the landscape

14 Quantification of BioCredits

The Initiative holder shall demonstrate and quantify biodiversity conservation outcomes using the metrics described in Section 13. The quantification shall be applied in accordance with the applicable biodiversity conservation outcome pathway under the BBS.

14.1 Metrics and range of adjusted values

Once the values of the previously described indicators have been obtained, they shall be adjusted to fall within the ranges established for each metric (Table 5).

Table 5. Summary of minimum and maximum limits for each of the metrics.

Indicator	Limits	Adjustment	Adjusted limits
Gamma diversity component (γ)	$0 < \gamma < \infty$	No adjustment	$0 < \gamma < \infty$
Gini-Simpson Diversity Index (D_{GS})	$0 \leq D_{GS} < 1$	No adjustment	$0 \leq D_{GS} < 1$
Pielou's Evenness Index (J')	$0 \leq J' \leq 1$	No adjustment	$0 \leq J' < 1$
Perimeter-Area Fractal Dimension (PAFRAC)	$1 \leq \text{PAFRAC} \leq 2$	$\text{PAFRAC} - 1$	$0 \leq \text{PAFRAC} < 1$
Contagion index (CONTAG)	$0 \leq \text{CONTAG} \leq 100$	$\frac{CONTAG}{100}$	$0 \leq \text{CONTAG} < 1$
Area-weighted Mean Core Area Index CAI_{AM}	$0 \leq CAI_{AM} \leq 100$	$\frac{CAI_{AM}}{100}$	$0 \leq CAI_{AM} < 1$
Simpson's Diversity Index (SIDI)	$0 \leq SIDI < 1$	No adjustment	$0 \leq SIDI < 1$

Source: BioCarbon, 2025

For the application of Equation 23, any adjusted indicator value equal to or greater than the operational maximum established by BioCarbon for the application of this Methodology shall be set to that operational maximum. The operational maximum shall be lower than one and shall be applied consistently across all Initiatives and monitoring periods.

14.2 Adjustment of the TS and HCV values

For each applicable Object of Conservation, the Threatened Species score (TSo) shall be calculated as the sum of the values assigned in Table 6 to the applicable conservation-status categories represented by at least one species within that Object of Conservation

14.2.1 Threatened species (TS)

For Threatened Species (TS), the sum of the different categories present in the ecosystem is applied (Table 6).

Table 6. Threatened species (TS)

Category	Symbol	Value
Critically Endangered	CR	5
Endangered	EN	4
Vulnerable	VU	3
Near Threatened	NT	2
Least Concern	LC	1
Data Deficient	DD	1

For the purposes of this Methodology, TS is a conservation-status score derived from the applicable categories listed in Table 6. The inclusion of Near Threatened, Least Concern, and Data Deficient does not classify those categories as threatened.

14.2.2 High Conservation Values (HCV)

The HCV factor used in the calculation of BioCredits shall recognize the identification of one or more HCV categories without making the presence of HCVs a condition for BioCredit quantification. Where no HCV category is identified, a neutral factor of one shall apply. Where one or more HCV categories are identified, each identified category shall contribute a value of two to the HCV factor. The HCV factor shall be determined as follows:

$$HCV_F = \begin{cases} 1, & if\ N_{HCV} = 0 \\ 2N_{HCV}, & if\ N_{HCV} \geq 1 \end{cases} \qquad \text{Equation 22}$$

Where:

HCV_F	=	High Conservation Value factor used in the calculation of BioCredits
N_{HCV}	=	Number of HCV categories identified, calculated using Equation 13

14.3 Calculation of BioCredits

14.3.1 Per monitoring period

BioCredits for the monitoring period are calculated using Equation 23.

For the application of Equation 23, the gamma diversity component, Threatened Species score, Gini-Simpson Diversity Index, and Pielou's Evenness Index shall be calculated separately for each applicable Object of Conservation.

$$BioCredits_{mp} = \frac{[HCV_F]\sum_{o=1}^{n_{OC}}\left[\frac{\gamma_o[TS_o]}{1-\left(\frac{D_{GS,o}+J'_o}{2}\right)}\right]}{1-\left(\frac{PAFRAC+CONTAG+CAI_{AM}+SIDI}{4}\right)} \quad \text{Equation 23}$$

Where:

$BioCredits_{mp}$	=	BioCredits quantified for the biodiversity conservation outcomes generated by the Initiative during the monitoring period
o	=	Index for the applicable Object of Conservation
n_{OC}	=	Total number of Objects of Conservation included in the quantification
γ_o	=	Gamma diversity component calculated for Object of Conservation o
TS_o	=	Threatened Species score calculated for Object of Conservation o
$D_{GS,o}$	=	Gini-Simpson Diversity Index calculated for Object of Conservation o
J'_o	=	Pielou's Evenness Index calculated for Object of Conservation o
HCV_F	=	High Conservation Value factor determined in accordance with Section 14.2.2
$PAFRAC$	=	Adjusted Perimeter-Area Fractal Dimension at the landscape level
$CONTAG$	=	Adjusted Contagion Index at the landscape level

CAI_{AM}	=	Adjusted Area-weighted Mean Core Area Index at the landscape level
$SIDI$	=	Simpson's Diversity Index at the landscape level

14.3.2 Per minimum spatial unit (MSU)

The BioCredits quantified for the monitoring period shall be expressed per Minimum Spatial Unit (MSU) using Equation 24.

$$BioCredits_{MSU} = \frac{BioCredits_{mp}}{A} \quad \text{Equation 24}$$

Where:

$BioCredits_{MSU}$	=	BioCredits, per minimum spatial unit of one hectare; BioCredits ha^{-1}
$BioCredits_{mp}$	=	BioCredits quantified per monitoring period;
A	=	Total area of the Initiative; ha

15 Monitoring Plan

As part of the Conservation Initiative Document (CID), the Initiative holder shall submit a Monitoring Plan that includes, at a minimum:

(a) the data and information required to apply the BioCredit quantification metrics;
(b) the data and information required to establish and, where applicable, reassess the biodiversity baseline;
(c) the procedures and data required for risk assessment and risk management;
(d) the procedures for data quality assurance and quality control applicable to monitoring activities and quantification results;
(e) the procedures for the periodic calculation of BioCredits;
(f) the roles and responsibilities for monitoring, data management, quantification, and reporting;
(g) the procedures required to monitor the Initiative's contribution to the Sustainable Development Goals (SDGs), in accordance with the applicable BioCarbon requirements;

(h) the procedures required to monitor climate change adaptation measures; and
(i) the monitoring frequency applicable to the selected indicators and metrics.

The monitoring plan shall be structured appropriately and in accordance with:

(a) national circumstances and the context of the biodiversity conservation initiative;

(b) good monitoring practices, appropriate for the follow-up and control of the activities of the biodiversity conservation initiative;

(c) procedures to ensure the quality of the data.

The Monitoring Plan shall provide for the collection of the data and information necessary to:

(a) demonstrate continued compliance with the applicability conditions established in Section 5;

(b) monitor biodiversity conditions and biodiversity conservation outcomes in relation to the applicable baseline or counterfactual, where relevant;

(c) monitor identified risks and the implementation of corresponding risk-management measures;

(d) monitor the Initiative's contribution to the Sustainable Development Goals (SDGs), in accordance with applicable BioCarbon requirements;

(e) monitor compliance with the applicable Sustainable Development Safeguards (SDSs); and

(f) monitor the implementation of climate change adaptation measures.

The Monitoring Plan shall include qualitative and quantitative indicators associated with the composition, structure, and functionality of ecosystems and other variables relevant to the conservation objectives and the quantification of biodiversity conservation outcomes. For each indicator, the Monitoring Plan shall specify, as applicable, the metric, unit of measurement, data source, monitoring method, frequency, and responsible party.

Monitoring indicators and methods shall be consistent with the biodiversity baseline and shall enable comparison across monitoring periods and the application of the quantification metrics established in this Methodology.

The Initiative holder shall define the monitoring frequency based on the conservation objectives, the characteristics and sensitivity of the selected indicators, ecological dynamics, identified risks, and the level of uncertainty associated with the monitored biodiversity conservation outcomes. Monitoring intervals shall be sufficient to detect ecologically significant changes and support the application of the quantification metrics established in this Methodology.

Monitoring periods under this Methodology shall be no shorter than one (1) year and shall not exceed five (5) years.

15.1 Sampling Effort Standardization

15.1.1 Rationale

The biodiversity indices defined in Section 13 (richness, dominance, evenness, and derived diversity components) are computed directly from field-recorded species and individual counts. These counts are sensitive not only to the true state of biodiversity at the site, but also to the amount and consistency of sampling effort applied to detect it. Without standardized effort, an apparent decline in richness or diversity between monitoring periods may reflect reduced detectability rather than an actual loss of biodiversity, and an apparent increase may reflect greater effort rather than genuine improvement. This section establishes requirements to ensure that comparisons of biodiversity indices across monitoring periods are attributable to ecological change rather than sampling artifacts.

15.1.2 Effort documentation

For each taxonomic group and each monitoring period, the Initiative holder shall document and report the sampling effort applied, using metrics appropriate to the survey method employed, including but not limited to:

Survey method	Effort metric
Camera trapping	Camera-trap nights
Mist netting	Net-hours

Point counts	Number of points x visits x minutes per visit
Pitfall / funnel trapping	Trap-nights
Line transects	Transect-kilometers surveyed
Active/visual search	Person-hours of search effort
Vegetation plots	Number and area of plots sampled

15.1.3 Consistency across monitoring periods

For a given taxonomic group, sampling effort applied in a monitoring period shall not deviate by more than 20% from the effort applied in the immediately preceding monitoring period for that same group, unless a scientifically justified reason for the deviation is documented (e.g., expanded initiative boundary, adoption of an improved survey method with demonstrated equivalence or superiority). Surveys shall be conducted, to the extent feasible, within comparable seasonal windows across monitoring periods, since species detectability for most taxonomic groups varies systematically with season.

15.1.4 Sampling completeness

For each taxonomic group and monitoring period, the Initiative holder shall report an estimate of sampling completeness, calculated as the ratio of observed species richness to estimated asymptotic richness using a recognized non-parametric estimator or species accumulation function (Colwell & Coddington, 1994; Soberón & Llorente, 1993). Data shall be considered adequately sampled where this ratio is at least 85%, consistent with completeness thresholds applied in comparable landscape-level biodiversity assessments (e.g., Arellano & Halffter, 2003). Where this threshold is not met, the Initiative holder shall either supplement sampling until the threshold is reached, or report the result together with its completeness value and an explicit uncertainty caveat.

15.1.5 Comparability rule between periods

Where sampling effort differs between the monitoring period under assessment and the immediately preceding one (even within the tolerance established above) species richness (Equation 1) and any index derived from it (Equations 2, 7, 8) shall additionally be reported on an effort-standardized basis, using individual-based rarefaction (Hurlbert, 1971; Gotelli & Colwell, 2001), with the lower of the two periods' total number of individuals (N) as the common reference sample size, so that period-to-period comparisons reflect ecological change rather than a difference in sampling intensity.

15.1.6 Review flag

Where observed species richness for a taxonomic group decreases by more than 25% relative to the immediately preceding monitoring period while the corresponding total number of recorded individuals (N) for that group does not decrease proportionally, this shall be flagged for review prior to use in Equation 23. The review shall determine whether the change is attributable to a genuine ecological signal or to a sampling artifact, and shall be documented in the monitoring report together with the evidence considered.

16 Risk management

The Initiative holder shall assess the environmental, financial, social, and other material risks associated with the implementation of biodiversity conservation activities and the achievement of biodiversity conservation outcomes.

Based on the identified risks, the Initiative holder shall define and implement appropriate risk management and mitigation measures to support the integrity and durability of biodiversity conservation outcomes.

In this regard, the Initiative holder shall:

(a) determine the context, scope, and criteria applicable to risk management;
(b) identify potential natural and anthropogenic risks that may affect conservation activities or biodiversity conservation outcomes and define appropriate mitigation measures;
(c) identify potential financial risks related to expected costs, investments, and cash flows of the Initiative and define appropriate mitigation measures;
(d) identify material risks associated with stakeholder participation and the implementation of biodiversity conservation activities; and
(e) assess the significance of the identified risks using an appropriate and documented approach.

The Initiative holder shall apply appropriate methods to assess direct and indirect risks and shall define mitigation measures within an adaptive management approach.

Adaptive management shall enable conservation activities and specific actions to be adjusted in response to changing conditions, monitoring results, and new information in order to support the achievement and durability of biodiversity conservation outcomes.

The Initiative holder shall document the identified risks and corresponding management and mitigation measures in the Initiative documentation, including reference to the applicable management plans or procedures.

17 Uncertainty management

The Initiative holder shall identify, assess, and document the sources of uncertainty that may affect the quantification of biodiversity conservation outcomes and BioCredits under this Methodology.

Uncertainty assessment shall consider, as applicable, uncertainty associated with data sources, sampling design and representativeness, measurement methods, biodiversity indicators and metrics, spatial data, classification procedures, model assumptions, and the calculation of BioCredits.

Data and methods used for quantification shall be sufficiently accurate, consistent, representative, and reproducible to support the reliable application of the metrics established in this Methodology. The Initiative holder shall document the data sources, assumptions, methodological choices, limitations, and quality-control procedures relevant to the uncertainty assessment.

Where uncertainty is material and may result in the overestimation of biodiversity conservation outcomes or BioCredits, conservative approaches shall be applied. Such approaches may include the use of conservative parameter values or assumptions, exclusion of insufficiently supported data, adjustment of quantified results, or other scientifically justified measures appropriate to the source and magnitude of uncertainty.

The Initiative holder shall conduct an uncertainty analysis using an appropriate and scientifically justified approach. The analytical method shall be proportionate to the nature of the indicators, data, metrics, and sources of uncertainty involved. Appropriate approaches may include sensitivity analysis, confidence intervals, standard deviation, assessment of monitoring data quality, spatial accuracy assessment, or other suitable methods. Annex 2 provides non-binding references that may support the selection of appropriate uncertainty analysis approaches.

Uncertainty shall be reassessed for each monitoring period where new data, changes in monitoring methods, or other material circumstances may affect the reliability of the quantified results. The uncertainty assessment and any conservative treatment applied shall be documented and made available for auditing.

18 Durability of biodiversity conservation outcomes

The Initiative holder shall demonstrate that the biodiversity conservation Initiative has the legal, institutional, financial, and management arrangements necessary to support the continuity of conservation activities and the durability of biodiversity conservation outcomes.

Durability under this Methodology refers to the capacity to maintain biodiversity conservation outcomes over time, recognizing that ecosystems are dynamic and subject to natural variability, anthropogenic pressures, climate-related risks, and other external factors. It does not imply that biodiversity conservation outcomes are absolute or irreversible.

The Initiative holder shall identify and manage material risks that may affect the durability of biodiversity conservation outcomes, in accordance with the risk management requirements of this Methodology and the applicable requirements of the BBS.

Measures supporting durability shall include, as applicable:

(a) legal, institutional, contractual, or governance arrangements supporting the continuity of conservation activities;
(b) clearly defined roles and responsibilities for implementation, monitoring, and management;
(c) adequate financial and operational arrangements to support the implementation of conservation activities;
(d) monitoring capable of identifying material deterioration or loss of biodiversity conservation outcomes; and
(e) corrective and adaptive management measures to address identified risks or material deterioration.

Any material deterioration or reversal of biodiversity conservation outcomes shall be identified, documented, and addressed in accordance with the applicable requirements of the BBS.

19 References

The following references provide the scientific, methodological, and normative basis for the development and application of this Methodology. They support the selection of biodiversity indicators, landscape metrics, monitoring and sampling approaches, uncertainty assessment, additionality, risk management, and the durability of biodiversity conservation outcomes under the BioCarbon Biodiversity Standard.

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Annex 1. Some information references[3]

Non-exclusive guidance is provided on methods and techniques for biodiversity and landscape information gathering. The nature of science and methodological approaches requires that the methods and techniques used be updated and adapted as tools and available knowledge evolve. Therefore, it is essential to maintain flexibility and adapt strategies to the specific needs of scientific initiatives and advances.

If the initiative holder has more precise equipment or techniques, these are also valid, as long as they are used consistently and systematically during the monitoring periods. Here are some references for biodiversity and landscape monitoring techniques and methods.

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[3] This Annex is provided for informational purposes only and does not establish mandatory methodological requirements.

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The application of methods and techniques for information gathering should consider the following:

(a) Pre-planning: Identify sampling areas according to ecosystem representativeness, logistical access and project objectives;
(b) Training: ensure that personnel have the necessary training for sampling, identification and handling of samples;
(c) Ethics and impact minimization: avoid unnecessary damage to species and ecosystems during field activities;
(d) Record: Document metadata (date, time, coordinates, weather conditions) along with evidence (e.g. photographic, bioacoustic or video);
(e) Environmental Permits: guarantee the legal authorization to carry out sample collection and handling activities according to current regulations.

Annex 2. References for uncertainty analysis

This Annex provides non-binding references to support the consideration of uncertainty in biodiversity assessment and does not prescribe a specific analytical approach.

Ecological models	Banos-Gonzalez, I.; Martínez-Fernández, J.; Esteve-Selma, M. -Á.; & Esteve-Guirao, P. (2018). Sensitivity Analysis in Socio-Ecological Models as a Tool in Environmental Policy for Sustainability. *Sustainability*, *10*(8), 2928. https://doi.org/10.3390/su10082928
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Version	Date	Description
Document for public consultation	November 21, 2022	Initial version - Document submitted for public consultation
Version 1.0	January 9, 2023	Updated version Some clarifications and minor editorial changes
Version 2.0	February 24, 2024	Updated version Quantification period Eligible activities Monitoring period
Version 3.0	August 23, 2024	Updated version Definitions Adjustments in Equations and Multiplier Factor
Version 4.0	January 27, 2025	Updated document Some definitions Mathematical model for quantification of BioCredits References for consultation
Draft for Public Consultation Version 4.1	August 11, 2026	Methodological update and alignment with the BioCarbon Biodiversity Standard (BBS) Version 5.0. Clarification of applicability to terrestrial ecosystems; alignment with the biodiversity conservation outcome architecture, additionality, temporal attribution, monitoring, uncertainty management, risk management, and durability requirements; methodological and editorial refinements; and internal consistency improvements.