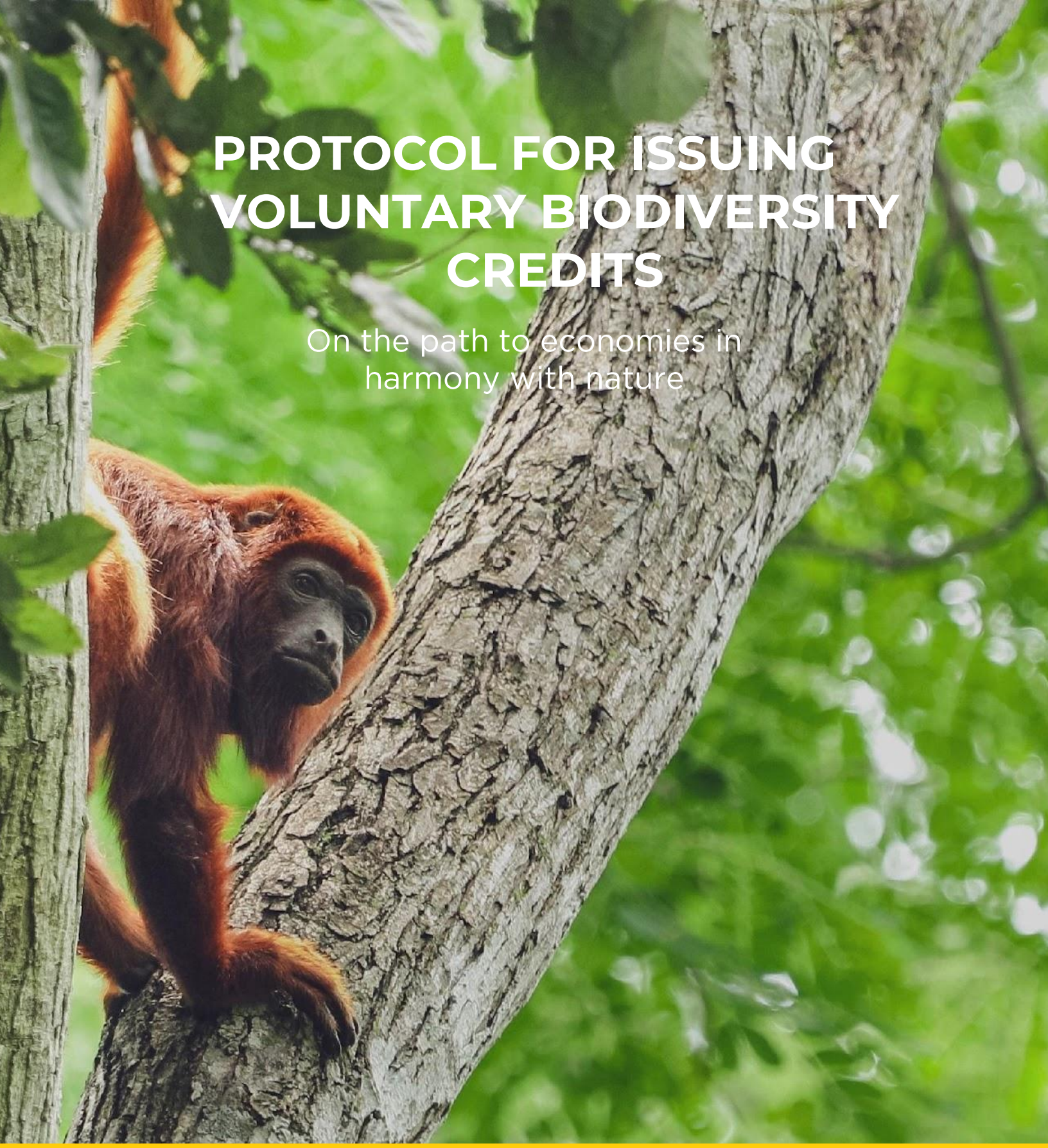

PROTOCOL FOR ISSUING VOLUNTARY BIODIVERSITY CREDITS

On the path to economies in harmony with nature

English Version 3.0 | November 2022

TERRASOS

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This document constitutes the translated copy of version 3.0 of September 2022
of the *Protocol for the Issuance of Voluntary Biodiversity Credits*,
which may be updated periodically by the interested parts.

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CLARIFICATION BEFORE STARTING

Thanks to the joint work and efforts made by the aforementioned institutions, the Protocol for the Issuance of Voluntary Biodiversity Credits is one of the first protocols worldwide for the issuance of Biodiversity Credits. In this sense, this document is a Beta version, which is under constant revision by Terrasos, and the different partners of the Working Group. In addition, it represents a technical, financial, and technological innovation for biodiversity conservation and natural resource management, establishing a roadmap to generate projects that ensure quantifiable gains in terms of biodiversity, as well as the financial mechanism to ensure its sustainability over time. With the objective of improving the protocol and facilitating its application to different projects oriented to biodiversity protection, weinvite stakeholders interested in this document to send us their constructive comments via e-mail: biodiversitycredits@terrasos.co.

TERRASOS

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- ABBREVIATIONS AND ACRONYMS

VBC	Voluntary Biodiversity Credits
CCBA	The Climate, Community, and Biodiversity Alliance
CBD	Convention on Biological Diversity
COP15	Conference of the Parties on Biodiversity
GBIF	The Global Biodiversity Information Facility
IPBES	The Intergovernmental Scientific-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
NNLB	No Net Loss of Biodiversity
UN	United Nations Organization
PNGIBSE	National Policy for the Comprehensive Management of Biodiversity and its Ecosystem Services (Colombia)
RLE	Red List of Ecosystems
SiB	Colombian Biodiversity Information System
KBA	Key Biodiversity Areas

1 INTRODUCTION

The year 2020 marked the beginning of a crucial decade for the international environmental agenda. The United Nations (UN) Decade for Biodiversity ended in 2020, and the efforts made to stop the loss of species and biological richness did not achieve the expected results. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), nature is in global decline at an unprecedented rate in human history, and the species extinction rate has accelerated over the last 50 years. Similarly, the IPBES affirms that if the rapid decline in biological diversity continues, not only will we not meet the specific objectives of nature conservation, but also other international goals such as those set out in the 2030 Agenda or the Paris Agreement will not be reached (IPBES, 2019).

Faced with this scenario, international efforts are concentrating on negotiating and defining a post-2020 framework with concrete and efficient actions, which will allow biodiversity to be put on the path to recovery by 2030. Moreover, by 2050 biodiversity is expected to fully recover, and people to live in harmony with nature[1], to the extent that countries conserve, restore and sustainably use natural resources, ensuring the provision of ecosystem services and providing essential benefits for all people.

The conclusions of the varied agendas and negotiations that are being carried out found that a combination of measures is needed to halt and reverse biodiversity loss, including actions to address land-use change, improve the effectiveness of conservation actions and restoration, and increase the coverage of such actions through ecosystem-based management[2]. Similarly, it is necessary to develop spatial planning tools to protect species and reduce or eliminate threats to biodiversity, as well as actions to transform economic and financial systems, which have a central role in changing global financial flows from having a negative to positive impact on nature (CBD, 2020).

Consequently, and given the need to create and promote projects that ensure the recovery of biodiversity and contribute significantly to international goals, Terrasos, P4F and others stakeholders from the Working Group, created the *"Protocol for the Issuance of Voluntary Biodiversity Credits*. This Protocol seeks to promote exceptional biodiversity conservation projects, providing criteria for their design and operation which adopt conservation measures based on areas with great ecological value, and are managed based on financial, legal, and technical guarantees working under a performance-based approach. Likewise, we believe that this Protocol will allow the mobilization of public and private environmental investments to generate a market for Biodiversity Credits, which will allow the projects and their actions to be sustainable in the long term and generate environmental, social, and economic value in the regions where they are located.

This Protocol is designed so that eligible biodiversity conservation projects can register, quantify, and issue Biodiversity Credits (VBC). These credits may be acquired by both individuals and legal entities

[1] Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets, 2010.

[2] Ecosystem-based adaptation involves the conservation, sustainable management, and restoration of ecosystems as a cost-effective solution that can help people adapt to the impacts of climate change (Colls et al., 2009).

that want to make a positive and effective contribution to the conservation of threatened ecosystems and biodiversity in general.

2 OBJECTIVES OF THE PROTOCOL

The "Protocol for Issuing of Voluntary Biodiversity Credits" (hereinafter The Protocol) seeks to establish a roadmap to generate projects that ensure quantifiable gains in terms of biodiversity, as well as the financial and legal assurances required to ensure sustainability and permanence. Accordingly, the Protocol:

- Defines the concept of Biodiversity Credits.
- Specifies the requirements that conservation projects must meet for the registration and issuance of Voluntary Biodiversity Credits.
- Establishes the principles that govern conservation projects and the issuance of Voluntary Biodiversity Credits.
- Determines the mechanism for the quantification of Voluntary Biodiversity Credits.
- Establishes quality and transparency criteria for the monitoring, reporting and verification of preservation and restoration actions, and the accounting of Voluntary Biodiversity Credits.
- Proposes the "*Credit Release Schedule*" that guarantees the fulfilment of administrative and technical milestones in tandem with the issuance of Credits that lead to a results-based payment mechanism, oriented to measurable and permanent gains in terms of biodiversity conservation.
- Establishes the minimum conditions that a conservation project registration platform must have for monitoring transactions of Voluntary Biodiversity Credits, to avoid double counting events.
- Defines the different roles that make up the value chain of voluntary biodiversity credits and establishes the minimum characteristics that each of them must meet.

3 SCOPE

This document describes the guiding principles of biodiversity conservation projects that may be eligible for the generation of Voluntary Biodiversity Credits (VCB), as well as the methodology for a preservation and restoration project to quantify the amount of Voluntary Biodiversity Credits that can be issued. In addition, it establishes the release mechanism for these, as well as the monitoring, reporting and verification requirements. This document is a guide for different interest groups as follows:

a) **Project owners:** Refers to the owners of the biodiversity credits. Project owners must demonstrate that they have the legal right to control and operate project activities. The Project

Operator shall demonstrate ownership of potential credits or eligibility to receive potential credits by meeting at least one of the following: A. Own the land and potential credits upon which the Project is located; or B. Own an easement or equivalent property interest; or C. Have a written and signed agreement from the landowner, granting ownership to the Project Operator of any credits.

b) **Developer of the conservation projects.** Any organization, NGO, community, among others, with the ability to design conservation and restoration projects for the purpose of biodiversity conservation. They may make use of this Protocol for the quantification and release of VBC. In turn, they will be able to follow the recommendations regarding the monitoring, reporting and verification of VBC, in order to increase the probability of obtaining public and private resources from investors and potential clients who are looking for exceptional projects that ensure results in terms of biodiversity.

c) **Individuals and legal entities** interested in making positive contributions to biodiversity may make use of this Protocol to guide their investments in those projects where measurable and permanent results in biodiversity are guaranteed, as well as transparency and traceability in the allocation of their investments.

d) **Investors.** Private companies, international organizations and other financiers may use the principles established in this Protocol to direct their investments in exceptional projects, with good practices and where risks are minimized.

e) **Verifiers.** Third parties that carry out the monitoring and verification of conservation and restoration actions, and the accounting of the VBC issued by a conservation and restoration project. The verifiers ensure that the management of the VBCs is being carried out in a transparent manner and that their sale represents demonstrable gains in biodiversity.

f) **Registry platform administrators.** Legal entities independent of the Protocol that develop and operate the information systems necessary to maintain adequate accounting and integrity of the information that: (1) supports the preservation and restoration activities of each project, (2) and clearly and uniquely identifies the transactions and the final beneficiary of each of the VBCs.

g) **Government entities** that may require that such projects be registered and informed to government entities. They may also be interested in knowing about the standards and protocols for voluntary biodiversity credits to design and implement their regulations and public policies, as well as to develop preservation and restoration projects with demonstrable gains in biodiversity.

h) **Certification bodies/ Digital standards developers:** Independent entity (private or governmental) that manages the rules and conditions necessary to issue credits. It certifies the projects, develops and updates the Protocol, and designs the templates for content development, among other functions. Additionally, technological innovation should be facilitated to allow for the integration of methodologies based on digital standards.

3.1 Clarification:

As mentioned above, this protocol is a guide for various actors to successfully generate projects that secure quantifiable biodiversity gains and can accelerate financial flows into conservation and ensure permanence. As such, the protocol is not a prescriptive document and has a degree of flexibility, recognizing that biodiversity conservation projects have diverse characteristics that will require the adaptation of some elements of this protocol.

This protocol does not address pricing issues. Each project developer must secure a price per credit that ensures the permanence and sustainability of the project considering fair benefit sharing and all project costs and expenses. The determination of the price of each credit is entirely outside the scope of this protocol.

4 CONCEPTUAL FRAMEWORK

The Protocol aims to facilitate the issuance of Voluntary Biodiversity Credits from varied conservation projects under a rigorous, and at the same time practical, approach in its implementation. Similarly, it intends for projects to be technically rigorous, contribute to the achievement of demonstrable gains in biodiversity in areas with great ecological value, and ensure the permanence of preservation and restoration actions, in addition to ensuring that the projects and its environmental conservation goals are realistic, achievable, and measurable.

Given the foregoing, this Protocol proposes a quantification and issuance of Voluntary Biodiversity Credits based on "*ecosystems*[3]" as an approach to biodiversity conservation[4], in which, according to the threat categories of each ecosystem, conservation projects will be valued in a differentiated way. Other aspects that characterize the project and therefore influence the quantification of VBCs are the area linked to the project, the specific actions to be developed within each ecosystem (preservation or restoration), the connectivity opportunities that the project generates and the permanence in time of these actions. Based on these four (4) elements (ecosystem, actions with respect to the total area, connectivity, and temporality – See Figure 1), and as will be seen in detail later, the Voluntary Biodiversity Credits are quantified for each conservation project.

[3] See the definition of *Ecosystems* in the Glossary at the end of this document.

[4] See the definition of *Biodiversity* in the Glossary at the end of this document.

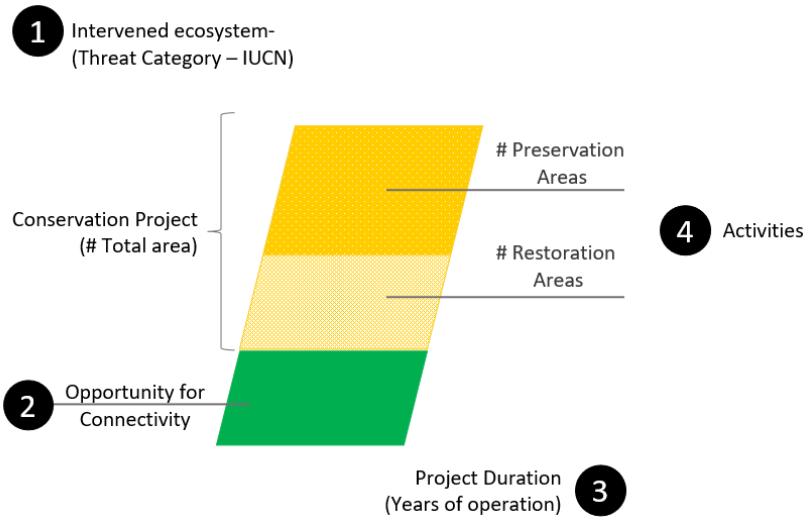

Figure 1. Technical characteristics that determine the number of VBCs that a conservation project can issue.

4.1. Biodiversity at the ecosystem level

This Protocol proposes ecosystems as a proxy for [overall] biodiversity to support the issuance of Voluntary Biodiversity Credits, because they represent a large-scale interpretation that allows us to identify important assemblage of biodiversity that require protection in terrestrial and marine landscapes and serve as proxies for poorly understood fine-scale features (Margules & Pressey 2000; Pressey & Bottrill, 2009). Clear evidence of this is the ease of evaluating the deterioration of an ecosystem vs. the extinction of a particular species. Ecosystem assessment and measurement considers other types of components (e.g., abiotic), which are not measured by species assessments. Similarly, ecosystem-level biodiversity assessments may require less time and cost less than species-by-species assessments or genetic assessments and may facilitate measurement and reporting of results (Keith et al, 2020).

In this sense, although there are multiple approaches to understanding biodiversity, differentiating, and evaluating projects based on the state of conservation of the ecosystems[5] where they are located is an assertive, rigorous approach that can be widely accepted, since currently, an information infrastructure is being developed that supports the management of ecosystems and the services they provide. IUCN recently adopted its "*Global Ecosystem Typology"* (Keith et al, 2020), with the aim of supporting global, national, and regional efforts to assess and manage risks to ecosystems and promoting global policy initiatives such as criteria for the IUCN Red List of Ecosystems (RLE) and the Key Biodiversity Areas (KBA), among other initiatives.

In particular, the ecosystem red lists define ecosystems as assessment units that represent complexes of organisms and their associated physical environment within an area. This definition therefore

[5] According to the categories established in the IUCN Red List of Ecosystems (RLE).

incorporates four (4) elements: biotic complexes, abiotic complexes, interactions, and spatial location (Keith et al, 2023). The combination of these four elements leads to a robust approach to biodiversity conservation, since it does not ignore the specific aspects of fine elements within a landscape, in addition to considering and evaluating them in context with their varied interactions, as noted above, including both biotic and abiotic. Given the framework above, this approach promotes the need for more sophisticated and self-sufficient conservation actions, compared to approaches where some of the four elements mentioned above are addressed individually.

With the foregoing, the Protocol recognizes that ecological processes are crucial for diagnosing threats to individual species and resolving potential management conflicts and therefore support the ecosystem-based approach, without prejudice to conservation actions at the species level or other levels of biodiversity. On the other hand, through the monitoring and follow-up requirements proposed below, the Protocol ensures that key elements such as threatened species are not overlooked in project planning decisions, while also ensuring that these integrate efforts at multiple levels of biodiversity, thereby ensuring that conservation outcomes are strengthened and more effective.

It is worth mentioning that although not all countries have the red list of ecosystems for their jurisdiction, this Protocol aims to encourage political will as well as national and international investment in this type of effort, which will allow the identification of critical areas of ecosystems for the conservation of biodiversity and the supply of environmental services, as well as those with greater risk of collapse[6], while informing the sustainable management of ecosystems and guiding voluntary environmental investments.

Finally, an ecosystem approach for the quantification and issuance of Voluntary Biodiversity Credits entails social and economic benefits, to the extent that it allows prioritizing investment decisions for preservation, restoration, and sustainable development, for example, for the allocation of national or corporate budgets (Carwardine et al. 2009). On the other hand, considering that human well-being depends on ecosystems and their ability to provide a large number of environmental services, this approach becomes a communication and education tool to support biodiversity conservation and sustainable land and water management.

5 ELIGIBLE PROJECTS

This Protocol applies to projects whose main objective is the conservation of biodiversity through preservation and restoration actions, and the implementation of monitoring, reporting and verification activities that demonstrate measurable gains in biodiversity and that occur within the framework of voluntary investments, whether natural or legal persons. The Protocol seeks to promote and accelerate investments in biodiversity conservation by generating a payment for performance mechanism whereby a project can issue Voluntary Biodiversity Credits as they achieve demonstrable and verifiable management milestones and gains in biodiversity.

[6] See definition of Ecosystem *Collapse* in the Glossary at the end of this document.

5.1. Eligible activities

Biodiversity conservation projects that adhere to this Protocol for the quantification of VBC, must demonstrate quantifiable gains in biodiversity, i.e. that they will bring a given landscape from a state of lower to greater biodiversity, for which it will be necessary to carry out preservation and restoration actions separately or jointly, as described below:

5.1.1. Preservation

Preservation is all actions that allow the protection and maintenance of the natural state of biodiversity and ecosystems by limiting or eliminating barriers to conservation. Preservation actions generally include strategies related to activities in the project site such as, the establishment of legal and financial mechanisms that ensure the maintenance of the areas in the long term, the generation of income from the non-destructive use of ecosystems, the enclosure of areas, the establishment of living barriers, the isolation of forest fragments, as well as the development of surveillance and control programs and, even issues related to the clarification of land rights or property title to the land where the conservation project will be structured (MADS, 2015; 2018; Mendoza et al, 2012).

5.1.2. Restoration

Restoration is an interdisciplinary strategy that seeks to help restore an ecosystem that has been degraded, damaged, or destroyed (MADS, 2015; Mendoza et al, 2012, SER, 2004; 2019). Ecological restoration, as understood by the Protocol, is a complex process that transcends the traditional concept of *"change from a modified cover to a state similar to the original".* In principle, ecological restoration requires the meshing of many environmental, social, legal, and economic aspects[7].

Consequently, this Protocol considers ecological restoration to be the process of assisting (helping) the recovery of a damaged, degraded, and/or modified ecosystem (Gann et al., 2019). This definition, by using the term *"assisting recovery*", implies that the ecosystem itself plays an important role in its restoration. The intervention carried out must provide the conditions for restoration, but this is only one factor in the process; restoration professionals (people or organizations that carry out a restoration process) must play a role of facilitators so that the organisms carry out the recovery. Excessive human intervention in a process means that it is not called ecological restoration, and is closer to gardening, ecological engineering, agronomy, or cultivation, since the ecological result of the process is being determined. Excessive intervention produces a version of ecosystem that fits with an anthropic conception of nature or one which is the result of budget and time constraints. In this sense, the process of selecting species and the arrangements that are carried out with them are very important, since these result in human conceptions of nature. Ecological restoration uses gardening techniques, forest engineering, agriculture, among other disciplines; but the difference between ecological restoration and these disciplines is the goal of allowing the ecosystem to evolve or develop according to its inherent properties (Clewell & Aronson, 2013).

[7] Based on the Standards of Practice and Planning established by the *Society for Ecological Restoration* (SER) in is publication *International Principles and Standars for the Practice of Ecological Restoration* (Gann et al., 2019).

This way of conceiving and approaching ecological restoration not only promotes the recovery of an ecosystem, but it also makes the process an efficient economic investment. The facilitators that help recovery (restoration professionals) have many limitations in what can be done; therefore, actions must be focused on overcoming the causes of deterioration. Therefore, the actions range from corrections in the biophysical environment, facilitating the exchange of organisms and materials through landscape connectivity, generating socioeconomic conditions that allow the permanence of the actions and thus promoting the resurgence of ecological processes. These types of interventions allow an ecosystem to recover through its internal processes (Clewell & Aronson, 2013).

Given the above, and taking into account what is established by the *Society for Ecological Restoration* (Gann et al., 2019), the implementation of restoration projects must consider the following:

1. ***Protect the site from damage*.** Restoration work or actions must prevent further damage and cannot cause damage to the ecosystem. These include physical damage (for example, "vegetation clearing), chemical contamination (excessive fertilizer use, pesticides, among others) or biological contamination (introduction of species that are not native to the region or pathogens).

2. ***Involve the right participants.*** The people involved in the project must be the right ones to carry it out. Regional actors and the community should be invited to participate in the project.

3. ***Incorporate natural processes.*** All treatments and restoration strategies must be carried out in such a way that they correspond to the strengthening of the natural processes that are observed in the site, in this way promoting or assisting recovery.

4. ***Respond to changes that occur on the site.*** It is very important to note that management must be adaptive and informed by monitoring results. This includes both corrective changes to accommodate unexpected ecosystem responses and additional work that was not accounted for in the framework or was poorly modelled.

5. ***Ensure compliance.*** The project must comply with all current legislation.

6. ***Communication with stakeholders.*** There must be active communication with the interested parties, anticipation in the generation of reports that account for the progress of the project.

It is worth mentioning that for project to be eligible, natural areas converted in the last 10 years will not be considered. This is in order not to generate perverse incentives for the transformation of natural ecosystems.

6 DEFINITION OF VOLUNTARY BIODIVERSITY CREDITS

A Voluntary Biodiversity Credit (VBC) is a transactional unit that represents approximately $10m^2$ of a preserved and/or restored ecosystem that is technically, financially, and legally managed by the project developer to achieve quantifiable results in terms of biodiversity. Each credit can only be sold once during the life of the project, which avoids double counting.

The credit definition is based on the concept of a loan that nature has given us, which means that whoever buys a VBC is, in other words, voluntarily contributing to the generation of positive impacts on biodiversity. Credits are used to represent demonstrable biodiversity gains from a conservation project.

6.1. Principles

For a biodiversity conservation project to be able to issue Voluntary Biodiversity Credits, it must ensure that in its structuring and operation, as well as in the issuance, marketing and monitoring of credits, it operates under the following principles.

a) **Traceability:** Ensured access to information related to:
   - *The value chain:* mechanisms must be generated to track and communicate how a Voluntary Biodiversity Credit is created, how it is marketed and how it is withdrawn from the market when all biodiversity conservation goals are reached.
   - *Biodiversity information:* monitor and publish data related to biodiversity monitoring, restoration and conservation actions that are carried out.

b) **Permanence:** The conservation project must have the technical, administrative, financial and legal conditions to ensure the permanence of the activities of preservation and restoration of ecosystems and their biodiversity. The projects that wish to be included in this Protocol must guarantee the continuity of the actions for a period of at least 20 to 30 years (See section 7.1.3.1 Minimum duration of conservation projects). The duration of the action and what is included in the cost of the Credit must be consistent with the time required to achieve the defined objectives.

c) **Rigor:** Biodiversity conservation projects that wish to issue Voluntary Biodiversity Credits must ensure an analytical and scientific rigor in the development of their activities. They must be supported by an establishment and monitoring plan where the objectives to be achieved and the indicators with which their compliance will be measured are specified very clearly (in accordance with the provisions of section 9 REGISTRATION DOCUMENT AND PLATFORM). On the other hand, the design of the conservation project must ensure an ongoing evaluation where the results are contrasted with the goals and objectives, ensuring an adaptive management where corrective changes are made if necessary and/or the implementation of actions that were not initially considered.

d) **Transparency:** All stakeholders must guarantee that the procedures are public and open to consultation (information related to the Loan registration, the preservation and restoration project, the participants and their roles in the Loan transaction, the actions to be carried out, dates, impact, goals and documents), as well as the information related to who the buyer is, and the prices must be public.

e) **Complementarity:** The actions proposed in the structuring of the projects must be complementary and in accordance with the environmental planning and management instruments of the region and with the national or regional conservation priorities. Similarly,

the monitoring and follow-up of the Credits must be complementary to the requirements and trends of the business sustainability reports and indices.

f) **Applicability:** The Protocol will be designed in such a way that, while complying with technical rigor to generate benefits for biodiversity, it is practical and applicable enough to ensure its implementation in a variety of environmental, social, and economic contexts.

g) **Additionality:** Every project that issues Voluntary Biodiversity Credits must generate additional outcomes (demonstrable gains) in terms of biodiversity conservation, which would not have occurred without the implementation of the project. Additionality must also ensure that negative impacts on biodiversity are not transferred to other areas.

To ensure that the gains in biodiversity generated by the project are new, it is necessary to clearly establish which barriers to conservation exist and how they will be overcome thanks to the preservation and restoration actions of each project. These barriers should not only be restricted to the environmental nature, but the analysis should also include social, economic, and legal barriers. To this purpose, this Protocol suggests the following conditions be analysed:

Table 1. Additionality conditions: Analysis of barriers that prevent gains in biodiversity.

Additionality criteria	**Applies Yes/No* Supporting data**
1. Generates new revenue streams for preserved and restored areas	
2. Contributes to avoiding biodiversity loss	
3. Reduces investment barriers (lack of financial resources) to achieve gains in biodiversity	
4. Reduces institutional barriers (restrictions by policies and laws, institutional risks, non-enforcement of the law)	
5. Reduces technological barriers (access to information, lack of training and knowledge in information technologies, lack of technological infrastructure)	
6. Reduces barriers caused by local tradition (as opposed to local knowledge or cultural traditions)	
7. Reduces barriers caused by prevailing practices (*"the project is the first of its kind in the region"*)	
8. Reduces environmental barriers (degraded soils, extreme events, limitations due to adverse weather events)	

9. Reduces social barriers (demographic pressure, social conflicts, lack of organization at the local level)	
10. Reduces tenure barriers and property rights	

* For each project, the applicability of additionality criteria must be analysed according to their context and the mechanism or action that will allow to overcome said barrier must be justified.

The result of this analysis must demonstrate that the preservation and restoration actions and associated investments allow for the removal of these barriers and increase the project revenue streams. In addition, it is important that the project promotes more than one barrier being overcome, especially those related to environmental nature barriers (1, 2 and 8), land tenure and property rights (barrier 9) and investment barriers (3).

As mentioned, each of the principles must be guaranteed in the project development phase, as well as in the issuance, marketing, monitoring, reporting and verification of the Credit. However, not all the principles are inherent to the Credit, but may be associated with the projects that issue them or with the value chain, as shown below:

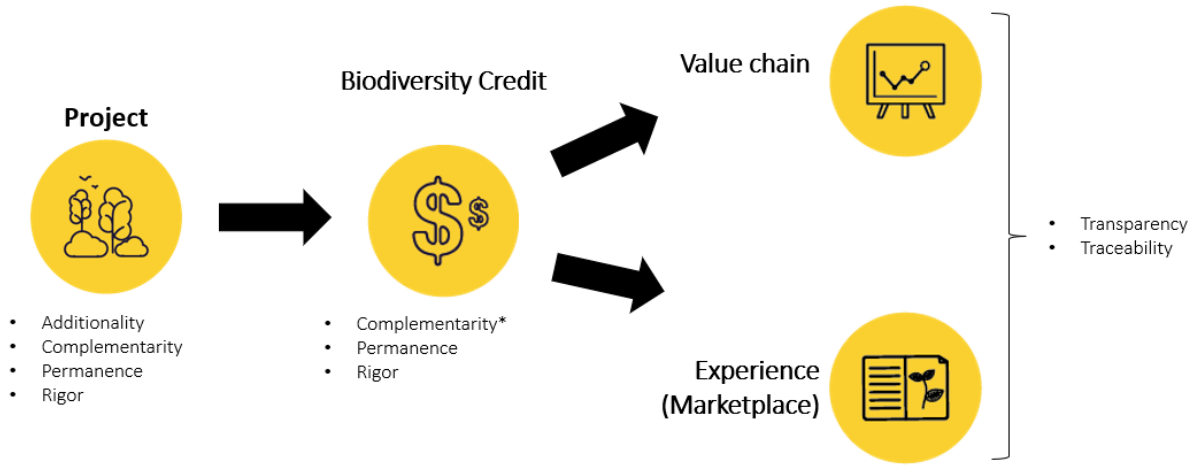

Figure 2. Necessary principles for biodiversity conservation projects to issue Voluntary Biodiversity Credits.

7 METHODOLOGY FOR ISSUING VOLUNTARY BIODIVERSITY CREDITS

Once a project complies with the set of principles in relation to its structuring and operation, and confirms the number of hectares that are going to be included in the project, and in which of them preservation and restoration actions will be developed, the following methodology is proposed for the quantification of the Voluntary Biodiversity Credits that each project can issue.

The fundamental element behind the methodology is the **design of a homogeneous and tradable transactional unit**, but that recognizes that conservation projects are different and that different actions and decisions by the project developer generate more or less additionality. As detailed below, the outcome of the potential credits that a project can issue depends on differentiating factors that are important for biodiversity conservation.

7.1 Quantification of Voluntary Biodiversity Credits

This methodology seeks to differentiate conservation projects according to their technical characteristics and value them differently according to the state of conservation of the ecosystem that is being intervened, as well as the relationship between preservation and restoration activities to be carried out. The more threatened the intervened ecosystem, the greater the number of credits that the project will be able to issue. With this, the Protocol seeks to promote and stimulate biodiversity conservation efforts in those ecosystems that are most threatened, with the smallest extensions of native remnants, as well as with the highest degrees of fragmentation.

This methodology is based on the hypothesis postulated by the IUCN Red List of Ecosystems (RLE) (Bland et al., 2017), in which the ecosystem risk is a function of the species that compose them, their interactions and the ecological processes on which they depend. For the categorization of threats, this list includes criteria related to the evidence of the risk of ecosystem collapse, measured through the reduction in the geographic distribution or the degradation of its key processes and biotic components (Keith et al, 2013).

Given the above, a Credit allocation methodology is proposed based on four (4) differentiating factors related to:

1. **Factor 1:** IUCN threat category of the ecosystem where the project is located.
2. **Factor 2:** Opportunities for ecological connectivity generated by the project.
3. **Factor 3:** Project duration.
4. **Factor 4:** Areas dedicated to preservation and restoration actions in relation to the total project area, which relates to the distribution and degradation of key ecosystem processes.

Next, the formula for the quantification of Voluntary Biodiversity Credits is presented, as well as the description of each of its components or differentiating factors.

Equation 1. Formula for the quantification of Voluntary Biodiversity Credits

$$\#\ Potential\ credits = \frac{TPA * (F1 + F2 + F3) + ARes * F2 + APre * F2}{10}$$

Where:

- **TPA:** Total project area in square meters.
- **ARes:** Areas dedicated to restoration actions in square meters.
- **APre:** Areas dedicated to preservation actions in square meters.
- **F:** Factor

The methodology for assigning VBC is based on differentiating factors with the aim of:

a) Ensuring that the factors that determine the number of credits reflect the prior and potential conditions of the intervention site and therefore the specific needs for the structuring and operation of the conservation project. Consequently, the number of credits that a project can issue varies significantly as the degree of threat to the ecosystem increases, the connectivity it generates with neighbouring areas, the longer the project's operation time (permanence), and the actions to be implemented.

b) Ensuring that commercialization of Voluntary Biodiversity Credits guarantees the generation of the necessary income to develop preservation and restoration activities fully, efficiently, and permanently in the area that is linked to the project, and, with this, demonstrable results in biodiversity are ensured.

7.1.1 Differentiating Factor 1: IUCN Ecosystem Threat Category

Ecosystem Threat Category according to the IUCN is the first factor implemented for the quantification of Voluntary Biodiversity Credits that a project can issue. This is because the state of ecosystems is related to intrinsic values of biological diversity, so addressing biodiversity conservation at the ecosystem level allows large-scale ecological processes and the important dependencies and interactions between species that compose it are considered explicitly (see 4.1 Biodiversity at the ecosystem level). To develop this factor, the categorization of ecosystems generated by the Red List of Ecosystems (Bland, et al. 2017) will be taken as a reference, which provides a new global unified Protocol to assess the status of all ecosystems in the world that are at risk, which can be applied at the global, national, regional, or local level.

The Red List of Ecosystems is an adequate reference, because it was structured in such a way that it complies with four (4) criteria: generality, precision, realism, and simplicity. With this, the classification can be applied to all types of ecosystems, handling data of different quality and detail. Through precision, it manages to promote transparency and replicability, as well as with realism, reliable and precise scientific evaluations are supported, but they are also simple enough to ensure accessibility to the tool by multiple users (Keith et al, 2015).

Given the above, the RLE makes it possible to assess and compare the risk situation of ecosystems, according to standardized quantitative criteria, and allows prioritizing investments in the management, restoration, and conservation of ecosystems. Ecosystems that are most threatened are those in which investments should be prioritized, since the limitations, tensions, and costs associated with their conservation and restoration are greater.

7.1.1.1 Threat Category according to the RLE

There are eight possible conservation categories in which an ecosystem can be classified, three of which group the ecosystems that are considered threatened (see Figure 3):

- **Critically Endangered** (CR): Ecosystems where information about their restricted distribution, the decrease in their areas, as well as the levels of environmental degradation and the disruption of biotic processes indicate that there is an extremely high risk of collapse.

- **Endangered** (EN): Ecosystems where information about their distribution, the trend of decline in their areas, as well as the levels of environmental degradation and the disruption of biotic processes indicate that there is a very high risk of collapse.

- **Vulnerable** (VU): Ecosystems where information about their distribution, the decline trend in their areas, as well as the levels of environmental degradation and the disruption of biotic processes indicate that there is a high risk of collapse.

These categories are nested, so that an ecosystem type that meets a Critically Endangered criteria will also meet the Endangered and Vulnerable criteria. The four additional categories that exist are:

- **Near Threatened** (NT): Ecosystems that do not meet the criteria for the threatened ecosystem categories but are close to qualifying or are likely to qualify for a threatened category in the near future.

- **Least Concern** (LC): Ecosystems that unequivocally do not meet any of the criteria of the threat categories. Widely distributed and relatively undegraded ecosystems are included in this category.

- **Data Deficient** (DD): An ecosystem is data deficient when there is no adequate information to make a direct or indirect assessment of its risk of collapse. Data insufficiency is not a threat category and does not imply any level of risk of collapse. The inclusion of ecosystems in this category indicates that their status has been reviewed, but that more information is required to determine their risk status.

- **Not Evaluated** (NE): Ecosystems that have not yet been assessed.

An additional category known as **Collapse** (CO) [8] is assigned, as it groups together ecosystems where their particular biotic or abiotic characteristics are virtually certain to be lost, and the native biota feature is no longer maintained (see Figure 3). This is the analogue of the extinct category (EX), used for species.

[8] See the definition of *Ecosystemic Collapse* in the Glossary at the end of this document.

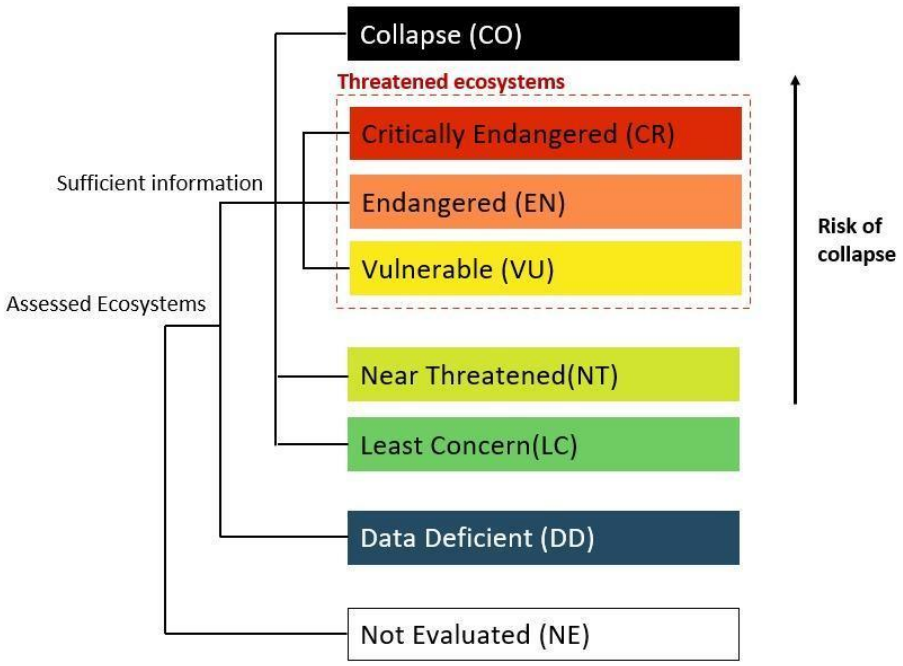

Figure 3. Structure of the categories of the IUCN Red List of Ecosystems.

7.1.1.2 Value of the differentiating factors according to the category of threat

Once the theoretical basis for the inclusion of ecosystem conservation status as a differentiating factor in the allocation of Voluntary Biodiversity Credits is understood, the following factors are proposed for each of the threat categories:

Table 2. Proposed weighting for the differentiating factor related to the ecosystem threat category.

Threat Category according to the LRE	Factor
Critically Endangered Ecosystem (CR)	0.25
Endangered Ecosystem (EN)	0.24
Vulnerable Ecosystem (VU)	0.23
Not in threat category[1]	0.22
Transformed Ecosystems	*

(1) Near Threatened (NT), Least Concern (LC) and Data Deficient (DD); (*) Read considerations in the paragraphs following the table.

Source: Terrasos, 2021

As can be seen in the "Factor" column, the highest value is 0.25 and it can be observed that as the degree of threat decreases, the weight of the factor decreases and with it, the number of credits to be issued.

On the other hand, it is observed that for those ecosystems considered as "Transformed" the differentiating factor is not defined, since these can be altered states or be part of a matrix of ecosystems in some category of threat. In such case, the projects should be evaluated with the differentiating factor that corresponds to the ecosystem where the intervened area occurs and to which the objective is reaching that state given restoration and preservation actions. In other words, a transformed area within a matrix of Tropical Dry Forest will be assigned the differentiating factor corresponding to said ecosystem, ensuring that the restoration actions align with the surrounding ecosystem, seeking to its recovery.

7.1.2 Differentiating factor 2: Opportunities for ecological connectivity

The second factor for the quantification of Voluntary Biodiversity Credits is a measure of the potential contribution to landscape connectivity of a given project. Its valuation rationale aims to positively weight those conservation projects that promote ecological connectivity processes (also called landscape connectivity) and that contribute to the recovery and/or maintenance of the matter and energy flows that sustain ecological processes at the landscape scale.

Ecological connectivity[9] is an attribute of the landscape as a whole, where the morphological and structural units that compose it are related from a functional perspective, with exchanges of energy, materials, organisms, information, etc., taking place between them; in other words, connectivity is the degree to which the energy movement and the flow of living matter through source patches within a landscape matrix is facilitated or impeded (Taylor, 1993). Ecological connectivity is key to the survival of wild plant and animal species and is crucial for ensuring genetic diversity and adaptation to climate change across biomes and spatial scales.

By including this factor, the protocol aims to promote the clustering of projects and ensure that they have a much more significant landscape-level impact than a matrix of isolated conservation projects in degraded matrices could have.

A convenient and popular approach recognizing how landscape elements interact to promote or restrict the movement of living matter and energy comes from landscape ecology and results from the patch-corridor-matrix model (Forman and Gordon, 1986, Forman, 1995) (see Figure 4). This model allows, through a series of metrics, representing the structure and morphological composition of a given landscape. Likewise, the patch-corridor-matrix model facilitates the assessment of the integrity/fragmentation of a given landscape and facilitates the inference of the capacity or potential to favour or not the ecological flows within it.

[9] See the definition of *Ecological Connectivity* in the Glossary at the end of this document.

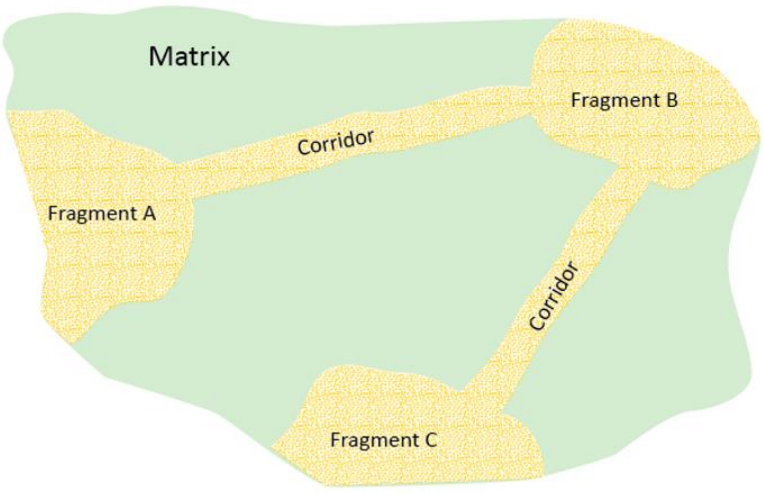

Figure 4. Connectivity ecological framework. Adapted from Barnes, 2000.

With the objective of proposing a standard and practical methodology to determine ecological connectivity, it is proposed to use the metrics of the Fragstats software[10]. This program is widely used for the calculation of landscape metrics, with special emphasis on the quantification of landscape structure. Fragstats was designed to be as versatile as possible, as well as being almost 100% automated, requiring little technical training, making it an ideal tool for this protocol. Fragstats calculates three sets of metrics. For a given landscape matrix, Fragstats calculates several statistics for 1) each fragment or patch[11], 2) each class type[12], and 3) the landscape matrix as a whole [13] (Figure 5).

[10] For further detail and information: https://edis.ifas.ufl.edu/publication/FR431

[11] Fragment or patch level. Calculations are applied to each fragment individually. This is the appropriate level, for example, to determine which is the fragment with the largest surface area among all those represented.

[12] Class level. Calculations are applied to each set of patches of the same class, i.e., those that have the same value or represent the same type of land use, habitat, etc. It is the appropriate level to calculate what is the area occupied by a given land cover, such as forest, or what is the average extent occupied by forest patches. For example, each of the land cover classifications defined by the Corine Land Cover methodology corresponds to a class of elements within the landscape.

[13] Landscape level. Calculations are applied to the landscape, i.e., to all fragments and classes at the same time. The result informs the degree of heterogeneity or homogeneity of the area as a whole that has been quantified.

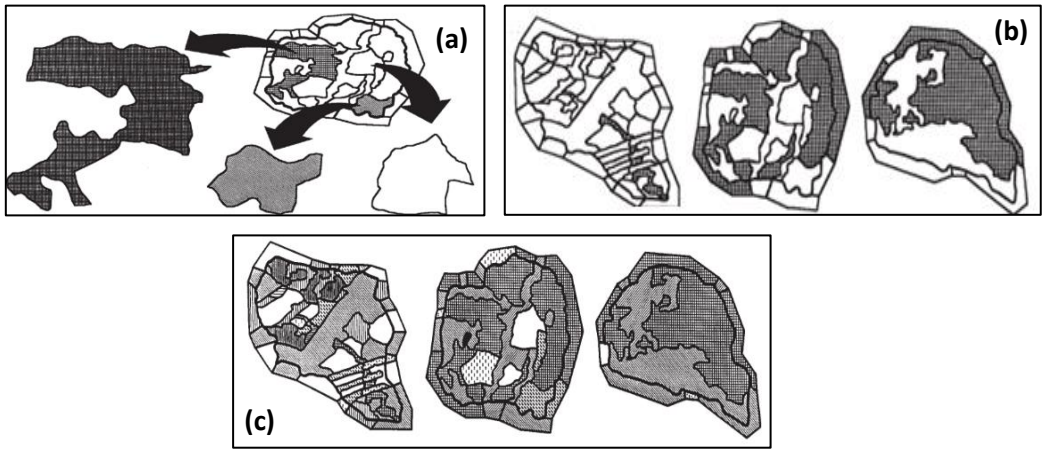

Figure 5. Types of elements in the landscape - a) fragment or patch; b) class type; c) the landscape matrix.

The connectivity factor proposed for the quantification of Voluntary Biodiversity Credits results from the weighted sum of 3 metrics: for patches, classes, and the landscape, respectively. The following is a general description of each metric (or sub-factor) suggested for the estimation of the Connectivity Factor (F2).

1. **Core area (CORE):** is equal to the area (m2) within the patch that is further than the specified edge distance from the patch perimeter, divided by 10,000 to convert to hectares.

2**. Core Area Percent of Landscape (C%LAND):** equals the sum of the core areas of each of the patch types in m^2 divided by the total area (matrix) of the landscape. In other words, it is the percentage of the landscape that represents the core area of a specific patch type.

3. **Cohesion (Cohesion - COHESION):** measures the physical connectedness of the corresponding patch type. Patch cohesion increases as the patch type becomes more clustered or aggregated in its distribution; therefore, more physically connected.

The algorithms for each of these metrics can be found in Appendix C of McGarigal et al., 1995.

Equation 2 . Formula for the quantification of the Connectivity Factor (F2)

$$F2= (0.25)\ FciPATCH + (0.25)\ FcjCLASS + (0.50)\ FckLANDSCAPE$$

Where :

- F2: Is the Connectivity Factor
- FciPATCH = ((COREi – min(CORE)) / (max(CORE) – min(CORE)) * 100)
- FcjCLASS = ((C%LANDj – min(C%LAND)) / (max(C%LAND) – min(C%LAND)) * 100)
- FckLANDSCAPE = ((C%COHESIONk – min(C%COHESIONk)) / (max(C%COHESIONk) – min(C%COHESIONk)) * 100)

The following factors are proposed according to the ecological connectivity:

Table 3. Proposed weights for the differentiating factor related to connectivity opportunities.

Potential contribution to regional connectivity	Ranges F2	Factor
The project makes **little or no contribution** to the maintenance or restoration of landscape connectivity at a regional scale.	0-25	0.1
The project makes a **moderate contribution** to the maintenance or restoration of landscape connectivity on a regional scale	26-50	0.15
The project shows a **significant contribution** to the maintenance or restoration of landscape connectivity on a regional scale	51-75	0.2
The project shows **a highly significant contribution** to the maintenance or restoration of landscape connectivity at a regional scale.	76-100	0.25

Source: Terrasos, 2022

Clarifying note: If the project demonstrates its significance for the maintenance or restoration of landscape connectivity at a regional scale by providing technical inputs such as landscape ecology analysis or connectivity corridor modelling (at a scale of 1:25,000 or more detailed), the project developer could justify the connectivity opportunities generated by the project, to assign a specific factor to it. This will be revised by the verifier.

7.1.3 Differentiating factor 3: Temporality – Duration of the project

The third differentiating factor for the quantification of Voluntary Biodiversity Credits is the timing or duration of the project. This factor is very important since the achievement of quantifiable gains in biodiversity, especially in relation to the richness, structure, and vegetal composition of ecosystems, requires long-term actions that ensure that said ecosystem reaches a state of self-sufficiency and that, once the life of the conservation project is over and is otherwise not under anthropic pressure, it can maintain its characteristics and can continue to provide the associated ecosystem services.

7.1.3.1 Minimum duration of conservation projects

As mentioned above (see section 5.1 Eligible Actions), when we speak of ecological restoration, we refer to the process of assisting (helping) the recovery of a damaged, degraded, or modified ecosystem. The ultimate goal of restoration is to create a self-sustaining ecosystem that is resistant to disturbance without further assistance. This is achieved by aiming, among other things, at recovering two main characteristics of ecosystems: richness (number of species) and composition (the abundance of the species) (Ruiz-Jaen & Aide, 2005; Rozendaal et al., 2019).

In the Neotropical Forests, where most of the world's tree diversity is distributed, the richness of tree species is recovered by natural regeneration, 80 % on average, after 20 years, both in dry and humid forests (Rozendaal et al., 2019). Other studies determine that it takes between 30 and 50 years, without any further pressure on biodiversity, to recover 90% of the species richness. Species composition, on the other hand, takes centuries to recover and varies greatly across forest types. However, it has been reported that between 20 and 40 years are necessary for more than 50% of the composition to recover, a point where it can be considered that a self-sufficient ecosystem has been established (Ashton et al., 2001; Guariguata, 2001; Ruiz-Jaen & Aide, 2005; Derroire, 2016; Rozendaal et al., 2019).

However, in projects where natural regeneration is combined with assisted restoration [14] methods, the recovery process, both in terms of species richness and composition, can be accelerated, even more so if those projects have primary forests that are being preserved close to the restoration areas, as this will not only further accelerate restoration, but also improve the richness and composition recovery process (Ruiz-Jaen & Aide, 2005; Rozendaal et al., 2019).

In this context, this Protocol seeks to promote the structuring of conservation projects that have a minimum duration of between 20 and 30 years, since only at that time scale can it be ensured that the preservation actions and, specifically, those of restoration generate real and demonstrable impacts in biodiversity.

In addition to the aspects of the nature of ecosystems and ecological restoration, this Protocol promotes the structuring of projects with a 30-year operation as a bid to align with the international goals of the global political-environmental agenda, which has concluded that the next 30 years – by the year 2050 - is the time in which we must halt and reverse the degradation and destruction of biodiversity and achieve a resilient recovery of the biosphere. To this end, consistent conservation projects are needed to ensure an intervention of the ecosystems long enough for them to recover and be self-sufficient after 2050.

Finally, it is worth noting that thirty (30) years is the time in which will give the next generational handover, i.e., the time for a new social agency to start influencing important global decision-making. Handing over the outcomes, represented by a set of conservation projects, sustainable in time and with measurable gains in biodiversity, to the new generation, will set a precedent on how biodiversity can be recovered, and effective environmental management mechanisms can be developed. In addition to the aforementioned, handing over the results to a new generation could allow other problems and

[14] See the definition of *Assisted Restoration* in the Glossary at the end of this document.

challenges to be addressed, by achieving other biodiversity conservation objectives known to be essential to consider as a society in the future. In the same way, considering the generational change in environmental issues implies recognizing that the most far-reaching effects of climate change and the loss of biodiversity are still a few decades away, however, the current options and the actions that are taken now will be critical to how those effects play out. Future generations have been postulated as interested parties in the decision-making of the present time and therefore the mechanisms that we establish to address these problems must have a long-term vision, which ensures the achievement of said generational changes (White, 2017).

7.1.3.2 Value of the differentiating factors according to the duration of the project

As mentioned above, this Protocol seeks to promote the development of exceptional conservation projects that ensure demonstrable and quantifiable results in biodiversity. Consequently, any conservation project with a duration of less than 20 years may not issue and market Voluntary Biodiversity Credits supported by this Protocol. To this end, and considering natural regeneration studies and international commitments in environmental matters, the following differentiating factors are proposed for temporality:

Table 4. Proposed weighting for the differentiating factor related to project duration.

Duration of the project	Factor
30 years or more	0.25
29 years	0.23
28 years	0.205
27 years	0.185
26 years	0.16
25 years	0.14
24 years	0.12
23 years	0.095
22 years	0.075
20 - 21 years	0.05

Source: Terrasos, 2021

As in the previous factors, the highest possible value is 0.25, but unlike the others and because it is a wider range, the lowest value is 0.05, establishing that the shorter the duration in years of the project, the lower the number of credits it will be able to issue. This is done with the objective of promoting the development of projects that consider a permanence of at least 30 years, which represents a relevant time for an ecosystem without interventions that generate negative impacts and assisted through ecological restoration processes, to have reached a point of self-sustainable recovery in which, in addition to generating quantifiable and demonstrable gains in biodiversity, it does not require more human intervention or assistance to continue its natural course.

7.1.4 Differentiating factor 4: Preservation and restoration actions

The fourth differentiating factor for the quantification of Voluntary Biodiversity Credits that a project can issue seeks to recognize the value of conservation projects according to the number of hectares where preservation and restoration actions will be implemented (to see the definitions of each of the actions, see section 5.1 Eligible actions), as follows:

Table 5. Proposed weighting for the differentiating factor related to the actions to be implemented.

Actions to implement	Factor
Preservation	0.23
Restoration	0.25

Source: Terrasos, 2021

As in the differentiating factor related to the threat category of the intervened ecosystem, in this case the highest value is 0.25. On the other hand, the hectares of the total project dedicated to restoration allows the assignment of a greater number of credits to be issued than those dedicated to preservation. The Protocol seeks to promote not only projects for the preservation of native ecosystem remnants, but also to structure projects that contribute to recover and increase the quantity, integrity, and health of biodiversity, increasing the coverage of the most threatened ecosystems, helping not only to halt the decline in their geographic distribution, but also to reverse it. On the other hand, the weighting of the restoration action factor intends to promote conservation projects with restoration actions that aim to create connectivity between native forest remnants, and thus decrease habitat fragmentation, which has increased rapidly over the last few decades and is considered as one of the main threats to biological richness and diversity (Ćurčić, et al., 2013).

The Protocol recognizes that for those ecosystems where there are very few native remnants, preservation exercises are vital and for this reason the methodology presented here ensures that a project of this type can issue as many credits as there are hectares linked to the project. Likewise, the Protocol recognizes the difference in the resources necessary to carry out one or another action and seeks through the difference in factors to mobilize sufficient resources to develop efficient restoration actions, with the necessary permanence to ensure that the intervened ecosystems recover their quantity, integrity, and health.

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Supplementary Table Nº1

Voluntary Biodiversity Credits quantification example

Project description: Biodiversity conservation project of 100 hectares (1,000,000 m^2), located in one of the last remnants of Tropical Dry Forest of Colombia, an ecosystem catalogued, according to the IUCN Red List of Ecosystems, as Critically Endangered (CR). According to the project registration document, preservation activities will be carried out on 35 hectares (35,0000 m^2) and restoration activities on the remaining 65 hectares (650,000 m^2). According to the same document, and thanks to the landscape analysis, no connectivity opportunities are identified (the project site is isolated in a degraded matrix). Activities will be carried out for a period of 30 years.

Where:

TPA: Total project area in square meters
ARes: Area dedicated to restoration actions in square meters
APre: Area dedicated to dedicated to preservation actions in square meters
F: Factor

Description of the calculation:

The Protocol proposes a calculation of the number of VBCs through a three-part equation in which a distinction is made between factors that apply to the total project area and those that apply differently to partial areas, as follows:

The total number of square meters of the project is multiplied by the sum of the factors corresponding to the threat category of the ecosystem being intervened, the opportunity of the project to generate connectivity and the total duration of the project.

The square meters where restoration actions will be carried out are multiplied by the restoration factor and those corresponding to the preservation area are multiplied by the preservation factor.

Finally, all values should be added together and then divided by 10 to obtain the total number of potential credits.

7.2 Formula explanation

The equation for the calculation of potential credits is based on the equation used by the Ministry of Environment and Sustainable Development to calculate the amount to be offset or compensated, in which the sum of several factors is multiplied by the total area of the project to be compensated, which is known as the Compensation Factor[15]. In this order of ideas, the first three differentiating factors of this protocol are added before being multiplied by the total area of the project, thus resulting in a grouped factor for the calculation of biodiversity credits. In contrast, the fourth factor (conservation actions) depends on the internal zoning of each project and because each factor affects only a portion of the project, it is necessary to multiply each factor by the specific area it affects.

After adding each of the components of the formula, we obtain an estimate of the square meters with the potential to issue credits. Finally, the result must be divided by 10 because each credit is equivalent to more or less 10 m^2.

7.2.1 Simulations

To provide an example of the calculation of potential credits according to the various differentiating factors, 3 hypothetical scenarios are included below, whose only constants are: the total area of the project, equal to 100 hectares (1,000,000 m^2) and the area of the preservation and restoration actions, equal to 350,000 m^2 and 650,000 m^2, respectively. The scenarios are:

1. Supplementary table 1 scenario
2. Minimum credit number
3. Maximum credit number

Scenario 1, supplementary table 1.

Based on the case in the table above, the project has the following characteristics:

Table 6. Simulated scenario 1

[15] See chapter on how much to compensate in the Biotic Component Compensation Manual. Directorate of Forests, Biodiversity and Ecosystem Services. Ministry of Environment and Sustainable Development, Bogotá, D.C.: Colombia, 2018

1	Example Supplementary Table 1					
Features		**Credit factors**				**Score**
Area type	**Area (m^2)**	**F1 Threat Category**	**F2 Connectivity**	**F3 Project Duration**	**F4 Activities to implement**	
Preservation	350,000	–	–	–	0.23	80,500
Restoration	650,000	–	–	–	0.25	162,500
Project Total	1,000,000	0.25	0.1	0.25	–	600,000
TOTAL SCORE						843,000
Potential credits ($10m^2$)						**84,300**

Graphically the scenario looks like this:

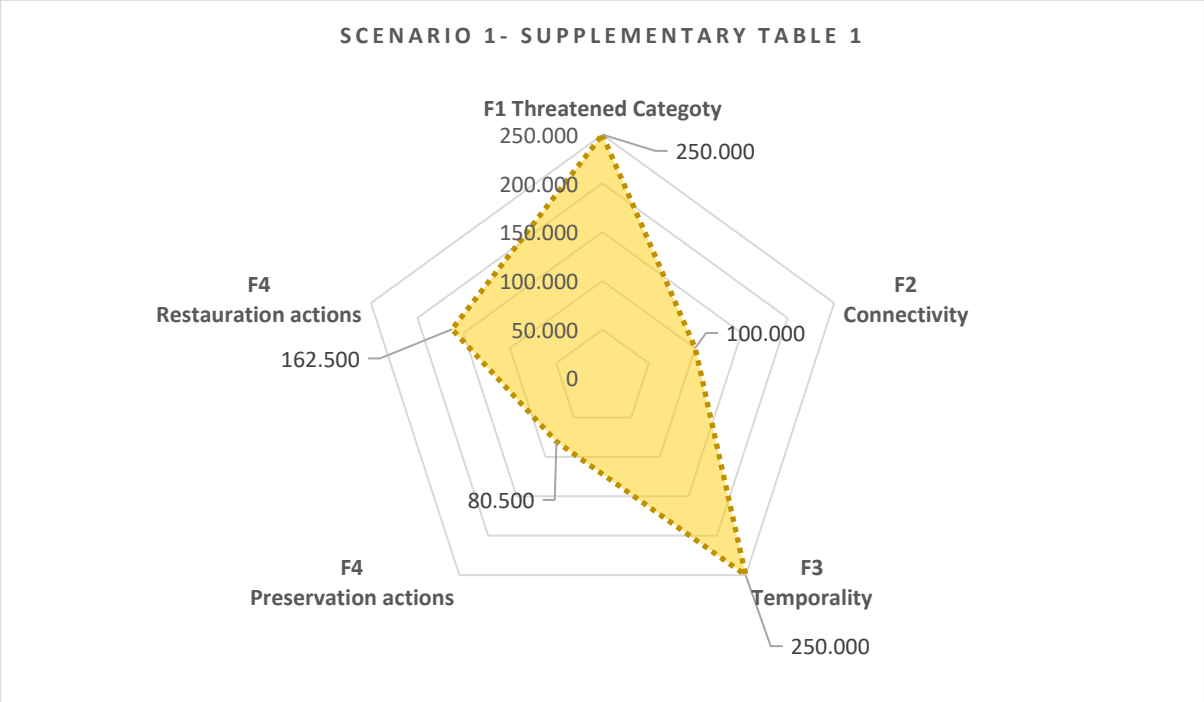


Figure 6. Simulated scenario 1.

Scenario 2, minimum score.

In this scenario we will simulate a project that obtains the lowest scores in each factor, i.e. it is located in a non-threatened ecosystem, does not generate connectivity, has a duration of 20 or 21 years and only performs preservation actions.

Table 7. Simulated scenario 2

2	Example Minimum Score					
Features		**Credit factors**				**Score**
Area type	**Area (m^2)**	**F1 Threat Category**	**F2 Connectivity**	**F3 Project Duration**	**F4 Activities to implement**	
Preservation	1,000,000	–	–	–	0.23	230,000
Restoration		–	–	–	0.25	–
Project Total	1,000,000	0.22	0.1	0,05	–	70,000
TOTAL SCORE						600,000
Potential credits ($10m^2$)						**60,000**

In this case, the project has 60,000 potential credits to issue throughout its execution since it does not earn points for carrying out restoration actions and earns one-fifth of the points for duration.

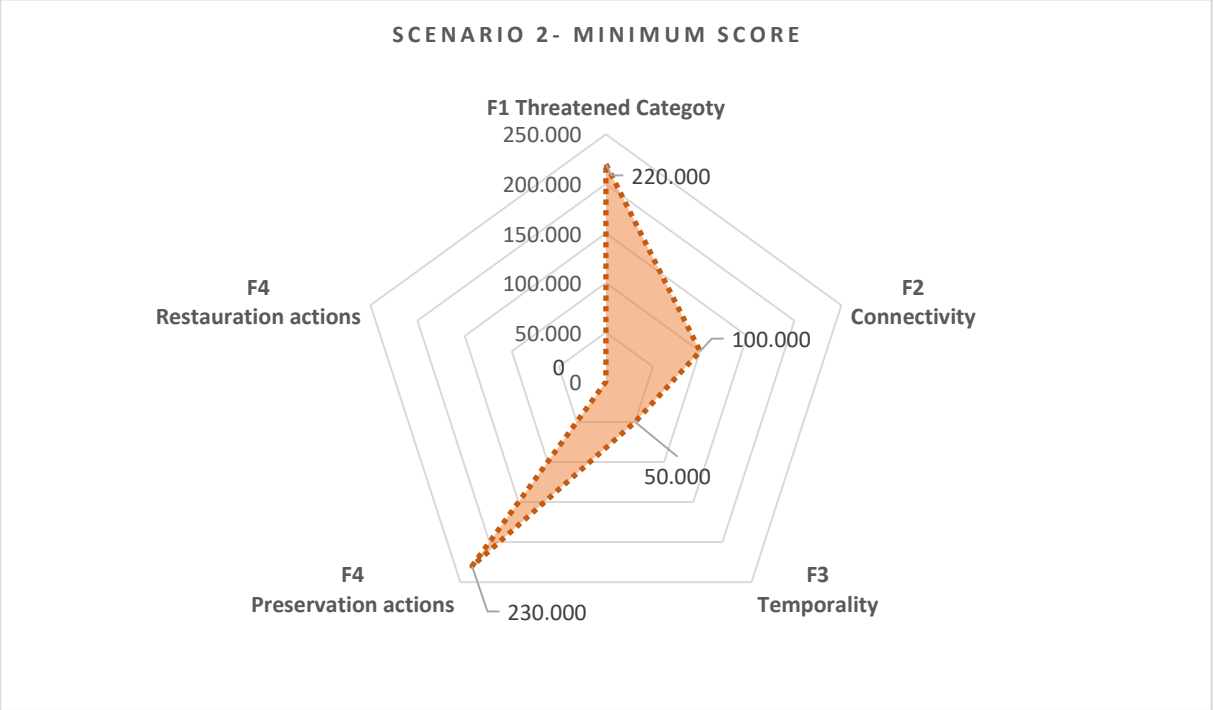


Figure 7. Simulated scenario 2

Scenario 3, maximum score.

In this hypothetical project, the highest values are taken for each of the factors: it is a project located in a critically endangered (CR) ecosystem, with the highest degree of connectivity, has a 30-year duration, and the entire area will be or is being restored. The scores are reflected as follows:

Table 8. Simulated scenario 3

3	Example Maximum Score					
Features		**Credit factors**				**Score**
Area type	**Area (m^2)**	**F1 Threat Category**	**F2 Connectivity**	**F3 Project Duration**	**F4 Activities to implement**	
Preservation		–	–	–	0.23	-
Restoration	1,000,000	–	–	–	0.25	250,000
Project Total	1,000,000	0.25	0.25	0.25	–	750,000
TOTAL SCORE						1,000,000
Potential credits ($10m^2$)						**100,000**

Graphically, it is clear how this project, by obtaining higher scores (edge of the graph), manages to generate more credits (coloured area). In this case, the project manages to generate the maximum number of credits according to its size: 100,000.

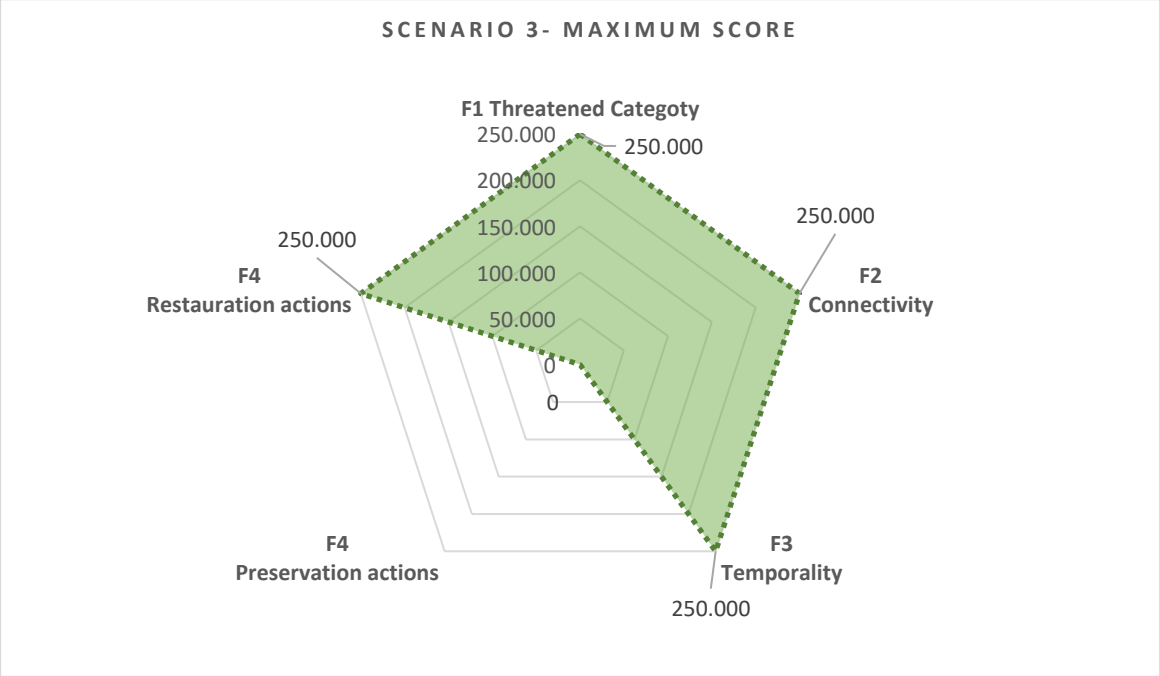
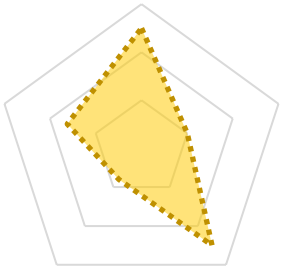
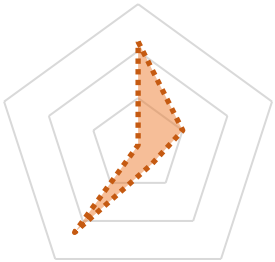
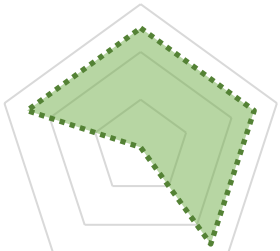


Figure 8. Simulated scenario 3

Comparative scenarios

In conclusion, the range of potential credits of a project varies between 60% and 100% of the total area and depends on its characteristics or differentiating factors. As a summary, the 3 above scenarios compared:

Table 9. Comparison of the 3 scenarios for credit issuance.

Scenario Supplementary Table 1	Minimum Score Scenario	Maximum Score Scenario
		
84,300 potential credits	60,000 potential credits	100,000 potential credits

7.3 Credit Release Plan

As mentioned above, the actions associated with biodiversity conservation projects commit results that are achieved in the medium and long term. Therefore, to ensure that the investments made in this type of projects are reflected in quantifiable gains in biodiversity and that the processes associated with the commercialization, sale and verification of Voluntary Biodiversity Credits are transparent and traceable, the following two operating mechanisms are proposed:

7.3.1 Credit Release Schedule

The Credit Release Schedule refers to a timetable that specifies the milestones that must be reached so that a conservation project can issue and market a specific number of Voluntary Biodiversity Credits. This means that an established conservation project will not be able to issue or make available for sale all its Potential Credits (see definition in section 10.2 Monitoring and follow-up of available VBCs) but will do so gradually to the extent to which a third-party verifier ensures that the project is meeting its performance standards. The Credit release schedule must be included in the *Registration Document* of the conservation project as described below.

Some key concepts to develop the Credit Release Schedule are:

7.3.1.1 Compliance Milestones

The release of credits must be linked to the achievement of compliance milestones, which can be:

a) **Management milestones:** Refers to all those results related to the structuring of the project and the assurance of legal, financial, and technical guarantees. Some examples of management milestones are land acquisition, limitation of land use, agreements with owners, funding of an account for long-term maintenance, closure or start of the planting process, among others. These must be milestones that enable the conservation of biodiversity or ensure its sustainability.

b) **Ecological milestones:** These are the results related to the improvement of the initial physical, chemical, and biological conditions in the project area. They can also be understood as implementation of the operations and maintenance plan, that is, those results related to the preservation and restoration actions. Some examples are replacing artificial and degraded covers with natural covers; strengthen the ecological connectivity between forest remnants and increase the habitat for species and protect and recover the structure and physical-chemical composition of the soil.

7.3.1.2 Ecological Performance Standards

The Performance Standards refer to all those observable or measurable physical, chemical, and biological attributes that will be used to determine compliance with the expected objectives in terms of recovery of natural resources and biodiversity. Like the Credit Release Schedule, performance standards must be specified in the *Registration Document*.

Performance standards are fundamental as compliance with management and ecological milestones does not ensure that the project is achieving its objectives, nor generating the expected improvements to the ecosystem. For example, although planting activities may be successfully completed according to the operation and maintenance plan, seedlings may or may not survive, which could affect biodiversity gains. Another example would be the construction of greenhouses for restoration activities, which do not necessarily guarantee that the goals of planting and survival will be met. Therefore, an ongoing monitoring exercise is required to track the progress of the project over time to determine whether it is generating the type of demonstrable profits specified in the *Registration Document* and whether it will achieve its green performance standards.

Below is an example of performance standards for a conservation project that considers preservation and restoration actions (Table 10). The Performance Protocol must detail the goals, objectives, indicators, and measurement units, which will represent the basis for the monitoring actions to be carried out by a third-party verifier. They will be the ones that verify if the project is achieving quantifiable biodiversity gains and help determine if it is necessary to apply adaptive management of the proposed actions, either by correcting a process or incorporating new activities that had not been considered initially.

Table 10. Example of Ecological Performance Standards - Goals, Objectives and Indicators.

Goal	Objective	Group	Variable	Indicator	Unit of measurement
1. Degraded and artificial land covers have been restored, improving their structure, composition, and function. 2. Forest ecosystems have been preserved, guaranteeing their permanence and the supply of ecosystem goods and services. 3. Areas identified as important for water regulation have been protected.	1. Replace artificialized and degraded covers with natural covers and improve their composition, structure, and function. 2. Preserve existing forest cover, where passive restoration actions will be carried out. 3. Protect the water recharge areas and drainage basins, favouring water regulation, infiltration, and runoff.	Vegetation	Composition	Species richness index Richness	(R)
				Dissimilarity	Dissimilarity index between restored area and reference plot (Jaccard similarity (Ij) and Bray-Curtis dissimilarity index (Djk)
			Composition and structure	Diversity and proportional abundance index	Margalef (Dmg)
					Shannon (H´)
					Parker (d)
					Simpson (D)
					Menhinick (Dmn)
			Structure	Mortality and recruitment rates	T_M, T_R
				Apical growth	Mean annual increase (MAI) cm/year
				Diametric growth	Mean annual increase (IMA) cm/year
				Indicator of sociological position	Distribution by height classes by coverage
			Function	Biomass	tons/hectare
4. Important areas have been protected for the reproduction, refuge, flow, and food of wild fauna	4. Protect and increase the habitat for species of fauna, allowing the growth of populations and the genetic flow between them	Fauna	Composition	Increase and/or permanence of the richness of mammalian species, to birds and herpetofauna	Number of species recorded by land cover
			Structure	Index of population size of bats of the *Phyllostomidae*	Estimated number of individuals in the population (N) of each species of the subfamily by means of the capture, mark, and recapture methodology
			Threat	Frequency of hunters and domestic and feral dogs entering the BHA	Frequency (Number of individuals/units of time)
				Decrease in the number of invasive species of mammals, birds and herpetofauna	Number of invasive species registered per area
5. Ecological connectivity nuclei and networks have been consolidated at a landscape scale, associated with the Tropical Dry Forest ecosystem in the Habitat Bank.	5. Strengthen the ecological connections between relicts of Bs-T in the areas of the Habitat Bank.	Vegetation	Landscape	Heterogeneity	Shannon Diversity Index
				Increase in relict areas	Rate of change in coverage (%)
6. Soil quality has been protected and recovered in the active and passive restoration areas of the Habitat Bank	6. Protect and recover the structure and physical-chemical composition of the soil in the preserved and restored areas of the Habitat Bank.	Soils	Chemistry	pH	Range
				Major elements (NPK)	Concentration (ppm)
			Physics	Apparent density	g/cm^3
				Organic matter	%

7.3.1.3 Release Schedule 20/20/20/20/20

This Protocol proposes that each project determines, according to its particular features and objectives, a five (5) phase Schedule for the Release of Voluntary Biodiversity Credits. 20% of the Potential Credits of the project is authorized for release at each phase by a third party (Figure 9).

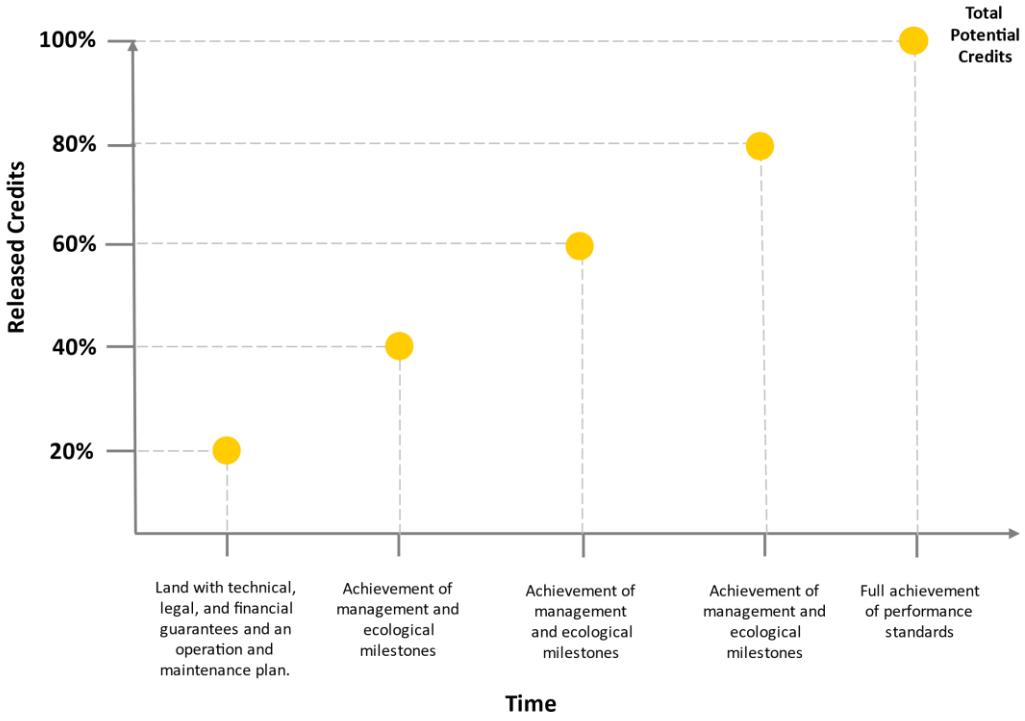


Figure 9. Voluntary Credit Release Schedule

The Protocol allows an initial Credit release if the entire conservation project has been consolidated, that is, all the information detailed in section *8. Registration and checklist* is available. This initial release occurs when the site where the conservation project will be developed is secured, the appropriate financial guarantees have been established, there is a structured and validated operations and maintenance plan, among other mechanisms to ensure legal and financial guarantees. The following three Credit release pahse (80% of the potential credits) are released as milestones are reached, both management and ecological, specified in the Schedule in the *Registration Document.*

The release of the last 20% of the Voluntary Biodiversity Credits will take place exclusively when all the Ecological Performance Standards are met to ensure that the milestones that allowed the previous releases achieved the biodiversity objectives set by the project.

Given the above, in order for the Credits to be released, an ongoing monitoring exercise is required to determine if the project is meeting its performance Standards and to decide if measures are necessary to ensure that the conservation project is achieving its objectives. As will be explained in more detail below, to carry out monitoring, it is necessary for a third-party verifier to visit the site where the project

is being developed. This visit must be carried out considering seasons that do not affect the ability to assess whether the applicable milestones have been met for each phase of Credit release.

7.3.1.4 Other considerations

With respect to the Voluntary Biodiversity Credit Release Schedule, it is necessary to consider:

a) If the project does not achieve the compliance milestones or the Performance Standards, the credit release schedule can be modified and, if applicable, there may be a reduction in the number of Potential Credits that the project can issue. Total suspension of Credit sales or transfers may also occur, where necessary, to ensure that all Credit sales remain tied to conservation projects with a high probability of meeting the Performance Standards.

b) The Credit Release Schedule must not alter the monitoring schedule of the project, nor must it alter the preparation and submission of monitoring reports to the registration platform, in accordance with the schedule specified in *the Registration Document*.

c) The Credit Release Schedule may have modifications with respect to what is proposed in the *Registration Document*, as long as there is sufficient evidence that, due to conditions of the ecosystems, climatic events, or aspects not considered that need adaptive management, some milestones or performance standards have not been met, even though all the activities proposed for their achievement have been carried out.

7.3.2 Performance-based payment

The commercialization of the Voluntary Conservation Credits must operate under the principle of payment for results (also known as performance-based payment). A third-party verifier will be necessary to approve the achievement of said results in relation to the operation and maintenance plan, the specific objectives of biodiversity conservation, the performance standards, and in accordance with the terms, conditions, rights, and obligations established in the respective contractual arrangement that is acquired with the possible users. As mentioned above, approval by the third party will result in the release of credits that can be sold and marketed as they already have associated management and conservation milestones.

In this sense, the person in charge of the project, which is the same person who issues the credits, defines a minimum spatial unit (e.g., square meters, hectares), which will serve as a transactional unit and on which a unit value will be negotiated. This value must include the costs necessary to implement the preservation and restoration actions and achieve the conservation objective that the person in charge must set, as well as the costs associated with ensuring transparency, traceability, sustainability, and permanence of the investments, and all the other principles described in this Protocol. The foregoing also includes the legal, financial, and monitoring costs that can ensure the viability of the conservation project, and of the issuance and commercialization of the credits.

In practical terms, compliance with conservation objectives and performance standards must be validated through: (1) the establishment of objectives, goals and indicators; (2) the planned monitoring by a third party of the established indicators; (3) the generation of compliance reports by the third party,

and (4) uploaded to the registration platform, which must be selected by the person in charge of the project, according to what is specified in section 9.2 Record. All of the information that is uploaded to the platform must be public. Based solely on these reports, the administrator of the registration platform, may or may not release Voluntary Biodiversity Credits, as specified in the Release Schedule proposed in the *Document of Registration,* as detailed in section 9.1 Check List Registration Document. The process results in contractual, administrative, and financial arrangements that guarantee transparency and sustainability, as well as a clear assignment of risks, responsibilities, and defined deadlines.

8 GENERAL CONCEPT OF THE PROCESS

The general activities that each of the interested parties must develop in the value chain of the Voluntary Biodiversity Credits and the flow of interactions between the different roles are graphically detailed below.

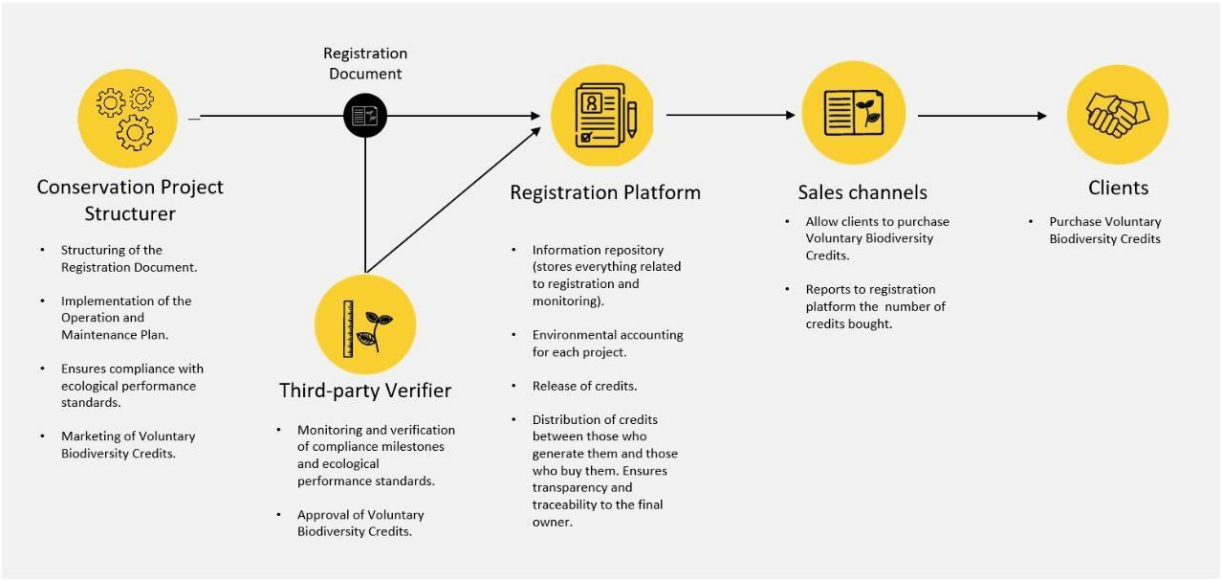


Figure 10. Process of Registration and Issuance of Voluntary Biodiversity Credits.

Next, each of the activities and tools to carry out the VCB registration and issuance process detailed in Figure 10 is described in detail.

9 REGISTRATION DOCUMENT AND PLATFORM

To ensure technical rigor, additionality and complementarity, as well as the transparency and traceability of any project that adheres to this Protocol to issue and market Voluntary Biodiversity Credits, the following requirements and procedures are determined to be mandatory, and have the objective of serving as a starting point for third-party consultants to carry out monitoring, reporting and

verification activities of the conservation project; as well as for interested users, as a tool to generate timely information and confidence in the purchase of Credits.

9.1 Registration Document Check List

Each conservation project that wishes to issue VBCs under this Protocol must structure a *Registration Document* with the information detailed below. This information must be verified and approved by a third-party verifier through the registration platform that the administrator of each project selects, and only at the time of approval can the first percentages of Credits be released, as specified in the section 7.2.1.3 Release Schedule 20/20/20/20/20.

a) General Information

- Name of the Project
- Start date and duration of the project
- Location and general characteristics of the project area, including the number of hectares and the identification of ecosystems in the project area.
- Justification of the suitability of the selected area to achieve the expected environmental results (net gain in biodiversity), as well as the aspects that make the project additional and complementary.
- Delimitation of the project, together with the list of flat coordinates of the traverse(s) in the applicable national coordinate system, indicating its origin or in the official geographic system in which it occurs.

b) *Physical-biotic baseline*

Refers to the characterization of the area where the conservation project will be carried out, and which must include at least, but not limited to, criteria such as:

- Type of coverage and its condition.
- Structure and composition of plant and fauna communities (e.g., species richness, structure, and composition).
- Key elements of biodiversity (e.g., threatened species, use species, endemism).
- Connectivity analysis.
- Types of ecosystem services and their condition.

c) *Design and objectives of the project*

- Type of action and/or actions to be developed to achieve quantifiable gains in biodiversity.
- Description of the expected objectives / expected quality of the project area, including the number of hectares for restoration and preservation actions.
- Operations and maintenance plan, which must contain, but is not limited to, the following contents:
    - Introduction
    - Objectives
    - Management strategy
    - Delimitation and isolation
    - Details of the activities and methodologies for conservation and restoration actions
    - Mitigation of risks and mitigation strategies
    - Establishment plan and management of concerted quotas
    - Work schedule
    - Budget for implementation
    - General establishment plan
    - Conclusions and recommendations
    - References
    - Annexes (if applicable)
- Performance standards, to ensure and demonstrate the expected gains in biodiversity and a proposed credit release schedule.
- Monitoring plan, detailing the mechanisms and timing of measurement. For each established goal, indicators must be established to monitor and observe the variations in the status of the processes in the specific compensation action

d) *Risk analysis*

- Analysis of the risks and contingency measures where they are identified details all the associated risks (technical, financial, legal), stage of occurrence, consequences, probability, impacts generated (technical, financial, others), contingency and monitoring measures, among others.
- Structuring of the long-term management plan, describing the management measures once the performance standards have been met to ensure the sustainability of the conservation project area, including the financing and operating mechanism.

e) Land tenure conditions and permanence assurance

- Description of the characteristics of property and land tenure. Official tenure documents must be provided in the case of private property or public property. In the case of collective properties or vacant lots, the respective administrative act that recognizes ownership and/or legal authorization for the structuring of the environmental conservation project on the property must be provided.

- Description of the legal or contractual mechanisms that would be used to ensure the permanence of the area(s) where the specific preservation and restoration actions would be implemented.

- Description of the legal instrument that limits land use in the property(ies), bearing in mind the duration of the specific preservation or restoration action(s) to be implemented.

f) Environmental registration and accounting

- Registration system that describes the mechanism through which the transparency and traceability of the resources associated with investments and obligations resulting from administrative acts will be ensured.

- Environmental accounting system detailing the procedures, mechanisms, and schedule to carry out and verify the transactions of the Voluntary Biodiversity Credits.

9.2 Registration Platform

Environmental asset registration platforms are tools that ensure the transparency and traceability of the results obtained in each of the activities of preservation, restoration, reduction/removal of greenhouse gases, among others. To ensure these characteristics in the operation of Biodiversity Credits, and generate trust in potential clients and associated interest groups, the Protocol proposes the implementation of a registration platform, which fulfils the functions of:

a) Being able to recognize the characteristics and the final property of each of the Voluntary Biodiversity Credits that are generated in use of the Protocol.

b) Serve as a space where the different stakeholders around the Voluntary Biodiversity Credits (project developer, third-party verifier, and client, among others) are articulated, and the roles and responsibilities of each one can be monitored.

c) Verify, together with the third-party verifier, that all the information requested in section 9.1 Check List Registration Document of this Protocol is generated before any Conservation project can issue Voluntary Biodiversity Credits.

d) Develop mechanisms to monitor compliance with management and ecological milestones, ensuring that their development and approval is carried out by a third-party verifier.

e) Maintain the environmental accounting of each conservation project, ensuring the correct traceability in the release and transaction of the Credits, preventing them from being marketed before the performance milestones necessary for their release are met, or from being sold more than once (avoid double counting).

f) To be a repository where all the information associated with each of the conservation projects is stored, ensuring confidentiality, and allowing consultation as applicable.

9.2.1 Requirements for the registration platform

As already mentioned, the registration platform for each project must be selected by its developer and described and justified in the *Registration Document* in the *"Environmental registration and accounting"* section. However, any registration platform that intends to support the information associated with this Protocol must comply with the following requirements, to ensure transparency and rigor in the operation and marketing of VBCs:

9.2.1.1 Timeliness and availability of information

The information must be available and within the reach of the interested parties, so that they can access it. Only authorized persons, according to the definitions of each process, should be able to view it. The registration company must guarantee the corresponding access according to the role of each user to the information systems.

9.2.1.2 Confidentiality of Information

Through security systems, access to information must be guaranteed in accordance with the different security rings and definitions of the roles of each user. The registration platform must ensure that there is no unauthorized disclosure of information, or direct access to it in an unauthorized manner. The loss of data confidentiality can cause operational, financial, and reputational problems that must be analysed and managed by the registry platform.

9.2.1.3 Immutability of information

The registration platform must have the mechanisms required for processing data and transactions that allow the authorship of the information that is generated and transmitted to be attributed with absolute certainty, and make it extremely difficult to alter afterwards, eliminating the possibility of alterations.

9.2.1.4 Traceability of information

The registration platform must ensure the set of those procedures that facilitate tracking and recording the history and trajectory of the information of the projects and the Biodiversity Credits, from their issuance to their cancellation, at any given phase through of certain tools.

9.2.1.5 Basic functionalities

To ensure transparency and traceability in the registry, the platform must have, at a minimum, the following functionalities and services:

- **Project flow:** The registry platform must be designed in such a way that it reflects the stages associated with the project of generation of Biodiversity Credits, with appropriate approval by the responsible user.

- **Self-management of automatic transactions:** For greater efficiency and security in operations, the registry platform must provide the possibility of offering transactions automatically carried out directly by users. Those transactions include the issuance, transfer and withdrawal or cancellation of Biodiversity Credits, among others that may arise.

- **Serialization of units:** Each unit or Biodiversity Credit issued must have a unique serialization that identifies it and allows adequate traceability of it. Each serial must contain items that make it possible to recognize the fundamental characteristics of the project and the units issued.

- **Accounting module:** Once Biodiversity Credit transactions have been carried out on the registration platform, the system must have an inventory control mechanism that prevents double accounting events from occurring.

- **Generation of reports:** The possibility of generating reports on the information registered in the platform must be offered according to the definitions given by the administrator. The objective is to be able to trace the historical movements and detail of the data of the projects and the Biodiversity Credits.

- **Know Your Customer process:** To ensure that the Biodiversity Credit mechanism is not used as a tool for money laundering and terrorist financing, or is exercised in an unethical and untransparent manner, the registry service provider must carry out a Know Your Customer process. For this purpose, reviews in restrictive lists (e.g. Specially Designated Nationals And Blocked Persons List) and in the media must be conducted.

- **Different types of users and roles:** The platform must have different types of users that allow a specific type of interaction according to the needs and obligations of each user depending on their role in the biodiversity crediting mechanism.

- **Public and private sections:** The conditions for disclosure of information must be ensured according to the disclosure requirements of each dataset and document. The characteristics of the public and private sections of the platform will be determined as established by the Biodiversity Credits Protocol.

- **Security standards and protocols:** To prevent leaks, fraud and manipulation of information that may lead to double counting events and unwanted transactions, the registry platform

must have security standards and protocols that allow a robust and reliable service operation for digitally stored data.

- **Information exchange:** Interoperability between information platforms is increasingly necessary to ensure adequate data exchange and management. For this reason, the system must have information exchange mechanisms through web interfaces.

It is important to note that the service provider has the necessary capacities to develop and deploy new functionalities according to new conditions that may be required by the Biodiversity Credits Protocol.

9.2.1.6 Service level agreements and terms and conditions

There must be Service Level Agreements (SLA) that guarantee the provision of the registration service to the different users of the platform. The SLAs must include the statement of objectives, the specification of the services and the responsibilities of the service provider and the customer.

Preferably, the SLA should include metrics to be achieved by the various services that are included in the SLA. In turn, it must have terms and conditions that detail the policies, procedures, and conditions of use of the registration service.
Likewise, it must have a personal data processing policy understood as the right of every person to know, update, and rectify the information that has been collected about them associated with the use of the registration service.

10 MONITORING, REPORTING AND VERIFICATION

Each conservation project that wishes to issue Voluntary Biodiversity Credits under this Protocol must carry out monitoring, reporting and verification actions to, on the one hand, ensure its integrity from a technical, legal, and financial perspective and, on the other hand, determine if the project is meeting its performance standards and achieving the objectives outlined in the *Registration Document*.

For this, a Monitoring Plan must be designed for each conservation project, associated with the Performance Standards, as part of the registration, issuance, and commercialization process. The plan must include:

a) The parameters to be monitored
b) The frequency of monitoring
c) The method of data collection
d) Those responsible for the measurement.

All data must be obtained by a third party to ensure quality controls. This is especially important considering that they are projects with objectives oriented for long-term compliance.

The monitoring plan also allows for the early identification of problems, corrective actions to address deficiencies identified through monitoring, and the carrying out of adaptive management activities, which are essential for a conservation project to achieve its objectives and, therefore ensure gains in biodiversity.

It is worth noting that this Protocol is based on external verifiers, who are experts in biodiversity issues (See section 10.3. Third Verifier). Therefore, the credibility of the verifiers is critical to the overall credibility of the Protocol and the Voluntary Biodiversity Credits.

Each project must carry out two types of follow-ups and monitoring:

10.1 Monitoring and follow-up of management and ecological milestones

For the first type of monitoring and follow-up, the progress in meeting the management and ecological milestones must be evaluated (see section 7.2.1.1 Compliance milestones), among which is progress with land linkage, implementation of the operations and maintenance plans, as well as progress in conservation and restoration actions. This has the objective of, as mentioned above, determining the fulfilment of the short, medium, and long-term objectives, as well as guiding the course of the implemented conservation and restoration measures, and correcting and adjusting the procedures through adaptive management.

The implementation of the monitoring plan should result in the generation of reports that determine how the project is advancing towards meeting its performance standards. These reports may include plans, maps, and photographs to illustrate site conditions, as well as assessments that provide quantitative or qualitative measures of demonstrable and quantifiable gains in biodiversity. These reports that will be uploaded to the registration platform and will demonstrate compliance or the lack thereof with the goals associated with the performance standards, determining whether, in effect, the platform administrator can release credits for sale and marketing.

10.1.1 Frequency of monitoring and reporting

Depending on the preservation and restoration actions to be carried out, the person in charge of the conservation project must establish in the monitoring and follow-up plan the monitoring frequency and the reporting timing that make clear the results achieved in accordance with the ecological performance standards and the credit release schedule previously outlined.

Monitoring will have to be carried out until compliance with all performance standards is demonstrated, and the frequency will depend on the indicators and measurement units selected. An example is presented below:

Table 11. Examples of measurement units and frequencies of the objectives of the monitoring and follow-up plan.

Group	Variable	Indicator	Measurement unit Measurement	Frequency
Vegetation	Composition	Species richness index	Richness (R)	Annual measurements for each type of vegetation cover
		Dissimilarity	Dissimilarity index between restored area and reference plot (Jaccard similarity (Ij) and dissimilarity index of Bray-Curtis (Djk)	
	Composition and structure	Index of diversity and proportional abundance	Margalef (Dmg)	
			Shannon (H´)	
			Berger Parker (d)	
			Simpson (D)	
			Menhinick (Dmn)	
	Structure	Mortality and recruitment rates	T_M, T_R	Annual measurements after the start of active restoration actions
		Apical growth	Mean annual increase (MAI) cm/year	
		Diametric growth	Mean annual increase (MAI) cm/year	
		Indicator of sociological position	Distribution by height classes by cover	
	Function	Biomass	tons/hectare	
Fauna	Composition	Increase and/or permanence in the richness of species of mammals, birds and herpetofauna	Number of species recorded by coverage	- Annual for the first 5 years once implementation actions are initiated. - Every 3 years after the first 5 years of implementation of actions.
	Structure	Index of population size of bats of the subfamily *Phyllostomidae*	Estimated number of individuals in the population (N) of each species of the subfamily through the capture, mark, and recapture methodology	
	Threat	Frequency of hunters and domestic and feral dogs entering the BHA	Frequency (Number of individuals/units of time)	
		Decrease in the number of invasive species of mammals, birds and herpetofauna	Number of invasive species recorded per cover	
Vegetation	Landscape	Heterogeneity	Shannon Diversity Index	In years 1, 5, 10, 20 y 30
		Increase in relict area	Coverage change rate (%)	
Soils	Chemistry	pH	Range	Once the restoration and conservation actions begin, it will be every three years for 12 years in the coverage dedicated to active restoration
		Major elements (NPK)	Concentration (ppm)	
	Physical	Apparent density	g/cm^3	
		Organic matter	%	

In addition to the public report that must be uploaded to the reporting platform registry, and the reports to which it is contractually committed with those who buy the Credits, the person in charge of the project must publish the monitoring data in the open biodiversity data portals, whether they are national (e.g. Biodiversity Information System of Colombia - SiB) or international (e.g. Global Biodiversity Information Facility - GBIF).

10.2 Monitoring and follow-up of available VBCs

To ensure transparency and traceability throughout the issuance process, as well as in the commercialization of Voluntary Biodiversity Credits, and as a mechanism to avoid double counting so that each Credit is sold only once during the life of the project, a permanent monitoring and tracking of the number of Credits should be carried out, which can be classified as follows:

- **Potential Credits:** Those refer to the total number of Credits that a conservation project can issue in accordance with the quantification methodology described in this Protocol (see section 7.1 Quantification of Voluntary Biodiversity).

- **Released Credits:** Are the credits that can be marketed and sold, since the project complied with the established management and ecological milestones in the Credit Release Schedule. The release of these Credits must be approved by a third-party verifier. The number of released credits cannot equal the number of potential credits, until the project has met all its ecological performance standards.

- **Sold Credits:** Refers to the Credits that have already been assigned to a user and buyer and that cannot be sold again. The number of credits that can be sold is equal to the number of released credits at the time of balancing, even if the number of potential credits is greater.

- **Available Credits:** Is the number of Credits resulting from the difference between the released Credits and those that have already been sold. The amount of these Credits may vary as more credits are released.

The monitoring and follow-up of the VBC must be carried out by the registration platform administrator, who will be the only one authorized to release Credits, according to the information that the project administrator provides to the platform and the respective verifications and validations carried out by the third-party verifier.

10.3 Verifier

As mentioned above, this Protocol is based on the fact that project developers must ensure an audit by informed and impartial third parties to determine if their conservation project can register on the selected platform and verify compliance with the ecological performance standards, in order to approve the release and commercialization of VBC. Independent evaluation increases the credibility of projects; however, this implies that the credibility of the evaluators is fundamental to the overall credibility of the Protocol [16].

[16] Third-party assessment methodology is widely used, an example of which are the Climate, Community and Biodiversity (CCB) Standards.

Given the above, the Protocol adheres to those established by the ISO 14066:2011[17] Standard and establishes that third-party verifiers must operate under the principles of:

a) Independence
   - Remain impartial with respect to the activity that is being validated or verified, and free from prejudice and conflicts of interest.
   - Maintain objectivity during validation or verification to ensure that findings and conclusions will be based on objective evidence generated during validation or verification.

b) Integrity
   - Demonstrate fair behaviour through trust, honesty, and working diligently and responsibly, observing the law, maintaining confidentiality, and making disclosures expected by law and the profession throughout the validation or verification process.

c) Fair Presentation
   - Truthfully and accurately reflect activities, findings, conclusions, and validation or verification reports.
   - Report significant obstacles encountered during the validation or verification process, as well as divergent and unresolved opinions among team members, the responsible party, and the client.

d) Due Professional Care
   - Exercise due care and judgment in accordance with the risk attributed to the task performed and the trust placed by customers and intended users.
   - Have the necessary competence to carry out the validation or verification.

e) Professional Judgment
   - Being able to draw meaningful and accurate conclusions, give opinions, and make interpretations based on observations, knowledge, experience, literature, and other sources of information.
   - Demonstrate professional scepticism.

f) Evidence-based approach
   - Evidence is verifiable. It is based on a sample of information. The appropriate use of sampling is closely related to the confidence that can be placed in the conclusions of validation and verification.

On the other hand, third-party verifiers must demonstrate that they have:

a) Competencies to perform the functions specified later in this Protocol, and all additional functions required by current legislation.

[17] DOCUMENTATION, T. P. S. (2011). Greenhouse gases—Competence requirements for greenhouse gas validation teams and verification teams.

b) Experience in the development and evaluation of preservation and restoration activities.

c) Experience in the development of methodologies for the evaluation of biodiversity conservation strategies.

d) A work team that meets the requirements of quantity and general and specific knowledge to evaluate the different components of biodiversity. In addition, the team should demonstrate ethical and professional conduct.

e) Necessary competences to develop methodologies in the field that allow them to obtain the necessary data to evaluate the results of the actions proposed in the *Registration Document* associated with the conservation project.

f) Knowledge for auditing the data and information that project developers provide them and that they acquire independently, with the aim of verifying compliance with ecological performance standards.

10.3.1 Verifier Responsibilities

The main objective of the verifiers is to carry out independent, objective, and documented monitoring, as applicable to each project, of compliance milestones (management and ecological) and to validate whether the ecological performance standards are being achieved, for this the verifier shall:

a) Evaluate the registration document based on the information provided by the project developer. The verifier will have to review especially the compliance milestones, the performance standards, the credit release schedule, and the monitoring plan. Once the methodologies and objectives have been approved, the verifier may approve the registration of the project with the selected platform.

b) Develop monitoring in an independent and objective manner, the verifier is responsible for obtaining in the field and through secondary information the necessary resources to assess whether compliance milestones are being met and whether they are leading to effective recovery of biodiversity in the project area.

c) Approval of the release of Voluntary Biodiversity Credits, once the monitoring events have been carried out. The verifier must, if applicable, approve the release of Credits according to the schedule proposed by the project developer.

11 NATIONAL AND INTERNATIONAL REFERENCES AND REGULATIONS

a) Biodiversity metric 3.0: Auditing and accounting for biodiversity (Natural England, 2021)

b) Climate, Community and Biodiversity Project Design Standards (CCBA, 2005)

c) Mitigation banks and in-lieu fee programs (Code of Federal Regulation)

d) Convention on Biological Diversity (United Nations, 1992)

e) Environmental legislation on the management of biological diversity (e.g. Compensation Manual of the biotic component, Decree 2099 of 2016, Resolution 1051 of 2017 and Resolution 256 of 2018, which recognizes and regulates the Habitat Banks)

f) Mitigation Bank Credit Release Schedules and Equivalency in Mitigation Bank and In-Lieu Fee Program Service Areas - Regulatory Guidance Letter (US Army Corps of Engineers, 2019)

g) National policies and action plans related to the use and management of biological diversity (eg PNGIBSE, National Restoration Plan)

h) The REDD+ environmental excellence standard (TREES), Version 2.0 (ART, 2021)

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13 GLOSSARY

- **Adaptive management** [SER, 2019]: A continuous process of improving practices through the application of knowledge acquired in evaluation and monitoring and the implementation of previously applied practices and techniques. It is the practice of reviewing management decisions in the light of information.

- **Available Credits*:*** It is the number of Credits resulting from the difference between the released Credits and those that have already been sold. The amount of these Credits may vary as more credits are released.

- **Assisted regeneration** [SER, 2019]: an approach to restoration that focuses on actively triggering any type of natural regeneration capacity of the remaining biota in or around a site, other than reintroducing the biota to the site or allowing the site to regenerate . While this approach is generally applied to sites with low to medium degradation, even some highly degraded sites have demonstrated the capacity for assisted regeneration provided adequate treatments are carried out in a sufficient time frame.

- **Barriers to recovery** [SER, 2019]: factors that prevent the recovery of an ecosystem or an ecosystem attribute.

- **Baseline survey** [SER, 2019]: Research of the biotic and abiotic elements of a site, prior to carrying out restoration actions, including its composition, structure, and function attributes. The baseline survey is implemented at the beginning of a restoration project in its planning phase, including the generation of a reference model, to develop the planning that includes restoration goals, measurable objectives, and treatment development.

- **Biodiversity** [Mendoza et al, 2012]: According to the Convention on Biological Diversity, it corresponds to the variability of living organisms from any source, including, among other things, terrestrial and marine ecosystems and other aquatic ecosystems and the ecological complexes of which they are part; it includes diversity within each species, between species and of ecosystems conservation.

- **Biodiversity Conservation** [Mendoza et al, 2012]: Emerging factor or property, which results from advancing actions of preservation, sustainable use, generation of knowledge and restoration. It is the main objective of the comprehensive management of biodiversity and its ecosystem services.

- **Comprehensive biodiversity management** [Mendoza et al, 2012]: Process by which actions for the conservation (knowledge, preservation, use and restoration) of biodiversity and its ecosystem services are planned, executed, and monitored, in a social and territorial setting defined with the aim to maximize social welfare, through the maintenance of the adaptive capacity of socio-ecosystems at local, regional, and national scales.

- **Ecological restoration project** [SER, 2019]: An organized effort that is carried out to achieve the goal of substantially recovering a native ecosystem, includes a planning, implementation and monitoring phase. A restoration project may include multiple deals and funding cycles.

- **Ecosystem** [Mendoza et al, 2012]: Dynamic complex of communities of plants, animals and microorganisms and the abiotic environment with which they interact and form a functional unit. Community or type of vegetation, understanding community as an assembly of populations of species that occur together in space and time.

- **Ecosystem approach** [Reid, 2005]: Strategy for the integrated management of land, water and living resources promoting conservation and sustainable use. This is based on the application of appropriate scientific methodologies focusing on the levels of biological organization that encompass essential structures, processes, functions, and the interactions between organisms and their environment.

- **Ecosystem-Based Adaptation** [Colls et al., 2009]: involves the conservation, sustainable management, and restoration of ecosystems, as a cost-effective solution that can help people adapt to the impacts of climate change.

- **Ecosystem collapse** [Keith et al. 2013]: In essence, it describes a state transformation in which the defining characteristics (compositional, structural, functional) of an ecosystem type are lost, and the system is completely replaced by a new one with different defining characteristics.

- **Ecosystem degradation** [Reid, 2005]: Persistent decline of ecosystems in their ability to provide services.

- **Ecosystem services** [UN]: Those processes and functions of ecosystems that are perceived by humans as a direct or indirect benefit (ecological, cultural, or economic). They include those of provisioning, such as food and water; regulating services, such as the regulation of floods, droughts, land degradation and diseases; support services such as substrate formation and nutrient recycling; and cultural services, whether recreational, spiritual, religious, or other non-material benefits.

- **Habitat** [UN]: the place or type of environment in which an organism or a population naturally exist.

- ***In-situ* Conservation** [FAO 1992]: Conservation “on the ground” of the genetic resources of selected species, within the natural or original ecosystem in which they occur, or in the place previously occupied by said ecosystem. Although the concept is most often applied to naturally regenerated populations, in situ conservation can also be understood as artificial regeneration, provided that the planting or seeding is done without deliberate selection and in the same area where the seeds were collected. or other reproductive materials.

- **Net gains in biodiversity** [MADS, 2018]: corresponds to the difference between the biodiversity values at the beginning of the project and those observed as a result of the biodiversity conservation actions throughout the execution of the project.

- **Performance standards** [CFR]: Performance standards are observable or measurable physical, chemical, and/or biological attributes used to determine whether a conservation project meets its objectives.

- ***Potential Credits:*** They refer to the total number of Credits that a conservation project can issue in accordance with the quantification methodology described in this Protocol

- **Reference model** [SER, 2019]: a model that indicates the expected condition that a restoration site would have if it had not been degraded (with respect to flora, fauna and other biota, abiotic elements, functions, processes, and successional states). This condition is not the historical condition, rather it reflects the background in environmental conditions.

- **Rehabilitation** [SER, 2019]: Management actions that seek to recover some level of ecosystem functioning in degraded sites, where the goal is the renewal and provision of ecosystem services and not the recovery of biodiversity and integrity of an ecosystem based on information provided by a reference ecosystem.

- ***Released Credits:*** These are the credits that can be marketed and sold, since the project met the milestones and ecological management established in the Credit Release Schedule. The release of these Credits must be approved by a third-party verifier. The number of released Credits cannot equal the number of potential Credits, until such time as the project has met all its ecological performance standards.

- **Remediation** [SER, 2019]: a management activity, such as the removal of external agents, excess nutrients, or contaminants, as a way to remove the sources of degradation.

- ***Sold Credits:*** Refers to credits that have already been assigned to a user and buyer and that cannot be sold again. The number of credits that can be sold is equal to the number of released credits at the time of balancing, even if the number of potential credits is greater.