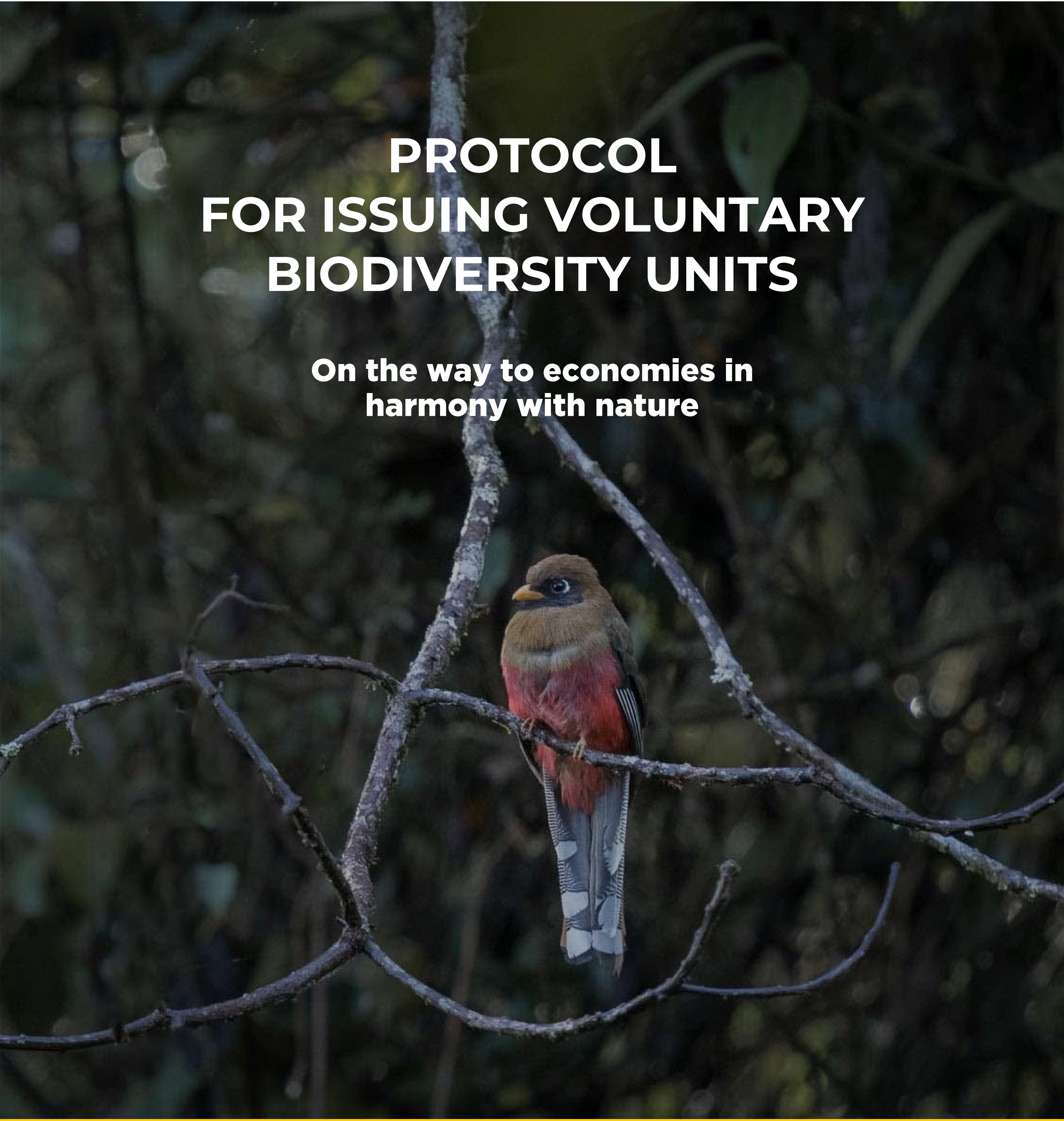
PROTOCOL FOR ISSUING VOLUNTARY BIODIVERSITY UNITS

On the way to economies in harmony with nature



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This document constitutes version 4.0 of March 2024 of the
Protocol for Issuing Voluntary Biodiversity Units,
which may be adjusted periodically by the stakeholders.

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PRELIMINARY CLARIFICATION

The **Protocol for Issuing Voluntary Biodiversity Units** (hereinafter **BU)** is one of the first protocols and methodologies to be established within the voluntary biodiversity market at a global level. In this sense, this document constitutes a Beta version, which is under constant review by Terrasos and the different allies of the *Working Group*.

The fourth version of this Protocol is the result of working sessions with international experts with an interest in biodiversity conservation, beyond the scope of the voluntary market alone. In addition, this update was driven by limitations identified during the application of the Protocol in other territorial contexts, increasing its adaptability for global use.

With the aim of accelerating ecosystem preservation and restoration, Terrasos has established communication channels, allowing for ongoing updates to the Protocol, which have culminated in its current version. This process involved receiving feedback via consultations with public and private entities, in addition to consolidating comments received via email, after which the pertinent changes were implemented. In addition, this represents a technical, financial and technological innovation in biodiversity conservation and the management of natural resources. It facilitates the establishment and development of the biodiversity market by providing a roadmap for generating projects that ensure quantifiable gains in biodiversity, as well as a financial mechanism to ensure their long-term sustainability. Thus, with the aim of perfecting the Protocol and facilitating its application to various biodiversity protection projects, we invite stakeholders interested in this document to provide constructive feedback on it and send them via email to: biodiversitycredits@terrasos.co.

About the concept of Biodiversity Credits, Biocredits and Biodiversity Units:

Versions 1 to 3 of the Protocol refer to ‘Credits’, but to standardize the terminology and language used in the international market, this document accepts the terms ‘Units’ or ‘Biocredits’ as synonyms. Version 4.0, however, will use the concept of ‘Biodiversity Units’ to refer to Voluntary Biodiversity Credits.

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Acronyms

CCBA	Alliance for Climate, Community and Biodiversity
CBD	Convention on Biological Diversity
COP15	Conference of the Parties on Biodiversity
GBIF	Global Biodiversity Information Service
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
KBA	*Key Biodiversity Areas*, Key Biodiversity Areas
LRE	Red List of Ecosystems
NPNB	No Net Loss of Biodiversity
UN	United Nations Organization
PNGIBSE	National Policy for the Integrated Management of Biodiversity and its Ecosystem Services
SiB	Colombian Biodiversity Information System
BU	Voluntary Biodiversity Units
IUCN	International Union for Conservation of Nature
IPLC	Indigenous People and Local Communities

1. CONTEXT

The loss of biodiversity and the accelerated change in ecosystems is bringing the world to a tipping point. This has led to a growing commitment on the part of governments and non-governmental organizations to work on mitigating the changes that the biosphere is undergoing, by strengthening sustainable activities (Porras & Steele, 2020). Among these initiatives is the Kunming-Montreal Global Biodiversity Framework, which identified the need to halt and reverse the biodiversity loss, with the aim of protecting 30% of coastal terrestrial and marine territories by 2030. Unfortunately, the limitations lie in the lack of resources in both the public and private sectors for the development of conservation projects. One solution is the implementation of Biodiversity Units, a concept defined as a unit that links a financial investment to an area in which a conservation project is being developed. This can be seen in the framework of voluntary and/or mandatory compensation. The difference between these two schemes is that infrastructure, mining, and other type of projects that exploit, affect, or degrade natural resources must compensate through the mandatory mechanism, paying an amount equivalent to the resources impacted, while the voluntary scheme is an initiative for natural and/or legal persons (GEF, 2023).

The investment in and development of Biodiversity Units (BU) would be a solution that would contribute to filling the funding gap for the development of biodiversity projects, which is estimated to be between 74% and 83% lower than what is needed to implement efficient measures annually (OECD, 2020). About 50% of current investment comes from governments, followed by private reserves (20%) and mandatory biodiversity offsets (6%), among other sources (Seidl et al., 2020). This funding alternative would help manage resources more effectively by having a third party take charge. This third party would coordinate and oversee the resources, facilitating efficient investments that align with the local context. This minimizes risk by limiting the number of people involved in the management and execution of resources, which in turn will ensure a positive impact on the ecosystem and biodiversity (Chausson et al., 2023).

Finally, these types of Units adopt a holistic approach, and by focusing on ecosystems, they offer both tangible and intangible benefits for the biodiversity and communities associated with the project. An example of this is their role as carbon sinks, their restoration of ecosystem services, their contribution to knowledge in local areas, and their reinforcement of the idea of the intrinsic value of nature. (Bush et al., 2023). The structure and function of each unit aligns with the vision that biodiversity is an essential part of the ecological infrastructure on which we depend, and that it must be restored and protected in the long term. This highlights the need to consolidate legal frameworks or structures that guarantee compliance with this goal.

This Protocol focuses on establishing a solution by developing projects, securing voluntary investment (public or private), and creating technical guidelines to ensure long-term, sustainable, and transparent funding.

2. INTRODUCTION

The agenda for meetings between international leaders focuses on building and strengthening alliances that will help accelerate the shift toward the sustainable use of natural resources. This challenge has mobilized efforts and fostered understandings that have led people equitably toward a more dignified, sustainable, peaceful, and prosperous way of life. This initiative is gaining strength with the constitution of the Sustainable Development Goals, which have been further supported by the Paris Agreement (2015) and the 30X30 target, both of which set ambitious objectives. The hope is that it will put biodiversity on the path to restoration by 2030 and foster greater harmony with nature by 2050 (*Convention on Biological Diversity*, 2022). This implies that countries will focus on conserving and restoring ecosystems, in addition to promoting the sustainable use of natural resources, ensuring the provision of ecosystem services.

In addition to this, the *Global Biodiversity Framework* (GBF) was published during COP 17. This strategy seeks to generate knowledge that describes the changes taking place across the planet due to factors such as pollution, climate change, deforestation, and the burning of fossil fuels, among others. This in turn will help assess how ecosystems are deteriorating, allowing for better planning and management to mitigate negative impacts on biodiversity, support conservation efforts, and protect human lives (Ekardt et al., 2023). In addition, the GBF aims to strengthen international cooperation, not only by forming alliances that accelerate the consolidation of environmental policies, but also by increasing funding for Nature-based Solutions (NBS) projects. One of the biggest problems in the transition to sustainability is a lack of funding[1] (Chan et al., 2023).

According to publications from Governmental and Non-Governmental Organizations, it is important to identify a combination of strategies that can halt, reverse or minimize the loss of biodiversity, and take into account biotic, abiotic and socioeconomic factors. This will require developing ecological, spatial, and territorial planning tools to protect species and reduce or eliminate threats to biodiversity. Likewise, it is important to recognize the role that economic and financial systems can play in discouraging activities that harm the environment, and promote those that benefit it (CBD, 2020).

In addition, the climate crisis and biodiversity loss have raised concern in the industrial sector, as these could lead to irreversible losses of natural capital. This, in turn, triggers crises in the economic development of countries and limits essential aspects, such as access to water sources, food security, and exacerbates climate risk. For this reason, private sector investment must be strengthened to support strategies that help voluntarily restore, recover or transform their relationship with ecosystem services. This will not only ensure the preservation of natural capital within production processes but also improve the quality of life for communities affected by extractive or industrial activities.

[1] Inequality, political tensions and armed conflict in some countries are additional barriers to accelerating sustainability and protecting biodiversity.

As a result, recognizing the need to develop and drive projects that restore biodiversity and ecosystem services, and in turn, contribute significantly to international goals, Terrasos has developed the *"Protocol for Issuing Voluntary Biodiversity Units".* This Protocol establishes rigorous criteria for the design, operation and monitoring of exceptional conservation projects, with the potential to be applied to terrestrial ecosystems around the world. These projects are managed with financial, technical, and legal guarantees to ensure their effectiveness. Likewise, this Protocol aims to mobilize public and private investments to create a market for Biodiversity Units. In this way, it seeks not only to achieve conservation, but also to implement long-term sustainable actions that generate environmental, social and economic value, while maintaining ecosystem services in the territories where they are developed.

The Protocol is designed so that eligible biodiversity conservation projects can make use of the mechanisms for recording, quantifying, and issuing Voluntary Biodiversity Units. Depending on the technical characteristics and the territorial context, this will provide tools that ensure the restoration and conservation of biodiversity. The Units may be acquired by both individuals and legal entities that want to make a positive and effective contribution to the conservation of threatened ecosystems and biodiversity as a whole.

3. OBJECTIVES OF THE PROTOCOL

The *"Protocol for Issuing Voluntary Biodiversity Units"* (hereinafter 'the Protocol') seeks to enable the development of a market by creating a roadmap, to promote projects that will deliver quantifiable gains in terms of biodiversity, as well as a financial mechanism to ensure their sustainability. Accordingly, the Protocol:

- Defines the concept of Voluntary Biodiversity Units.
- Specifies the requirements that conservation projects must meet for the registration and issuance of Voluntary Biodiversity Units.
- Establishes the principles that govern the issuance of Voluntary Biodiversity Units.
- Outlines the mechanism for quantifying a project's Voluntary Biodiversity Units.
- Establishes quality and transparency criteria for the duration of the process, including the different stages of monitoring, reporting and verification of preservation and restoration activities/initiatives.
- Proposes the "Unit Release Scheme", which makes the issuance of Units subject to compliance with administrative, financial, and technical milestones, ensuring a performance-based payment system.
- Establishes the minimum requirements for a conservation project registration platform to monitor BU transactions and avoid double-counting.
- Defines the different stages of the certification and issuance process of the BU and outlines the roles that each of them must fulfill.

4. SCOPE

This document provides the guiding principles for conservation projects eligible for BU issuance, as well as the methodology for quantifying the project's potential units. In addition, it establishes the mechanism for the release of these Units, ensuring their quality and suitability, as well as the monitoring, reporting and verification requirements that support their use. As such, this document serves as a comprehensive guide for the following stakeholders:

a) **Property Owner(s):** The person(s) or group of persons who manage or own the land associated with the area where the conservation project is intended to be established.

b) **Project Structurer:** The person or team responsible for developing the preservation and/or restoration plan required by the project. This plan is based on the baseline conditions and the requirements of the territory where the project will be implemented. Additionally, the Project Structurer will establish the necessary methodology for collecting data for the duration of the project and define the ecological and management milestones for the Unit release scheme, concepts that are defined later in this document.

c) **Project Operator:** The person or organization responsible for the development and implementation of the project's restoration and/or preservation plan. In addition to collecting and consolidating the necessary information, the Project Operator will report on the development and progress of the project based on management and ecological milestones.

d) **Investors:** Private companies, international organizations, and other funders may use the principles established in this Protocol to direct their investments in exceptional projects that follow best practices and minimize risks.

e) **Buyers:** Individuals, private companies, public entities, NGOs, or governments interested in making voluntary investments that benefit biodiversity and ecosystem services through the preservation and restoration of ecosystems. These buyers aim to invest not only in measurable and permanent biodiversity offsets, but also in transparency and traceability regarding the allocation of their investments. This should align with the project's metrics, as it may represent a voluntary contribution toward mitigating the impacts on biodiversity and/or ecosystem services.

f) **Third-Party Verifier:** Third parties are responsible for the monitoring and verification of conservation and restoration activities, as well as accounting for the BU issued by the project. Verifiers ensure the transparent management of the BUs, and that their commercialization is linked to demonstrable gains in biodiversity.

g) **Administrators of Registration Platforms:** Independent legal entities responsible for developing and operating the information systems necessary to maintain accurate accounting and ensure the integrity of the information, which (1) support the preservation and restoration activities of each project, and (2) clearly and uniquely identify the transactions and the beneficial owner of each BU.

h) **Government entities: These entities** may be interested in learning about voluntary biodiversity certification standards and protocols to help design and implement regulations and public policies, and develop preservation and restoration projects with demonstrable biodiversity gains.

i) **Standards Providers:** An independent entity responsible for managing the rules and conditions required for project development and implementation. They are tasked with certifying or validating projects, developing and updating the Protocol, and designing the templates for content development, among other functions.

Finally, this Protocol should serve as a guide for stakeholders to structure and develop projects that generate quantifiable gains in terms of biodiversity and use this financial mechanism to ensure their sustainability. It is important to note that the Protocol is not a prescriptive or normative document, but has a certain degree of flexibility, recognizing that biodiversity conservation projects have diverse characteristics that will not always fully align with what is stated here.

The objective of this Protocol is not to provide a financial analysis for determining the cost of a BU. Each Project Structurer must ensure a unit value that aligns with the principles set out in this Protocol, ensuring a fair distribution of benefits, and covering all operating costs and expenses for the duration of the project.

5. CONCEPTUAL APPROACH

The Protocol seeks to ensure that different conservation projects can issue BU using a rigorous approach whose implementation is practical and replicable across various social, environmental and territorial contexts. Technical rigor is essential for achieving demonstrable gains in biodiversity and ensuring the long-term impact of preservation and restoration efforts. For this reason, it is important that projects and their objectives are realistic, measurable and achievable.

The technical approach is based on the factors that most affect a territory's capacity to restore its potential ecosystem services. For this reason, an approach based on five differential factors is proposed, allowing the determination of the potential Units a project can issue. This corresponds to the complexity of the project's ecosystem and therefore to the costs associated with its execution.

The construction of a model entails risk, especially in an ecosystem composed of thousands of variables (Caron-Lormier et al., 2009). However, the Protocol, outlined in Figure 1, seeks to focus on those variables[2] that affect an ecosystem on a global scale, such as (1) the level of threat (determined by the

[2] Priority is given to those variables that can be implemented at a global level, and are accessible through secondary information sources. This helps to avoid perverse incentives in calculating the project's potential credits. Additionally, minimizing the number of variables in a model that describes the ecosystem decreases variability, thereby, increasing its accuracy (Fisher et al., 2019; Geary et al., 2020). Finally, the variables applied have a direct impact on the implementation costs of a restoration project.

IUCN), (2) landscape heterogeneity[3], (3) the degree of community involvement, (4) the project's long-term presence in the territory and (5) the condition of its ecosystems and, therefore, the proportion of area to be preserved and restored. Within the framework of the Protocol, these variables will be called 'factors'. Additionally, it outlines the scheme for quantifying a project's potential Units, which reflects project's complexity in terms of conservation, as well as the scheme for releasing Units for commercialization, based on a performance-based payment structure.

Figure 1. Differential factors that determine the number of BU that a conservation project can issue.

Note. Factors associated with the Protocol proposed by Terrasos (2024), which seeks a multidimensional approach to determine the BU that a project can issue.

5.1. Biodiversity at the ecosystem level

This Protocol proposes using ecosystems as a framework for assessing and issuing BU. Ecosystems provide a way of grouping or organizing biodiversity on a large scale, allowing the identification of key areas of biodiversity that require protection in both terrestrial and marine-coastal ecosystems. By describing the interactions between the biotic and abiotic components, ecosystems help guide actions that restore ecosystem services through the implementation of the BU. In addition, planning conservation activities helps control threats to biodiversity, while encouraging sustainable practices that do not significantly disturb the natural environment (Margules & Pressey 2000; Pressey & Bottrill, 2009).

Assessing the state or level of an ecosystem's degradation can be more accurate than evaluating a particular species' vulnerability to extinction. Evaluating and measuring ecosystems considers a larger set of factors (e.g., abiotic) that describe habitat conditions, making it an inherently integrative approach, in contrast to species-specific evaluations. In addition, an analysis of biodiversity and vulnerability at the ecosystem level is usually less time-consuming and costly than conducting species-by-species or genetic assessments. This helps streamline the measurement and reporting of results (Keith et al, 2020).

The conservation effort starts with assessing the vulnerability of ecosystems to degradation or extinction. There is currently an information infrastructure that supports the management of ecosystems and the services they provide. Ecosystem red lists, including the IUCN red list, define

[3] Landscape heterogeneity is an indirect measure of habitat fragmentation. A highly heterogeneous landscape indicates less connectivity, whereas greater homogeneity of natural cover indicates greater connectivity (Malanson & Cramer, 1999).

ecosystems as units made up of both organisms and the physical environment in a specific area, based on four fundamental elements (Keith et al., 2023):

I. Biotic complexes: The diversity of species and communities of organisms that inhabit an ecosystem.
II. Abiotic complexes: The physical and chemical factors that surround an ecosystem, such as climate, soil, and water.
III. Interactions and niches: The interactions between organisms and abiotic factors in an ecosystem.
IV. Spatial location: The location of an ecosystem and its characteristics.

The combination of these four elements allows for a robust approach to biodiversity conservation, since it considers the specific characteristics of each element within an ecosystem, as well as the interactions between them. This makes it possible to identify the specific threats it faces, and therefore develop effective conservation strategies. This comprehensive approach to ecosystem components encourages comprehensive biodiversity management, while promoting sophisticated, self-sufficient and long-lasting actions. In addition, this has a positive impact on ecosystem services within the project's area of influence. This not only enhances ecosystem resilience but also the sustainability of certain resources and natural capital, enabling the development of subsistence activities in the surrounding communities. This helps strengthen sustainable development over time as a co-benefit product involved in restoration and conservation activities, resulting in a transformation in the territory, not only in terms of biodiversity but also in the livelihoods of the communities, driven by voluntary investments from different sectors.

In light of this, the Protocol acknowledges that characterizing and understanding ecological processes are essential to diagnosing threats to species and thus resolving potential management conflicts. They therefore underpin the ecosystem-based approach, indirectly complementing conservation efforts at the species level and other taxonomic levels of biodiversity. Additionally, through the monitoring and follow-up requirements outlined in the following chapters, the Protocol ensures that other key elements such as threatened species and efforts across multiple levels of biodiversity are included in the planning and structuring of Management Plans to achieve significant conservation outcomes.

Implementing a standard such as those established by the IUCN, which allows for defining the level of threat to an ecosystem based on the risk factors of the territory (De Leo & Levin, 1997), helps boost political will and drive national and international investment in the conservation of critical ecosystems and the protection of ecosystem services. This approach will make it possible to raise awareness of and map out the ecosystems at the greatest risk of collapse[4], helping to inform and achieve the sustainable management of ecosystems through voluntary environmental investments.

5.2. Project Area of Influence

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

The activities outlined in the Management Plan for the project area seek to generate ecosystem benefits through a holistic approach, addressing biotic, abiotic and socioeconomic components. These benefits should be linked to monitoring indicators (later referred to as compliance milestones) based on measurable and quantifiable data. These activities generate positive impacts that can extend beyond the limits of the project, recognizing that biodiversity and the elements that interact with it do not respond to human-imposed limits or barriers.

The social benefits generated by the project may transcend the project area. For example, when the project promotes formal employment through hiring local labor and purchasing local goods and services, the impacts can be felt beyond the project area. In contrast, the effects on vegetation cover are more localized, since these activities are concentrated in the project area. The benefit and impact, therefore, will be limited to the properties associated with the project (Aragonés-Beltrán et al., 2017). For this reason, it is essential that the project registration document justifies the measures outlined in the project's performance standards, as these relate to the area within the scope of the project, where anticipated gains will include not only biodiversity, but also dignifying work, revitalizing the local economy, improving habitat quality, and restoring, and/or protecting ecosystem services.

Another key aspect of delimiting the area of influence is understanding the context of the project, and how it is affected by its surroundings. This understanding facilitates the analysis of stresses that may affect the development of the project and in turn, the generation of sustainable biodiversity gains over time. Incorporating this concept into the framework of a conservation project helps to clearly identify *project stakeholders* and define the scope of the Management Plan. It also helps identify the ecosystem services that the project area can protect, as well as the indicators required to monitor habitat quality, ecosystem services and biodiversity gains.

The Protocol aims to guide the delimitation of the relevant units of measurement for quantifying impact, thereby documenting improvements in the territory. To achieve this, it is essential that the data collection and sampling techniques are consistent and based on replicable methods, ensuring that the data collected and the indicators derived from it, are comparable. In addition, the project's baseline must correspond to the area within the scope of the project, so that the initial conditions are clear and the monitoring indicators provide evidence of changes over time.

To provide guidelines for the scope of a project, the following proposal discusses the extension of the analysis and the justification for incorporating information.

The following are considerations for determining the area of influence or scope of the project.

5.2.1. Biotic component

The scope of the biotic component project is limited to the project area, as this is where biodiversity gains are expected to be observed[5]. For this component, it is essential to define the taxonomic groups[6] under study and the unit of analysis[7] based on the territorial context to demonstrate the positive impact of the restoration strategies that have been implemented. This criterion determines the ecological performance standards of the project and the periodicity of measurement.

5.2.2. Abiotic component

For the abiotic component, the spatialization corresponds to the project area, similar to the biotic component, where improvements in conditions are projected. In addition, abiotic factors enable the quantification of improvements in habitat, serving as precursors of potential gains in biodiversity. For this reason, it is expected that, in the first instance, improvements in physicochemical parameters, such as soil or water quality, will be observed, leading to an increase in the availability of niches for species and, consequently, an increase in the composition and structure of the organisms associated with the territory.

The collection of primary information for this component and the projected restoration and preservation activities will provide the necessary input to consolidate the ecological performance standards and the periodicity required to evidence changes in the conditions of the project.

5.2.3. Socioeconomic component

The previous components require the collection of primary information to establish the baseline; in contrast, the socioeconomic component can be consolidated with secondary information. This approach aims to control potential biases when sensitive information is required or when opinions from the communities might influence the data. To achieve this, it is important to identify land use characteristics, key economic activities, forms of land tenure, and all relevant information that will enable the Project to be integrated into territorial activities. This aims to respecting the cultural and economic context in which the project will be developed, while ensuring community involvement aligns with the objectives of the Project. It is essential that the Baseline determines the ancestral, economic and cultural dynamics of the territory to guarantee the sustainability of the proposed actions.

6. ELIGIBLE PROJECTS

This Protocol applies to projects whose main objective is the conservation of biodiversity through preservation and restoration actions, integrating monitoring, reporting and verification processes that

[5] It is important in the characterization process to include an analysis of the landscape context to understand the level of fragmentation that exists in the territory. This understanding is essential for determining the management strategy that should be implemented in the project area, to ensure gains in biodiversity.

[6] A group of living organisms that are grouped together because they share physical, genetic, or evolutionary characteristics; for example, birds, herpetofauna (amphibians and reptiles), mammals and terrestrial plants.

[7] The unit of analysis for a biological group refers to a standardized and normalized measurement that can be used for spatiotemporal comparisons, such as alpha, beta, composition, and structural diversity.

demonstrate measurable gains in biodiversity outside of a regulatory framework (including voluntary investments by individuals or legal entities). The Protocol seeks to promote and accelerate investments in biodiversity conservation by establishing a performance-based payment mechanism, allowing projects to issue BUs as demonstrable and verifiable biodiversity management and net gain milestones are reached.

6.1. Eligible Stocks

Biodiversity conservation and restoration projects that adhere to this Protocol should demonstrate tangible improvements in biodiversity. This means that they must achieve a measurable increase in biodiversity within the project area. To achieve this objective, it will be necessary to establish a Management Plan for the project area that combines preservation and restoration actions, either individually or collectively, as detailed below.

6.1.1. Preservation

Ecological preservation actions include all actions that protect and maintain the natural state of biodiversity and ecosystems by reducing or eliminating barriers to conservation. These actions include the delimitation of agricultural and urban boundaries, restriction on changes in land use, and the prevention of deforestation, among others. Key preservation activities at the territorial level include the establishment of legal and financial mechanisms to ensure the long-term maintenance of the areas, generating income from the non-destructive use of ecosystems, the enclosure of areas, creating living barriers, isolating forest fragments, and developing surveillance and control programs. This also includes addressing land sanitation issues where the conservation project is to be structured (MADS, 2015; 2018; Mendoza et al, 2012).

6.1.2. Restoration

Ecological restoration is an interdisciplinary strategy aimed at facilitating the restoration of an ecosystem that has been degraded, damaged or destroyed (MADS, 2015; Mendoza et al., 2012 SER, 2004; 2019). As outlined in the Protocol, this strategy is a complex process that goes beyond the conventional notion of *"chang[ing] from a modified cover to a state similar to the original one"* since, by definition, ecological restoration requires the interplay of environmental, social, legal, and economic actors[8].

In this context, the Protocol understands ecological restoration as the process of assisting (promoting) the restoration of a deteriorated, degraded, or modified ecosystem (Gann et al., 2019). *"Assisting restoration*" implies that the ecosystem plays a key role in its own restoration. Therefore, human intervention must provide the necessary conditions for restoration, as it plays a role in the process. In other words, project operators–whether individuals or organizations responsible for the restoration

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

process–must act as facilitators so that the ecosystem, in all its biotic and abiotic complexity, may drive its own recovery.

On the other hand, excessive human intervention in this process would no longer qualify as "ecological restoration", diverting it toward activities such as gardening, ecological engineering, agronomy, or cultivation, since the ecological outcome would be manipulated. This would result in an ecosystem shaped by an anthropocentric view of nature, which can disrupt trophic interactions and ecosystem services in the territory. This is why the selection of species and planting methods are important in reforestation processes, as they can result in human conceptions of nature. Although ecological restoration incorporates techniques from disciplines such as gardening, forestry, and agriculture, its distinction lies in the purpose of allowing the ecosystem to evolve and develop according to its inherent properties (Clewell & Aronson, 2013).

BUs are a mechanism that allows the consolidation of ecological and landscape restoration strategies, while simultaneously providing an investment alternative that ensures long-term stability from a technical, financial, and legal point of view. Likewise, BUs have the potential to promote high-impact actions, such as the restoration of biotic and abiotic components, and the strengthening of natural biological processes by reducing habitat fragmentation. In addition, they help generate socioeconomic conditions that ensure the sustainability of these activities and promote the resurgence of ecological processes (Clewell & Aronson, 2013).

Ecological restoration stands out as a strategy that offers significant additional benefits compared to ecological preservation, due to its ability to revitalize degraded and damaged ecosystems. While preservation focuses on maintaining existing biodiversity without necessarily increasing it, restoration seeks to recover and improve ecosystem health by reintroducing native species, restoring habitats, and mitigating environmental impacts such as climate change, and fostering ecosystem resilience. This dynamic approach promotes the regeneration of key ecosystem services, such as water purification, carbon sequestration, and flood protection; services that, in principle, are maintained in areas only requiring preservation. Ecological restoration, therefore, not only conserves what remains but creates new opportunities for nature, ultimately offering invaluable additional benefits in promoting the sustainability and resilience of our planet.

Within the field of restoration, it is important to recognize the value of landscape restoration, which incorporates activities such as agroforestry systems. This practice combines fruit trees, timber, and agricultural crops[9], replicating the complexity of natural habitats, generating refuge and habitat for wild species, in addition to providing additional economic benefits to local communities (Santos et al., 2022). Agroforestry planting can strengthen the resilience of ecosystems to climate change and biodiversity loss. Therefore, it is essential to carefully integrate these practices into our conservation and ecological restoration efforts to strike a balance between environmental protection and human development. This integration of agroforestry and conservation promotes long-term sustainability, ensuring subsistence for the beneficiary communities while respecting their traditional livelihoods (Bhagwat et al., 2008).

[9] The plants implemented in agroforestry systems must be native or exotic species in a controlled manner that do not cause alteration or disturbance within the ecosystem.

In light of the above, and considering the guidelines that have been established by the Society for Ecological Restoration (Gann et al., 2019; Mutillond et al., 2024), the implementation of restoration projects should consider the following:

1. ***Protect the site from damage*.** Restoration activities must prevent damage to the ecosystem. This includes physical damage (e.g., vegetation "cleanups"), chemical contamination (e.g., over-fertilization, pesticides etc.) and biological contamination (introduction of non-native species or pathogens).

2. ***Involve the right participants.*** The management plan must be based on territorial characterization, identifying key actors essential for the development of a restoration or preservation project. While these actors are important, the multidisciplinary nature of the Protocol is crucial to ensuring the progress of a project.

3. ***Incorporate natural processes.*** All treatments and restoration strategies must be conducted in such a way that they align with and support the natural processes observed in the site, thereby promoting or assisting restoration.

4. ***Limit human activities in the project area***. Since anthropogenic activities contribute to environmental degradation, it is essential to restrict land use to activities that promote sustainability and preserve ecosystem services, and therefore natural capital.

5. ***Respond to changes that occur on the site.*** It is important to note that the management of the restoration process must be adaptive and informed by monitoring results. This includes making corrective changes to accommodate unexpected ecosystem responses and carrying out additional work that was not factored into initial planning or was poorly modeled.

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

7. ***Communication with stakeholders.*** There must be active communication with stakeholders, ensuring that the respective reports are generated documenting the progress of the project.

8. ***Minimum project duration.*** For a project to be eligible, it must have a minimum duration of 20 years from the date of its registration.

It is important to note that in order for a piece of land to be considered eligible for restoration actions, it must be demonstrated that no activities that significantly degrade soil conditions have been carried out in the project area over the last five years. This is to prevent creating perverse incentives for transforming natural ecosystems, such as deforesting a natural forest to generate a more profitable project for the landowner.

6.1.2.1. Social and environmental considerations

A high-integrity conservation project must be clear about the interactions it has with the ecosystem, and how it promotes ecosystem resilience. This resilience aligns with the conservation of ecosystem services in the project area, so it is important to include metrics that establish the co-benefits generated by the project. To guarantee gains in biodiversity, it is important to control environmental stresses and support assisted restoration, so that the project will result in improved habitat quality. In doing so, projects that implement this protocol are indirectly generating:

- Change in land and water use
- Elimination of pollution within the project's area of influence
- Restoration and replenishment of ecosystem services
- Control of invasive/exotic species
- Resilience to climate change

In this way, projects are able to track the positive impacts they generate, enabling the private sector–specifically corporations–to align their voluntary compensations with these impacts.

6.2. Overlap with other financial mechanisms

The Protocol for Issuing Voluntary Biodiversity Units (BU) is a financial tool designed to encourage restoration and conservation activities in a specific territory. This protocol prioritizes the protection of the environment, so it does not allow resource exploitation activities, such as extensive agriculture, mining, or other extractive activities. It also does not permit combination with other financial mechanisms, such as carbon markets or similar standards. Terrasos considers this guideline essential to prevent practices that could lead to double counting or create undesirable incentives for project developers. The only activities we consider aligned with the objectives and principles of this protocol are sustainable tourism, agroforestry systems and beekeeping, since all three strengthen the intrinsic connection between nature and human activities, promoting a holistic and sustainable vision of the system.

7. DEFINITION OF VOLUNTARY BIODIVERSITY UNITS

A Voluntary Biodiversity Unit (BU) is a transactional unit representing $10m^2$ of an ecosystem that has been preserved and/or restored. It is managed technically, financially, and legally by the project operator to achieve measurable biodiversity outcomes. Using the methodology proposed here, the project operator will determine the number of Biodiversity Units that the project may issue. Each unit can only be sold once throughout the project's lifespan, ensuring full transparency and preventing double counting.

The buyer of a BU would be voluntarily contributing to generating positive impacts on biodiversity and ecosystem services through conservation activities and the sustainable use of natural capital within the ecosystem. Additionally, the buyer is assured that their investment will be legally, technically, and financially managed for the duration of the project (a minimum of 20 years). The buyer will also be able to track the project and the unit(s) purchased, confirming that they were only sold once.

7.1. Principles

For a biodiversity conservation project to be able to issue a BU, it must ensure that its structuring, operation, issuance of Biodiversity Units, marketing, monitoring and reporting of compliance milestones all adhere to the following principles:

a) **Traceability:** ensuring access to information related to:
   - *The value chain:* Mechanisms must be in place to track and communicate how a BU is created, marketed and withdrawn from the market once all biodiversity conservation objectives have been met.
   - *Biodiversity information:* Monitor and publish data related to biodiversity monitoring, restoration and conservation actions being conducted.

b) **Permanence:** The conservation project must have the technical, administrative, financial, and legal conditions to ensure the long-term preservation and restoration of ecosystems and their biodiversity. Projects wishing to benefit from this Protocol must commit to the project for a minimum of 20 years, with a maximum of 50 years (see section 8.1.4.1 Minimum Duration of Conservation Projects).

c) **Rigorousness:** Biodiversity conservation projects wishing to issue BUs must ensure an analytical and scientific approach to the development of their activities. They must be supported by a management plan that specifies the project's objectives and the indicators that will be used to measure compliance, in accordance with the requirements outlined in section 10, DOCUMENT AND REGISTRATION PLATFORM. In addition, the design of the conservation project must include ongoing evaluation[10], where results are measured against the goals and objectives, ensuring adaptive management. This should allow for corrective changes to be made as necessary and/or for the implementation of actions that were not initially considered.

d) **Transparency:** Procedures must be public and open to consultation, including information related to the credit registration, the preservation and restoration project, the participants and their roles in the loan transaction, the actions to be taken, dates, impacts, goals and supporting documents, as well as information about the buyer and prices.

e) **Complementarity:** The actions proposed in the structuring of the project must be complementary to and in accordance with the territory's environmental planning and management tools, and with national or regional conservation priorities. Additionally, it is important to consider the environmental context and assess the potential for connectivity based on the total area of the project (Gil & Moreno, 2007). Similarly, other proposals or sustainability indicators that the Developer and Project Owner consider pertinent, which may not necessarily be linked to local regulations and obligations, may be incorporated if they contribute to the objectives of the project.

[10] It is suggested to carry out a spatiotemporal analysis of the information obtained during the operation of the project.

f) **Applicability:** It must be possible to integrate projects from different environmental, social, and economic contexts.

g) **Additionality:** Any project that issues BUs must demonstrate additional gains in terms of biodiversity conservation–such as natural capital, ecosystem services, species richness, and environmental factors, among others–that would not be achieved without the implementation of the project, as shown in the Table 1.

h) **Review and Oversight Responsibilities:** To ensure that the biodiversity gains generated by the project are new, it is necessary to clearly identify the barriers to conservation and how these will be overcome through the preservation and restoration actions of each project. These barriers should not only relate to environmental factors, but also social, economic, and legal factors.

Table 1. Additional Conditions: Analysis of Barriers Affecting Biodiversity Gains

Criterion of additionality	Applies (Yes/ No; justification)
1. It generates additional profits in terms of preserved and/or restored areas.	
2. It helps to prevent biodiversity losses.	
3. It reduces investment barriers (e.g. lack of financial resources) to maintain interest in ecosystems with a high degree of conservation.	
4. It reduces institutional barriers (e.g. restrictions by policies and laws, institutional risks, lack of law enforcement).	
5. It reduces technological barriers (e.g. access to information, lack of training and knowledge in information technologies, lack of technological infrastructure).	
6. It reduces barriers related to local traditions (as opposed to local knowledge or cultural traditions).	
7. It reduces barriers related to prevailing practices ("the project is the first of its kind in the region").	
8. It reduces environmental barriers (e.g. degraded soils, extreme events, limitations due to adverse climatic events).	
9. It reduces social barriers (demographic pressure, social conflicts, lack of organization at the local level).	
10. It reduces barriers to tenure and property rights.	

Criterion of additionality	Applies (Yes/ No; justification)
11. It improves functional connectivity for key species within the ecosystem.	

Note. *For each project, it is necessary to analyze which additionality criteria apply to its specific context and justify the mechanisms or actions that will allow each barrier to be overcome. The table should serve as an example; projects can add or remove criteria depending on the context and particularities of the ecosystem being targeted for preservation and/or restoration. **Projects using this Protocol must justify at least seven (7) additionality and three (3) complementarity criteria**.

The result of this analysis should demonstrate that preservation and restoration actions, and associated investments, allow these barriers to be removed. In addition, the project should demonstrate that it helps overcome various barriers, with a special emphasis on those related to the environment (barriers 1, 2 and 8), tenure and property rights (barrier 9) and investment (barrier 3).

These principles are interrelated in various ways that go beyond the BU, as shown in Figure 2. Aspects such as project structure, value chain, and expertise contribute to this, fostering collaboration among working groups to ensure best practices and achieve the project's objectives.

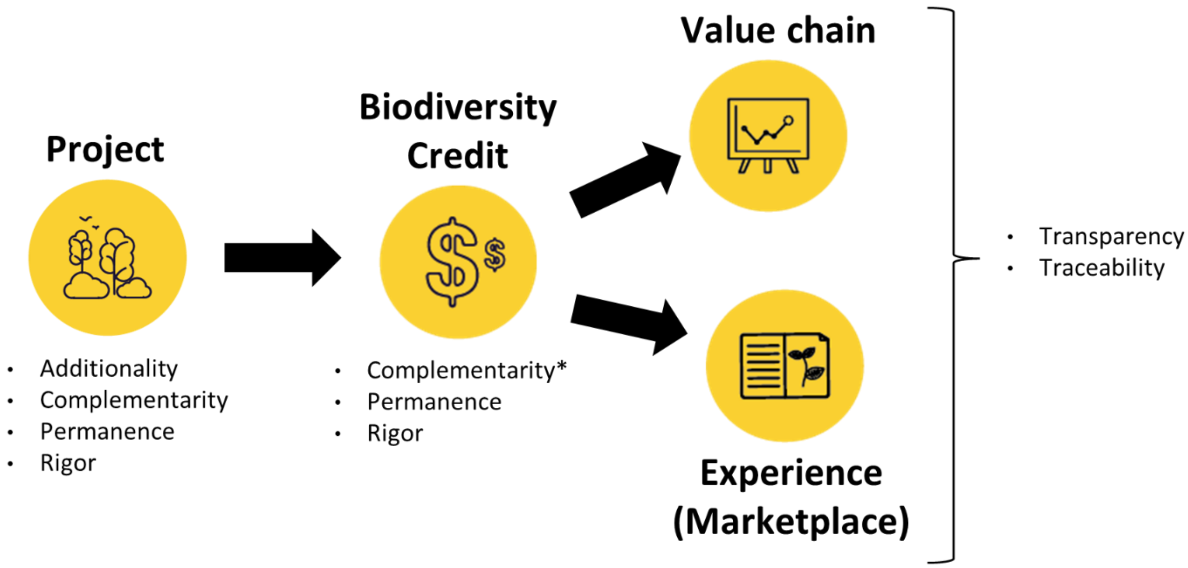

Figure 2. Requirements for Biodiversity Conservation Projects to Issue Voluntary Biodiversity Units.

Note: This figure illustrates the relationship between the components of a BU project and the fundamental principles established by the Protocol.

8. METHODOLOGY FOR THE ISSUANCE OF VOLUNTARY BIODIVERSITY UNITS

A fundamental element of the methodology is the **design of a standardized and tradable transactional unit** with the potential to be adopted and recognized internationally. While each conservation project is unique in its structure and operation, the territorial context and decisions of the project structurer influence the additionality of the project. Accordingly, the result, cost, and viability of the potential Units a project can issue depend on differential factors that are important for the biodiversity conservation.

8.1. Quantification of Voluntary Biodiversity Units

This methodology aims to differentiate conservation projects based on their technical characteristics, and to assess them according to the conservation status of the ecosystem being targeted, as well as the preservation and restoration activities to be carried out. The greater the degree of threat to and the strategic importance of the ecosystem involved, the greater the number of Units the project will be able to issue. This approach seeks to promote and accelerate biodiversity conservation efforts in those ecosystems that are most threatened or degraded, with the smallest area of native remnants and highest degrees of fragmentation.

This methodology is based on the hypothesis put forward by the IUCN Red List of Ecosystems (RLE) (Bland et al., 2017), which states that the risk to ecosystems is determined by the species that compose them, their interactions, and the ecological processes on which they depend. For threat categorization, this list includes criteria related the risk of ecosystem collapse, measured through reductions in geographic distribution or degradation of key processes and biotic components (Keith et al, 2013). Similarly, the methodology emphasizes the importance of the sociocultural component in the success of biodiversity preservation and restoration projects, as the human component plays a crucial role in decision-making and engagement with the territory.

In light of the above, a methodology for assigning BU is proposed based on five (5) differential factors, each of which is estimated to have a differential impact on the development costs of conservation projects in both terrestrial (Van Deynze et al., 2022) and marine (Edwards et al., 2010) ecosystems. These factors were chosen because they differentially describe the conditions of the territory without redundancy[11], and each has a direct effect on the costs of implementing a conservation project. This approach aligns the complexity and the level of degradation of the territory with the number of potential Units.

1. **Factor 1:** Threat category of the ecosystem where the project is located, based on IUCN criteria.
2. **Factor 2:** Opportunities for ecological connectivity generated by the project.
3. **Factor 3:** Sociocultural context of the project
4. **Factor 4:** Project duration
5. **Factor 5:** Area dedicated to preservation and restoration actions in relation to the total project area, reflecting the distribution and degradation of key ecosystem processes

Equation 1 shows the formula for quantifying Voluntary Biodiversity Units (BU), along with a description of each of its components or differential factors. Each of the factors carries equal weight in the total quantification of Units, i.e., the level of threat, connectivity opportunities, social participation, the duration of the project, and the proportion of areas subject to restoration and preservation are all equally important. This approach reflects the Protocol's commitment to respecting the concept of nature as an interconnected system which, for balance and sustainable use, requires projects to consider the abiotic, biotic and sociocultural contexts.

Equation 1. Formula for the Quantification of Voluntary Biodiversity Units

$$\frac{\#\,potential\ BU}{10\ m^2} = \frac{TPA * (F1 + F2 + F3 + F4) + ARes * F5 + APres * F5}{10}$$

Where:

- **TPA:** Total project area in square meters
- **ARes:** Area dedicated to restoration actions in square meters
- **APres:** Area dedicated to preservation actions in square meters
- **F:** Differential factor

[11] Two variables are considered redundant when they indirectly convey the same information. For example, elevation and temperature are redundant variables because, as elevation increases, temperature decreases, and vice versa. They behave linearly and are inversely proportional, so incorporating one variable describes the behavior of both. This is essential in descriptive and predictive models to avoid overparameterization and increase accuracy.

The methodology for assigning BUs is based on differential factors according to the scope of application (total project area, restoration areas, preservation areas) with the aim of:

a) Presenting the preconditions and potentials of the intervention site, and thereby identifying the specific needs for the structure and operation of the conservation project. Consequently, the number of Units that a project can issue varies significantly depending on factors such as the degree of threat to the ecosystem, the connectivity it generates with adjacent areas, the project's operational duration (permanence), and the actions to be implemented.

b) Ensuring that the profits generated by the commercialization of BUs provide the necessary income to fully develop preservation and restoration activities within the project area, thus ensuring demonstrable biodiversity outcomes.

8.1.1. Differentiating Factor 1: IUCN Ecosystem Threat Category

The IUCN ecosystem threat category is the first factor used in quantifying the BUs a project can issue. This is because the state of ecosystems is related to the intrinsic values of biological diversity. Addressing biodiversity conservation at the ecosystem level allows for the explicit consideration of large-scale ecological processes, along with key dependencies and interactions between the species that compose it (see 5.1 Biodiversity at the Ecosystem Level). To develop this factor, the categorization of ecosystems from the Red List of Ecosystems (Bland et al., 2017) will be used as a reference. This provides a unified protocol with global applicability for assessing the status of ecosystems at risk, which can be applied at the global, national, regional or local levels.

The Red List of Ecosystems (LRE) is an appropriate reference because it was structured to meet four (4) criteria: generality, precision, realism and simplicity. This allows the classification to be applied to all types of ecosystems, handling data from diverse sources and varying levels of detail. By emphasizing precision, the LRE promotes transparency and replicability, supported by the realism generated by scientific evaluations. This allows it to be open to evaluation and falsifiability, generating trust and continuous improvement, while being simple enough to ensure accessibility to the tool for a wide range of users, regardless of their area of expertise (Keith et al, 2015).

In light of the above, the LRE allows the risk status of ecosystems to be assessed and compared using standardized quantitative criteria, helping to prioritize investments in ecosystem management, restoration, and conservation. To this end, ecosystems that are under the greatest threat are considered the highest priority for investment, since the limitations, ecosystem pressures, and costs associated with their conservation and restoration are greater.

8.1.1.1. Threat Category according to the RLE

There are eight (8) threat categories by which an ecosystem can be classified, three (3) of which include ecosystems that are under threat (see Figure 3):

- **Critically Endangered** (CR): Ecosystems with restricted distributions, decreases in area, and levels of environmental degradation and disruption of biotic processes that indicate an extremely high risk of collapse[12].

- **Endangered**: (EN) Ecosystems with distributions, area declines, and levels of environmental degradation and disruption of biotic processes that indicate a very high risk of collapse.

- **Vulnerable** (VU): Ecosystems with distributions, area declines, and levels of environmental degradation and disruption of biotic processes that indicate a high risk of collapse.

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

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

- **Least Concern** (LC): Ecosystems that unequivocally do not meet any of the criteria for threat categories. This category includes widely distributed and undegraded ecosystems.

- **Data Deficient** (DD): Ecosystems with insufficient data, where there is inadequate information to make a direct or indirect assessment of their risk of collapse. Data Deficient is not a threat category and does not imply any level of risk. 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 assessed** (NE): Ecosystems that have not yet been assessed. For these cases, the Protocol proposes an alternative approach to describe the conditions of the territory.

An additional category, known as **Collapse** (CO), is assigned to ecosystems in which it is virtually certain that their particular biotic or abiotic characteristics have been lost, and the characteristic native biota is no longer maintained (see Figure 3). This category is analogous to the extinct category (EX) used for species.

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

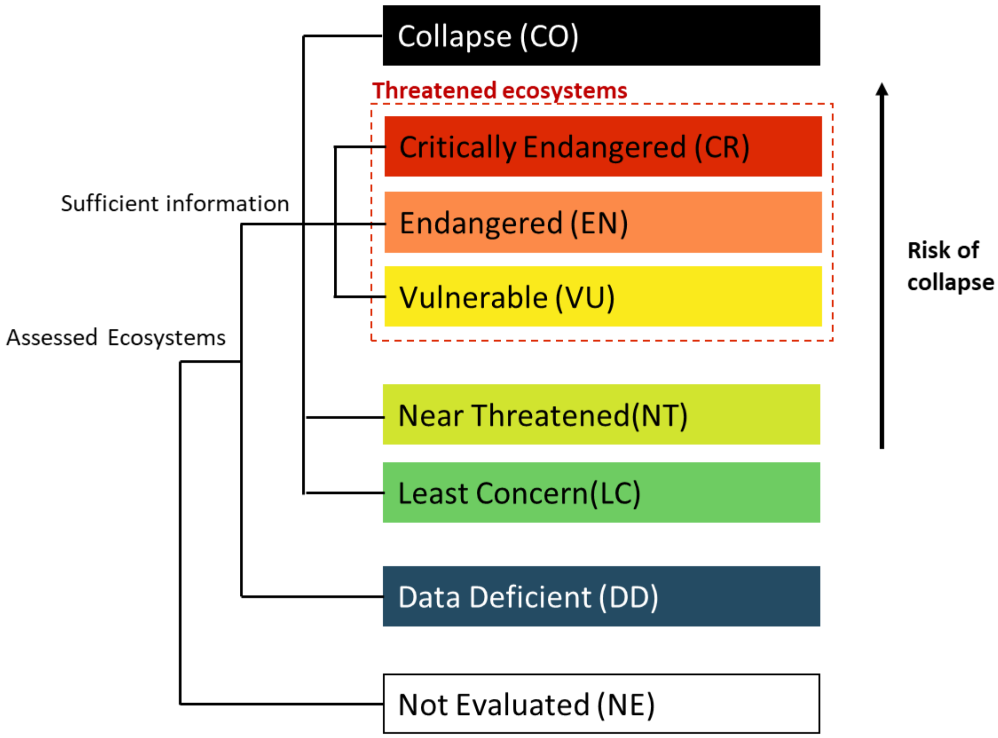

Figure 3. **Structure of the IUCN Red List of Ecosystems Threat Categories.**

Note. Categories established by the Red List of Ecosystems to classify levels of risk associated with degradation and level of endemism in each territory.

Source: Taken and adapted from IUCN, 2016.

8.1.1.2. Value of differentiating factors according to the threat category

Based on the context provided regarding the importance of categorizing and including the conservation status of ecosystems as a differential factor in the allocation of BUs, the following factors are proposed for each of the threat categories (see Table 2), based on the costs associated with conservation strategies[13].

Table 2. Proposed Weights for the Differential Factor Related to the Ecosystem Threat Category.

Threat Category according to the LRE (2016)	Factor
Critically Threatened (CR) Ecosystem	0.20
Endangered Ecosystem	0.18
Vulnerable Ecosystem (VU)	0.16
Not in Threat Category1	0.12

[13] The criteria for the different hazard categories are based on the size of the ecosystem (since smaller ecosystems are less resilient and therefore require greater effort for restoration), the duration and extent of negative impacts from human activities, and the vulnerability of the territory. It should be noted that the IUCN criteria are based on percentage, so they can be applied to an ecosystem or project of any size. Information available at: https://iucnrle.org/resources/key-documents.

Threat Category according to the LRE (2016)	Factor
Transformed Ecosystems	*

Note: Categories are proposed based on the complexity of implementing conservation strategies, as established by Etter et al., 2020.
(1) Near Threatened (NT), Least Concern (LC), and Data Deficient (DD).
(*) See considerations for addressing the information gaps regarding the threat category of a territory.
Source: Based on information from Terrasos, 2021

As shown in the "Factor" column, the highest value is 0.20. As the degree of threat decreases, the weight of the factor decreases and, with it, the number of Units to be issued.

For ecosystems classified as "Transformed", the differential factor is not defined. This is because such ecosystems can be in altered states or part of a matrix of ecosystems that fall under a specific threat category. In these cases, projects should be evaluated based on the differential factor that corresponds to the original ecosystem type of the intervened area, which the project aims to restore through preservation and restoration actions. In other words, an area transformed within a Tropical Dry Forest matrix will be assigned the differential factor corresponding to that ecosystem, ensuring that restoration actions seek to return it to a similar state.

A disadvantage of the implementation of the Red List of Ecosystems is that only about 40% of the Earth's surface has been assessed (see Figure 4), which limits the application of the Protocol. However, it is possible to apply the criteria to evaluate the project's area of interest, since it can be replicated in any terrestrial area that has not yet been evaluated[14], provided that there is sufficient knowledge about the pressures on the territory and the associated biodiversity.

[14] This link incorporates a step-by-step guide for implementing the Red List of Ecosystems assessment and analyzing the information using R statistics software (R Core Team, 2023). https://github.com/red-list-ecosystem/rle_indices.

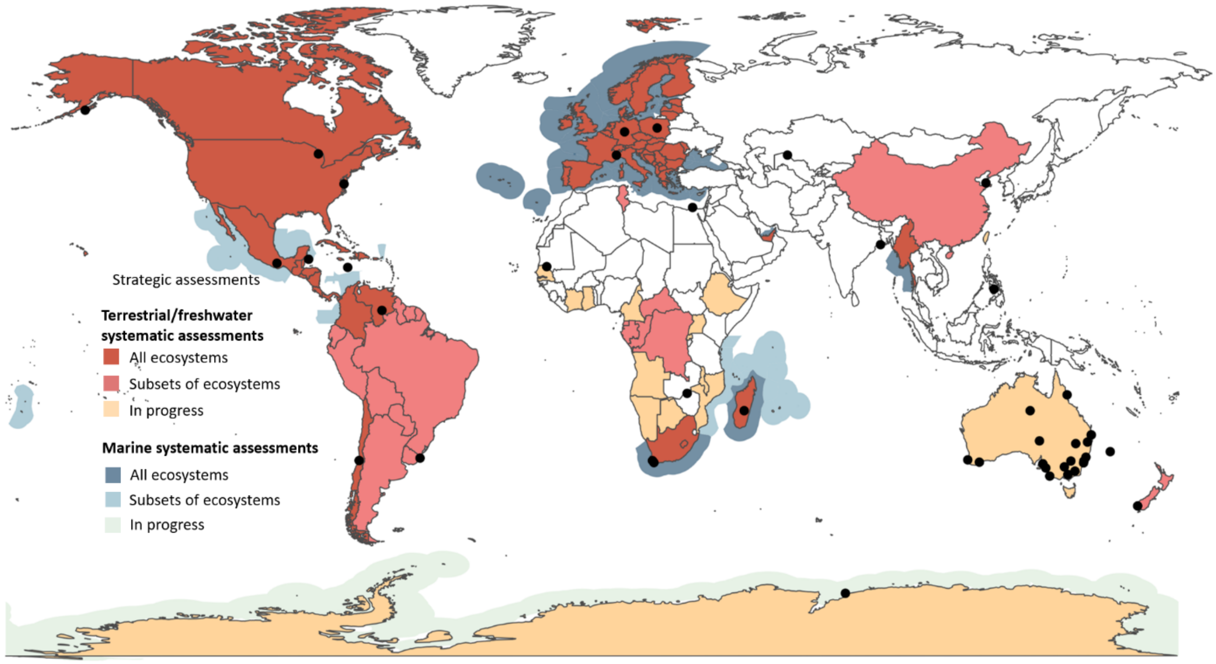

Figure 4. Ecosystems Assessed by Country.

Note. The areas in white have not been evaluated. Additionally, it should be noted that within each country there are areas that have not been evaluated according to the IUCN criteria.
Source: This figure was taken from the official IUCN Red List of Ecosystems website: https://assessments.iucnrle.org/.

If a project is unable to implement the IUCN LRE, the supplementary material provides a methodology for assessing ecosystem vulnerability. This allows for implementation of the Protocol for Issuing Voluntary Biodiversity Units in territories where information on threat category is lacking.

8.1.2. Differentiator 2: Green Connectivity Opportunities

The second factor for quantifying a BU is based on a project's **potential contribution to landscape connectivity**. This assessment seeks to give preference to conservation projects that promote ecological or landscape connectivity[15] and contribute to the restoration or maintenance of the flows of matter and energy that sustain ecological processes at the landscape scale.

Ecological connectivity[16] is an attribute of the entire landscape, where the morphological and structural units that compose it are functionally interconnected, and exchanges of energy, materials, organisms, information, and more, occur between them. In other words, connectivity is the degree to which the movement of energy and the flow of living matter through source patches within a matrix of materials is facilitated or impeded (Taylor, 1993). Ecological connectivity is key to the survival of wild plants and

[15] They should not be considered synonyms, since ecological connectivity considers interactions between species, while landscape connectivity refers to the matrix of land cover types that exist in each area. Although they have points of synergy, the analysis methodologies are conceptually different.
[16] See definition of *Ecological Connectivity* in the Glossary at the end of this document.

animal species and is crucial for maintaining genetic diversity and enabling adaptation to climate change across biomes and spatial scales.

Through this factor, the Protocol seeks to promote the clustering of projects to achieve a much more significant impact at the landscape level compared to isolated conservation projects within degraded matrices.

A convenient and popular approach to understanding how landscape elements interact to either support or restrict the movement of matter and living energy originates from landscape ecology and is based on the patch-corridor-matrix model (Forman & Godron, 1986, Forman, 1995) (see Figure 5). This model represents the structure and morphological composition of a landscape's constituent elements through a series of metrics, facilitating the assessment of landscape integrity or fragmentation. It also allows for inferences about a landscape's capacity or potential to support the ecological flows therein.

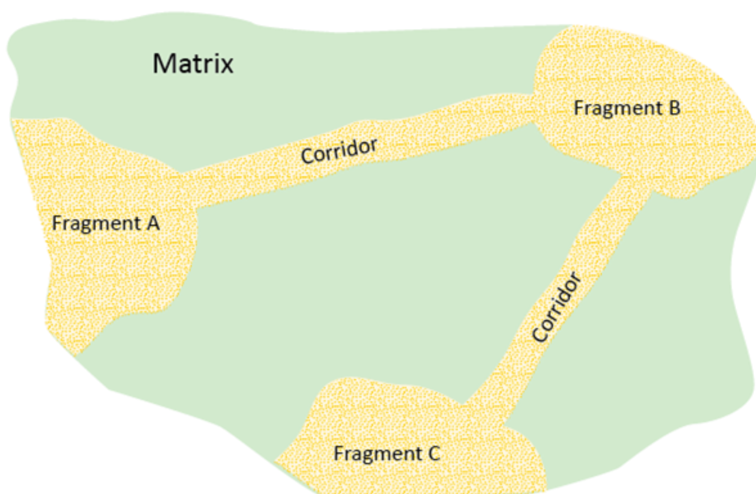

Figure 5. Theoretical model of connectivity, relating the components: patch-runner-matrix.
Note: Diagram representing how the fragments are connected by corridors, which may or may not be isolated.
Source: Adapted from Laushch et al., 2015.

To establish a standardized and practical methodology for determining ecological connectivity, the use of the "landscapemetrics" package[17] (Hesselbarth et al., 2019) in the statistical software R[18] (R Core Team, 2023) is recommended. It is a widely used tool in ecology and spatial analysis due to its versatility and ease of use. The "landscapemetrics" package enables analysis of a given landscape matrix by

[17] Complementary package of the R software, which allows obtaining different metrics of the landscape components, in addition to allowing statistical analysis of it.
[18] R is an open-source statistical software, which has allowed an accelerated development of complementary statistical tools, making it one of the most widely used software.

calculating various statistics for 1) each fragment or patch[19], 2) each patch class type[20], and 3) the landscape matrix[21] as a whole (see Figure 6). The supplementary material includes a script for calculating landscape heterogeneity, requiring only a land cover map of the project area in Raster format.

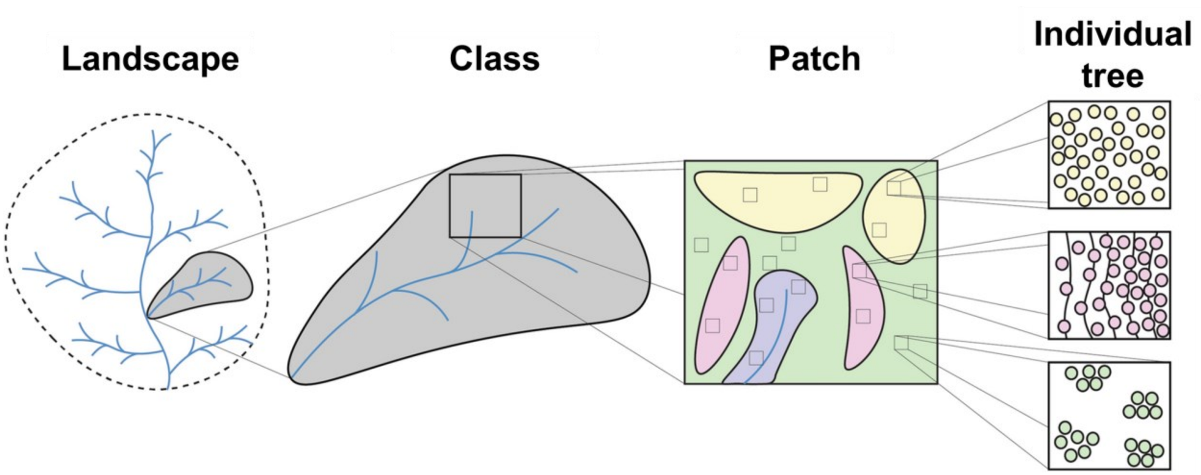

Figure 6. Types of landscape elements associated with the analysis of ecological connectivity.
Note. *Landscape elements range from the most general type (the entire landscape) to more specific components, such as individual trees. The greater the heterogeneity in the classes and patches of a landscape, the more heterogeneous it becomes; as an indirect measure, there will also be increased fragmentation, and therefore lower ecological connectivity.*
Source: Modified and adapted from Wang et al., 2014.

The connectivity factor used to quantify BUs is derived from the weighted sum of three metrics: one for Patch, one for Class, and one for Landscape. Below is an overview of each of the suggested metrics[22] (or subfactors) for estimating the Connectivity Factor (FC).[23]

1. **Core Area (*lsm_p_core: CORE):*** This is the area (m2) of the patch beyond the patch perimeter. It should be divided by 10,000 to convert the measurement to hectares.

2. **Percentage of *Landscape Core* Area (*lsm_c_cpland: C%LAND):*** is equal to the sum of the *core* areas of each of the patch types in m2, divided by the total area (matrix) of the landscape. In

[19] At the patch *level*, calculations are applied to each fragment individually. For example, this is the appropriate level for determining which fragment has the largest surface area among all those represented.
[20] At class *level*, calculations are applied to each set of fragments from the same class, i.e. those that have the same value or represent the same type of land use, habitat, etc. This is the appropriate level for calculating the area occupied by a certain land cover type, such as forests, or the average area occupied by forest fragments. For example, each of the land cover classifications defined by the Corine Land Cover methodology corresponds to a class of elements within the landscape.
[21] At landscape *level*, calculations are applied to the entire landscape, i.e. all the fragments and classes at once. The result informs us of the degree of heterogeneity or homogeneity across the whole area that has been quantified.
[22] The context-specific conditions of the area to be evaluated could require metrics different from those suggested in this Protocol, particularly if the Connectivity Factor is derived from the composition between patches, classes and landscape.
[23] Details of the algorithm used to obtain the metrics are available in Hesselbarth et al., 2019.

other words, it is the percentage of the landscape that represents the *core* area of a specific patch class.

3. **Patch Density (*lsm_l_pd: PatchDensity*):** Measures the physical connectivity of a given patch type. Patch cohesion increases as the patch type becomes more clustered or aggregated in its distribution, indicating a higher degree of physical connectivity. In other words, this is a normalized measure of landscape fragmentation.

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

$$FC = (0.25 * FciPATCH) + (0.25 * FcjCLASS) + (0.50 * FckLANDSCAPE)$$

Where:

- FC: 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 = PatchDensity

The following factors are proposed based on connectivity:

Table 3. Relationship between landscape heterogeneity results and the connectivity factor within the Protocol.

Potential to contribute to regional connectivity	FC Ranks	Factor
The project shows a **highly significant contribution** to the maintenance or restoration of landscape connectivity on a regional scale	76-100	0.20
The project shows a **significant contribution** to the maintenance or restoration of landscape connectivity on a regional scale	51-75	0.18
The project shows a **moderate contribution** to the maintenance or restoration of landscape connectivity on a regional scale	26-50	0.16
The project **does not contribute or contributes minimally** to the maintenance or restoration of landscape connectivity on a regional scale	0-25	0.12

Note. In the event that 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 the modelling of connectivity corridors (at a scale of 1:25,000 or more detailed), the project developer could justify connectivity opportunities generated by the project, in order to assign a specific factor. The relationship of the factors presented is adapted from Anderson & Danielson (1997).

8.1.3. Differentiating factor 3: Sociocultural context of the communities associated with the project

Local communities are highly vulnerable to the degradation of ecosystem resources, given their close relationship with and dependence on nature. Biodiversity credits offer an alternative that allows resources to be mobilized to communities with the aim of conserving degraded areas. In addition, these efforts are integrated with sustainable productive activities, which, although not overlapping, help ensure biodiversity gains. However, a project of this nature must guarantee transparency and fair, equitable treatment of the community. Therefore, it is essential that the socioeconomic characterization understands the social structure of the territory and is clear about how the communities will be incorporated into the project's value chain. This approach not only promotes justice and equity for the community and their way of life, but also guarantees the sustainability of the project's actions.

The third factor puts into context the level of participation of communities within the project's impact or scope of the project. Quantifying community involvement aims to recognize communities and their contribution to the protection and regulation of ecosystem services. A community is formed through self-recognition and mutual perception, shaped by proximity and a spatial organization of social structures connected by socioeconomic, religious and/or cultural interests. Social cohesion, spatial identity, value systems, and behavioral norms are fundamental elements that influence the functioning and dynamics of a community (Gómez, 2007). This definition does not seek to limit the concept of communities to ethnic, Afro-descendant or indigenous groups, but rather to incorporate other types of associations or associations that have been structured and legalized to facilitate relations with governments[24].

Community structures will have a higher level of complexity depending on their degree of formalization and the depth of their roots within the territory. Therefore, the calculation for Factor 3 differs from the other factors, as it is based on the level of community participation. A value will be assigned to a project based on the characteristics of the community that owns or partners in the conservation project. This protocol seeks to assess community structures according to their organizational level, as reflected in the type of land ownership and the regulations governing the use and exploitation of natural resources.

Thus, the inclusion of communities in projects for the issuance of Biodiversity Units not only recognizes their rights and knowledge, but also opens up the possibility of democratizing the economic benefits derived from conservation. This may include income generated from the sale of Biodiversity Units, employment opportunities in conservation activities, and the development of sustainable businesses that use natural resources responsibly. Communities can participate at various levels, ranging from leading and organizing the entire project, from registration to execution, to participating only in the development of the project's Management Plan. This is reflected in the rights that the community has over the project, whether political and/or economic, and in the benefits it may receive depending on its development during the projected time. This underscores the importance of including communities as part of a system that seeks to recover or maintain itself to conserve biodiversity.

Table 4 presents the factors relating to community participation in a project.

[24] An example of this is the provisions of Law 2219 of 2022 in Colombia, which allows and formalizes this type of association with the aim of incorporating a larger group of communities in spaces of territorial planning and local development.

Table 4. Social factors depend on the potential influence on the territory.

Social/cultural values of the project	Factor
The community has political[25] and economic[26] rights to the project	0.20
The community has economic rights to the project	0.18
The community participates in the development of the project's Management Plan, reflected in binding actions[27]	0.16
There is no community involvement in the development of the project's Management Plan	0

Note. Influence is defined as any activity that has a tangible effect on the community, which must be measured and monitored over time.

Figure 7 demonstrates the level of social responsibility that a project has based on the degree of social involvement. The largest box represents the highest score for the Social Factor, which decreases until it reaches a value of 0, indicating a project with no social participation.

[25] These are the rights that a shareholder has to approve or disapprove the actions of the directors of the company in which he or she owns shares.

[26] These rights often relate to the use, transfer, and benefit derived from such resources. In the context of property or assets, economic rights may encompass earning income, receiving profits, transferring ownership, or engaging in economic transactions.

[27] These binding actions should be reflected as safeguards and project management milestones.

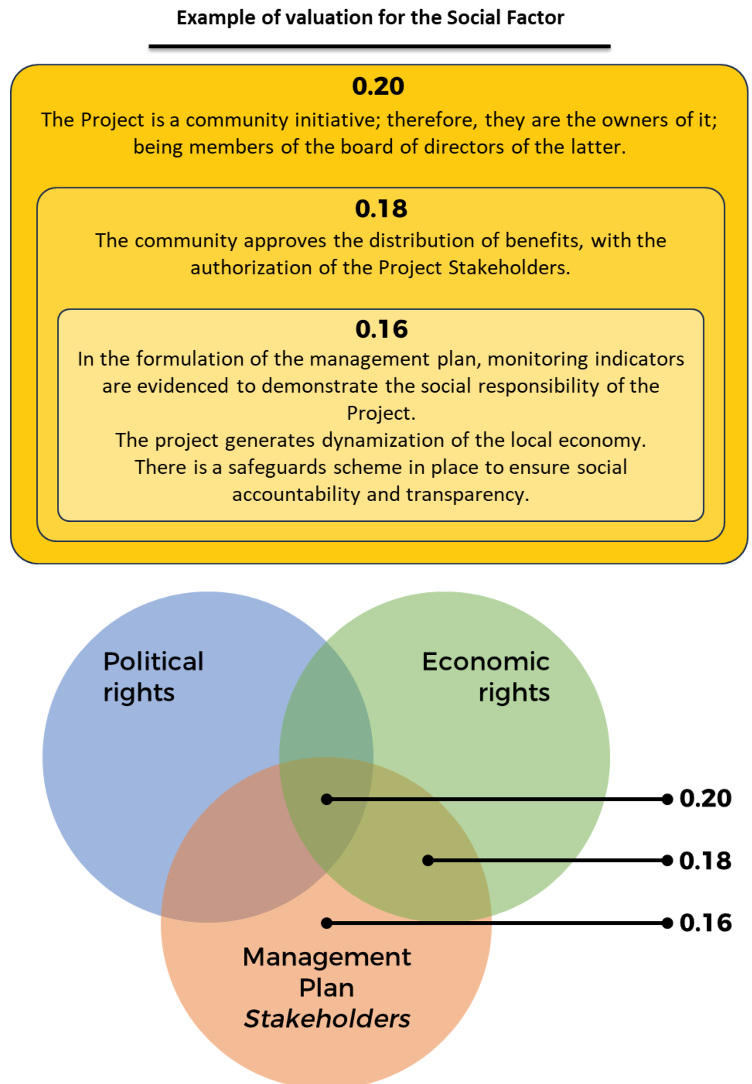

Figure 7. Justification of the maximum valuation of a project based on the level of community participation.

Note. It should be noted that each classification must have an associated reporting mechanism to ensure compliance with the project's conditions. For example, if you have a score of 0.20, evidence must be presented to demonstrate compliance with political rights, economic rights, and social compliance indicators related to the Project Management Plan. If the score is 0.18, then the evidence should relate to economic rights and social compliance indicators. Finally, it is important to clarify that this Factor does not seek to replace existing safeguards; on the contrary, it serves as a complement that facilitates the generation of monitoring indicators to ensure the transparency of the project.

8.1.4. Differential factor 4: Temporality – Duration of the project

The fourth differentiating factor for the quantification of BUs is the temporality 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 plant composition of ecosystems–requires long-term actions that ensure the ecosystem reaches a state of self-sufficiency. Once the conservation project has ended, and in the absence of anthropic pressures, the ecosystem should be able to maintain its characteristics and continue providing the associated ecosystem services.

8.1.4.1. Minimum duration of conservation projects

As mentioned above (see section 6.1 Eligible Actions), when we talk about ecological restoration, we are referring to the process of assisting the restoration of a deteriorated, degraded, or modified ecosystem. The ultimate goal of restoration is to create a self-sufficient ecosystem that is resilient to environmental changes or disturbances. This is achieved through the recovery of two essential characteristics of ecosystems: richness (number of species) and abundance of species (Ruiz-Jaen & Aide, 2005; Rozendaal et al., 2019).

The speed at which an ecological restoration process occurs depends on the type of ecosystem in which it takes place, with its completion recognized once the ecosystem reaches the climax community. For example, a highly productive ecosystem, such as a forest in the Neotropics, requires approximately 20 years to restore about 80% of the affected area[28] in terms of vegetation density. Analysis of other types of cover associated with the tropics indicates that they have similar successional times (Rozendaal et al., 2019). However, duration is variable and depends on the location of the ecosystem, taking up to 40 years in unproductive environments (Wilson et al., 2011).

When regeneration is not assisted (and is, therefore, natural), the restoration process can take between 30 and 50 years, during which pressures on biodiversity are eliminated. This allows for the recovery of 90% of species richness (the number of species in a given area). On the other hand, the abundance of species can take centuries to recover, and the speed of restoration varies among forest types. This affects the food web and therefore the resilience[29] of the ecosystem. However, reports indicate that it takes between 20 and 40 years for more than 50% of the composition to recover, at which point an ecosystem may be considered self-sufficient (Ashton et al., 2001; Guariguata, 2001; Ruiz-Jaén & Aide, 2005; Derroire, 2016; Rozendaal et al., 2019).

In projects where natural regeneration is combined with assisted restoration methods[30], the restoration of both of species richness and composition can be accelerated. This effect is even greater if primary forests are being preserved close to the restoration areas, as this will not only further accelerate the restoration process, but also improve the recovery of species richness and composition (Ruiz-Jaen & Aide, 2005; Rozendaal et al., 2019).

In light of the above, this Protocol seeks to promote the development of conservation projects that have a duration of at least 20 years and a maximum of 50 years. This timeframe ensures that preservation, and particularly restoration actions, will generate real and demonstrable impacts on biodiversity. In addition to ecosystem and ecological restoration considerations, this Protocol supports the

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[28] An intervention can be of human origin (deforestation) or natural (natural disaster).

[29] The complexity of a food web will allow for greater availability and variety of food, allowing species to withstand changes in the environment after a tipping point.

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

development of projects with a 30-year operational period, aligning with international goals set by the global political-environmental agenda. This agenda has concluded that the next 30 years - until 2050 – will be crucial for halting and reversing the degradation and destruction of biodiversity and achieving a resilient restoration of the biosphere. This requires sustained conservation projects that allow ecosystems enough time to recover and become self-sustaining beyond 2050.

Similarly, it is important to recognize that while the more far-reaching effects of climate change and biodiversity loss are still a few decades away, the actions taken today will be critical in shaping those outcomes and their repercussions. Future generations are considered stakeholders in today's decision-making, and therefore, the mechanisms we establish to address these problems must have a long-term vision (White, 2017).

8.1.4.2. Value of differential factors based on the duration of the project

As mentioned above, this Protocol seeks to promote the development of exceptional conservation projects that ensure demonstrable and quantifiable biodiversity outcomes. Consequently, any conservation project with a duration of less than 20 years will not be eligible to issue and market BUs under this Protocol. To this end, and taking into account studies on natural regeneration and international environmental commitments, the following factors associated with duration are proposed in Table 5 .

Table 5. Proposed weights for the differential factor related to project duration.

Project duration in years	Factor
50	0.20
45	0.19
40	0.18
35	0.17
30	0.16
25	0.14
20	0.12

Note. This table presents several factors associated with project duration, emphasizing that this Protocol considers a minimum duration 20 years essential for project eligibility. The variations in scores for each duration seek to maintain a proportional and linear relationship between the five differential factors of the Protocol.
Source: Terrasos, 2021

8.1.5. Differentiating factor 5: Preservation and restoration actions

The fifth differentiating factor for quantifying the BUs that a project can issue seeks to recognize the value of conservation projects based on the number of hectares that will benefit from preservation actions and restoration actions (for definitions of each of the actions see section 6.1 Eligible Stocks). In Table 6 presents the factors based on complexity. In the case of a restoration area, a higher level of territory degradation is expected, which therefore requires greater support and investment to guarantee the restoration of ecosystem services. Conversely, in an area designated for preservation, although protection measures are required, the territory can naturally recover in the event of biodiversity loss.

Table 6. Proposed weights for the differential factor related to the actions required.

Actions required	Factor
Restoration	0.20
Preservation	0.16

Note. The factors for areas under restoration and preservation are presented in this table. This highlights the importance of categorizing projects based on these two areas, since the project receives a weighted value based on the type of action required.
Source: Terrasos, 2021

In terms of the differential factor related to the threat category of the intervened ecosystem, the highest value is 0.20. In addition, the total hectares of the project dedicated to restoration will allow a greater number of Units to be issued, than those allocated for preservation. Through this approach, the Protocol seeks to promote not only projects focused on the preservation of native remnants of ecosystems, but also to develop projects that contribute to the recovery and enhancement of biodiversity quantity, integrity and health. This includes increasing the coverage of the most threatened ecosystems, helping to stop their decline but even reverse it. Additionally, the emphasis on restoration action seeks to promote conservation projects that incorporate restoration efforts to create connectivity between native forest remnants, thereby reducing habitat fragmentation–a phenomenon that has increased rapidly in recent decades and is considered one of the main threats to biological richness and diversity (Ćurčić et al., 2013).

The Protocol acknowledges that in ecosystems with few remaining native remnants, preservation efforts are vital. It also recognizes the differing resource requirements for preservation compared to restoration, assigning greater value to restoration actions. Through this differentiation, the methodology seeks to mobilize sufficient resources to implement efficient and long-lasting restoration actions, ensuring that the intervened ecosystems recover their quantity, integrity and health.

8.2. Explanation of the formula

The equation for calculating the potential Units is based on the equation used by the Ministry of Environment and Sustainable Development of Colombia to determine compensation requirements. In this equation, the sum of several factors is multiplied by the total project area requiring compensation, which is known as the Compensation Factor[31]. In this context, the first four differential factors of this Protocol are added together before being multiplied by the total project area (in m2), thus resulting in a grouped factor used to calculate the Biodiversity Units.

[31] See chapter on compensation amounts in the Manual of Compensation of the Biotic Component. Directorate of Forests, Biodiversity and Ecosystem Services. Ministry of Environment and Sustainable Development, Bogotá, D.C.: Colombia, 2018.

In contrast, the fifth factor (conservation actions) depends on the internal zoning of each project. Since each factor affects only a specific portion, each factor must be multiplied by the specific area (in m2) it affects.

After adding each of the components of the formula, we obtain an estimate of the square meters with the potential to issue Units. Finally, the result must be divided by 10, because each credit is equivalent to 10m2.

8.2.1. Simulations

To determine the effect of possible variations in project duration for a project with the potential to issue BUs, three hypothetical scenarios are presented for a project of 100 ha (1,000,000 m2).

1. **Scenario 1:** Maximum values for all five factors
2. **Scenario 2:** Minimum values for all five factors
3. **Scenario 3:** Intermediate values for all five factors

8.2.1.1. Scenario 1

A project that falls within the highest category of threat–meaning it faces the greatest risk of loss, has significant ecological importance in terms of its connectivity, potential, and influence on ethnic communities, and includes an entire restoration area–would issue 100,000 BUs. Table 7 presents an analysis of a project associated with the highest scores for the five factors outlined in the Protocol.

Table 7. Simulated scenario 1, with the factors giving the highest possible score.

1	Maximum number of Units scenario						
Characteristics		**Unit Factors**					**Points**
Areas	**Area (m^2)**	**F1 Threat Category**	**F2 Ecological connectivity**	**F3 Sociocultural context**	**F4 Project duration**	**F5 Actions required**	
Preservation	350,000	–	–	–		0.16	52,500
Restoration	650,000	–	–	–		0.2	130,000
Total, Project	1,000,000	0.2	0.2	0.2	0.2	–	800,000
TOTAL POTENTIAL UNITS							982,000
Potential units ($10m^2$)							98,200

Note. The project does not include a preservation area, since this would result in fewer points for Factor 5. The remaining factors apply to the entire area.

The list of points awarded can be seen in Figure 8.

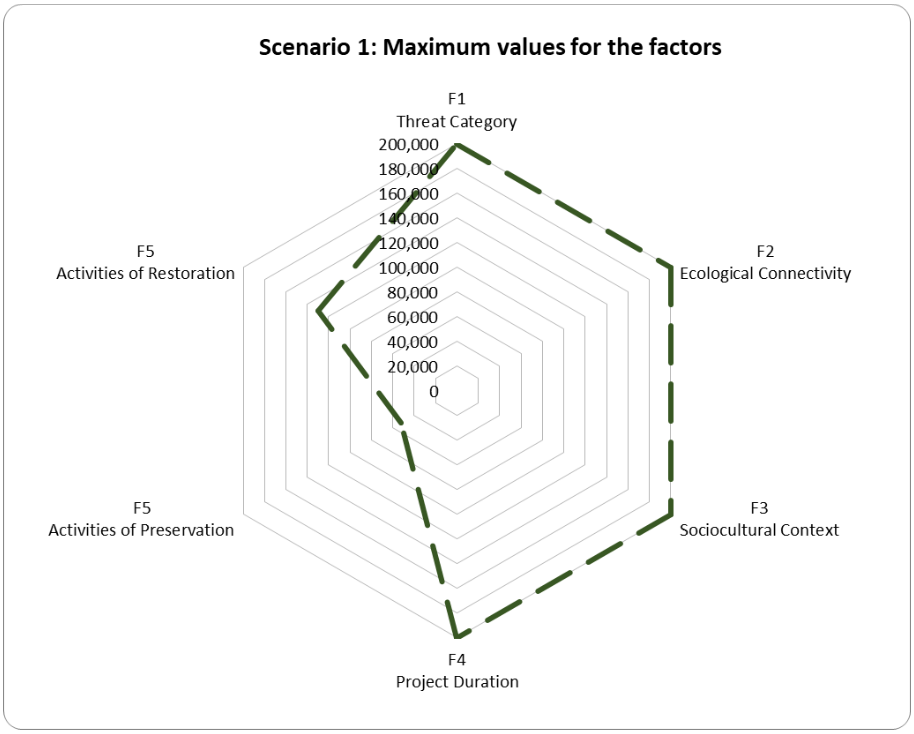

Figure 8. Simulated scenario 1, relationship of the factors giving the highest possible score.

Note. The maximum possible score for each factor is 200,000, since it corresponds to 20% of the total project area.

8.2.1.2. Scenario 2

In the second hypothetical scenario, the potential BUs are presented. For this scenario, it is assumed that the entire project area is dedicated to preservation activities. In addition, it is associated with an ecosystem that is not under threat and that has considerable ecological isolation, has no influence on ethnic or indigenous communities, and has a duration of 20 years. This analysis is presented in Table 8, while the possible point ratio for the project is presented in Figure 9.

Table 8. Simulated scenario 2, relating the lowest scores for each of the factors.

2	Minimum number of Units scenario						
Characteristics		**Unit Factors**					**Points**
Areas	**Area (m^2)**	**F1 Threat Category**	**F2 Ecological connectivity**	**F3 Sociocultural context**	**F4 Project duration**	**F5 Actions required**	
Preservation	350,000	–	–	–		0.16	56,000
Restoration	650,000	–	–	–		0.2	130,000
Total, Project	1,000,000	0.12	0.12	0.0	0.12	–	360,000
						TOTAL POTENTIAL UNITS	546,000
						Potential units ($10m^2$)	54,600

Note: The project does not include a restoration area, as this would generate the highest number of points for Factor 5. The remaining factors have been applied to the entire area.

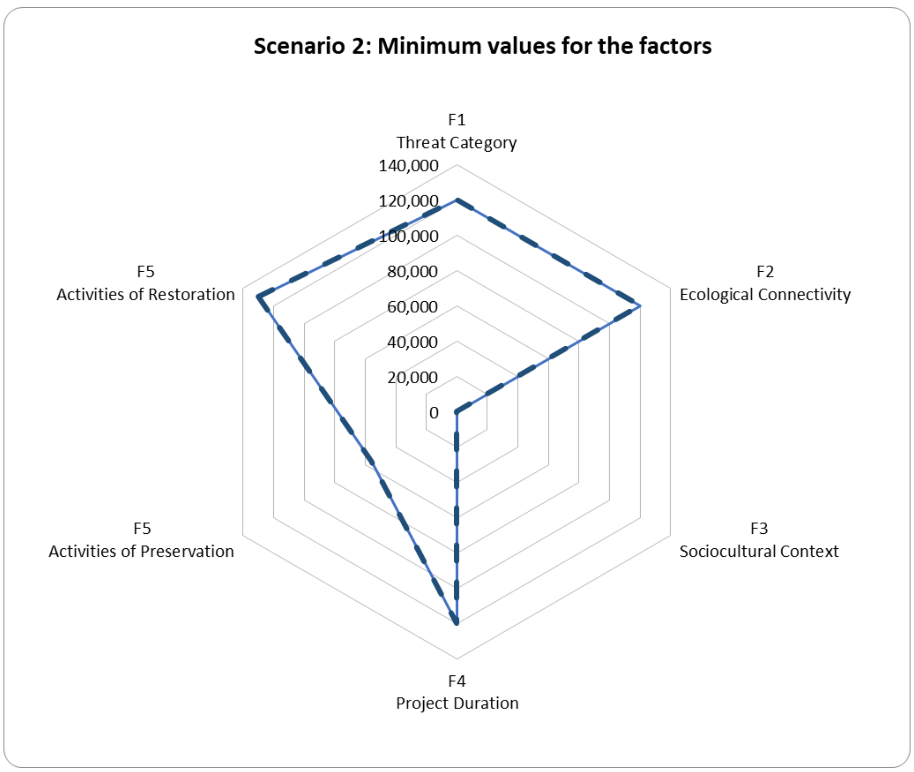

Figure 9. Simulated scenario 2, relationship of the factors awarding the lowest possible score.

Note: This shows the relationship between the area and the minimum score that a project can obtain, with restoration area (F5), project duration (F4) and sociocultural context (F3) having the greatest effect in this scenario.

8.2.1.3. Scenario 3

Table 9 presents the third scenario, showing the intermediate values for a simulated project. In this scenario, the project is associated with a vulnerable ecosystem, contributes to the connectivity of areas with low ecological relevance, has a relative impact on the economic dynamics of local communities, a duration of 25 years and includes distinct areas for restoration and preservation.

Table 9. Simulated scenario 3.

3	**Intermediate Number of Units Scenario**						
Characteristics		**Unit Factors**					**Points**
Areas	**Area (m^2)**	**F1 Threat Category**	**F2 Ecological connectivity**	**F3 Sociocultural context**	**F4 Project duration**	**F5 Actions required**	
Preservation	350,000	–	–	–		0.16	56,000
Restoration	650,000	–	–	–		0.2	130,000
Total, Project	1,000,000	0.16	0.16	0.16	0.16	–	640,000
						TOTAL POTENTIAL UNITS	826,000
						Potential units ($10m^2$)	82,600

Note. This scenario illustrates the intermediate conditions obtained by a project, showing differential values for restoration and preservation areas, each weighted differently according to the size of the area.

Figure 10 illustrates how the preservation area has a minor influence in relation to potential BUs, while the other factors have the greatest influence in the third scenario.

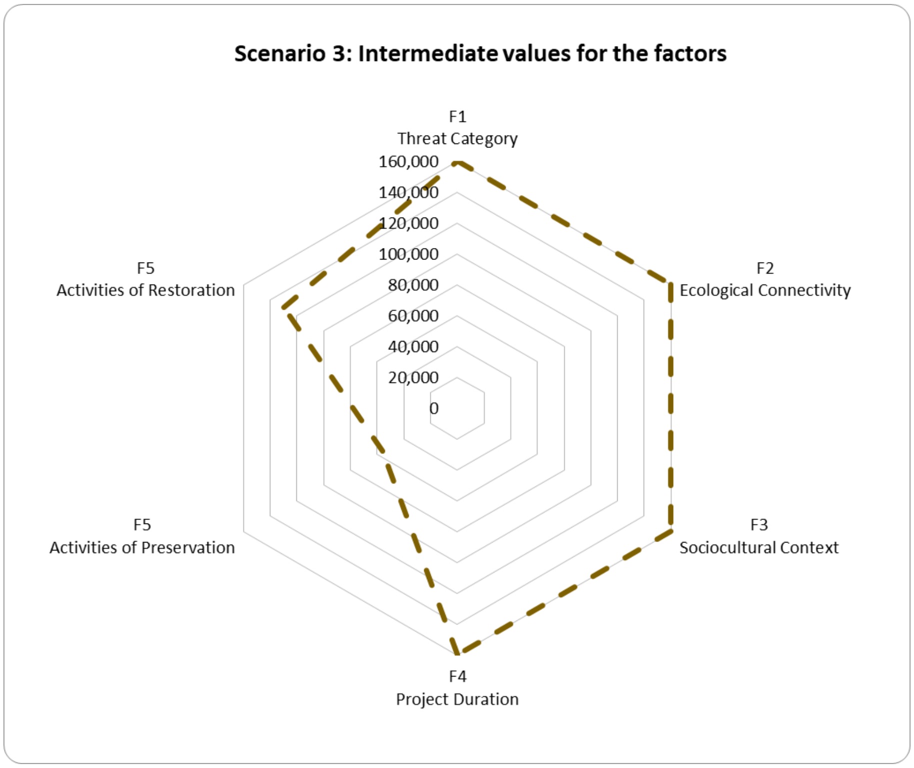

Figure 10. Simulated scenario 3, relationship of the factors giving intermediate scores.

Note: The scores associated with each factor are interrelated, with Factors 4 and 5 having the greatest impact on changes in the overall scores, and, consequently, influencing the issuance of Units in this scenario.

8.2.1.4. Comparative scenarios

By comparing the three scenarios, it is evident that factors capable of taking values of 0– specifically the Action Factors (particularly restoration) and the sociocultural context–have the greatest impact on the Biodiversity Units (BU) a project can issue. Whenever a project lacks areas designated for restoration or is not connected to indigenous or ethnic communities, there is a considerable decrease in the total number of BUs that can be issued, as shown in Figure 11.

In percentage terms, when a project receives the lowest scores across the five analyzed factors, it issues 54% fewer Units. This means that when a project area is entirely designated for preservation, lasts 20 years, and does not involve local or ethnic communities, this results in a significant reduction in the potential number of Units that can be issued. Conversely, when a project is associated with a territory that receives intermediate scores, it issues 16% fewer Units.

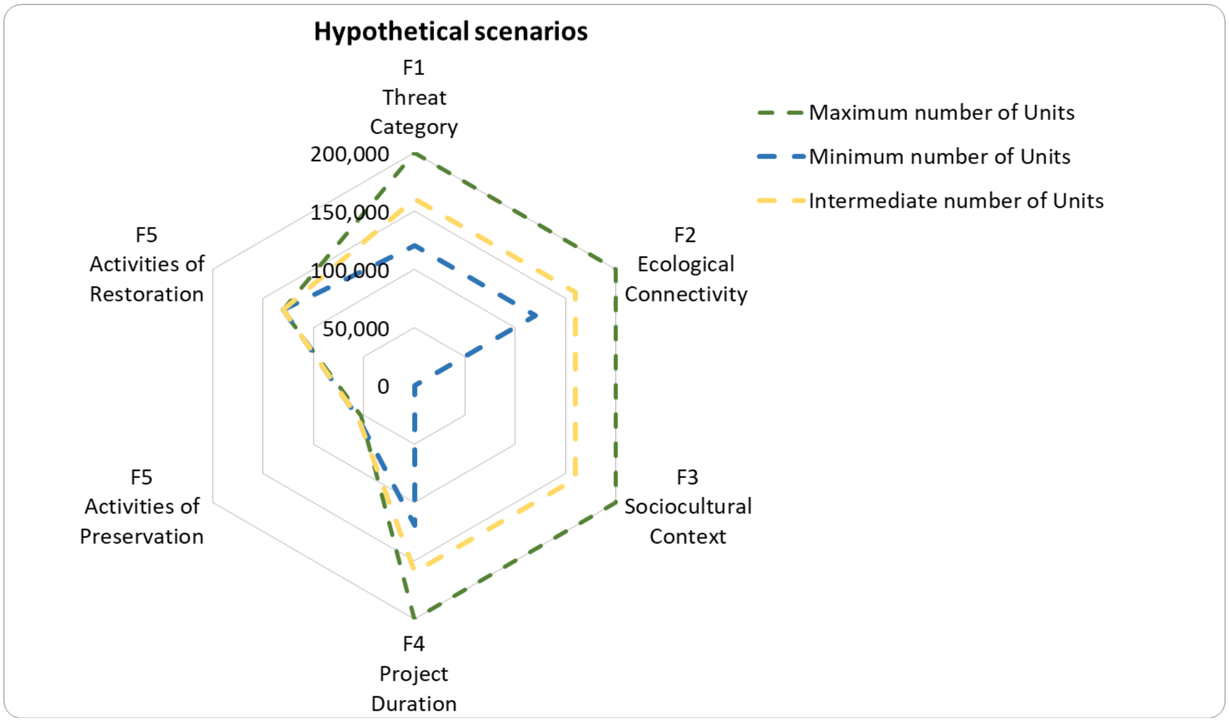

Figure 11. Comparison of 3 scenarios for the issuance of Units.

Note. This illustrates the points contributed by each factor across the different scenarios evaluated.

8.3. Unit Release Plan

As mentioned above, actions associated with biodiversity conservation projects yield both medium and long-term results. Therefore, to ensure that investments made in these types of projects are reflected in quantifiable gains in biodiversity, and that the processes related to the verification, marketing, sale, and accounting of the BUs are transparent and traceable, the following two operating mechanisms are proposed:

8.3.1. Unit Release Scheme

The Unit Release Scheme refers to a timeline that specifies the milestones a conservation project must achieve to issue and commercialize a specific percentage of BUs. This means that, initially, the project will not be able to issue or have available Units for sale but will gradually do as a third-party verifier confirms that compliance with the established performance standards. The Unit Release Scheme must be specified in section 10, DOCUMENT AND REGISTRATION PLATFORM, of the conservation project, as described below.

8.3.1.1. Compliance Milestones

The release of Units must be linked to the achievement of compliance milestones (or performance standards), which, in turn, are divided into management milestones and ecological milestones.

Management milestones refers to outcomes related to the structuring of the project and the establishment of legal, financial, and technical guarantees. Examples of management milestones include land acquisition, restrictions on land use, agreements with landowners, procurement of goods and services, financing of a long-term maintenance account, establishing enclosures, or initiating the planting process, among others. Management milestones support the conservation of biodiversity and ensure its sustainability.

Ecological milestones are outcomes related to the management plan, which focus on improving the initial physicochemical and biological conditions in the project area. These milestones represent the implementation of the operations and maintenance plan, as well as the anticipated results from preservation and restoration actions. Examples include replacing anthropized and/or degraded areas with natural covers, strengthening ecological connections between forest fragments to increase wildlife habitat, and protecting and restoring the soil's structure and physicochemical composition.

8.3.1.2. Project Performance Standards

Performance Standards refer to all observable or measurable physicochemical, biological, and social attributes used to assess the achievement of the project's objectives or goals in relation to restoring natural resources and biodiversity. Like the Unit Release Scheme, these performance standards must be specified in the *Registration Document*.

The baseline of a study is essential, as it establishes the current state of a territory on which a preservation and restoration plan is to be developed. By understanding the territory and creating an action plan, it will be possible to identify factors expected to change in the short, medium, and long term. This process also helps establish project monitoring indicators that align with performance standards.

The correct establishment of milestones is essential, since compliance with these measures demonstrates the project's improvements and tangible progress over time. This approach ensures the proper planning and investment to achieve the restoration and preservation of the territory.

The indicators and milestones are of diverse origin, yet they all have the primary objective of demonstrating to developers that the activities implemented are improving the territory. These improvements may include changes in soil, water or air quality, as well as improvements to the local economies, with each following a different timeframe for observable changes. Table 10 provides examples of monitoring parameters that quantify changes in the territory over time, and indirectly reflect the project's progress towards fulfilling the Sustainable Development Goals. These indicators should reflect and quantify the restoration of ecosystem services so that the impact measurements from the business sector align with the *offsets* generated by biodiversity projects.

The determination of indicators and expected outcomes will depend on the specific territory, context, and measures, which is why milestones are established based on the baseline rather than through the Protocol. However, projects are required to monitor at least 10 indicators, which must describe changes in the territory in line with the restoration and preservation plan.

8.3.1.3. *Guidelines for the structuring of project monitoring indicators*

Restoration and conservation projects must demonstrate the positive impact of their actions; therefore, it is important to establish standardized follow-up and monitoring indicators that accurately represent the area under study. An eligible project must include areas that require both preservation and restoration actions, so the indicators should be designed to reflect this distinction.

Projects should establish their indicators based on an understanding of the current state of the project, or baseline. Subsequently, it is important to understand the territorial context by assessing the extent to which external negative impacts may affect the project's development, and how the project's positive impacts may be affected by interactions with its surroundings. This refers to the project's area of influence, which is fundamental to understanding the context of the project, including the positive impact that preservation and restoration actions have on abiotic, biotic, and socioeconomic components. Finally, the unit of measurement for the indicator should be area-related or, failing that, standardized to ensure replicability and comparability over time (see Figure 12).

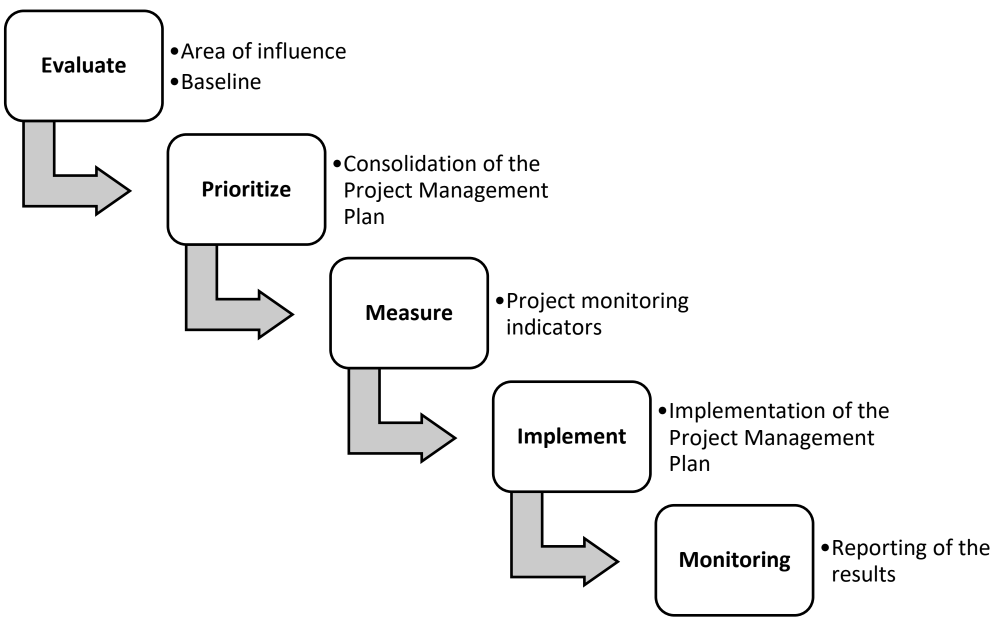

Figure 12. Flowchart illustrating the analysis of information and structuring of monitoring indicators for the conservation project.

Source: Modified from Taskforce on Nature-related Financial Disclosures (2023).

Table 10. Example Project Performance Indicators - Goals, Objectives and Indicators.

Impact	Objective	Group	Variable	Indicator	Unit of Measurement	Expected Result
1. Restoration of degraded and/or artificial vegetation covers.	1.1. Increase in natural cover.	Flora	Composition and structure by vegetation cover	% of restoration area	Change % restoration area= [% (restoration area t=n) / % (restoration area t=0)]	[%(t=n) - %(t=0)] < 0
	1.2. Increase in plant biomass in the project area			Mortality and recruitment rates	TM, TR	[Tm(t=n) - Tm(t=n-1)] < 0; [Tr(t=n) - Tr(t=n-1)] > 0
				Apical growth in restoration areas	Average annual increase (AMI) cm/year	[IMA (t=n) - IMA (t=0)] > 0
				Diametric growth in restoration areas	Average annual increase (AMI) cm/year	
				Biomass in the catering areas	Tons/hectare	[Ton/ha (t=n)] - [Ton/ha (t=0)] > 0
	1.3. Increasing species richness and abundance in the project area	Terrestrial and aquatic flora and fauna		Dissimilarity Index	Jaccard Index	[IJ'(t=n) - IJ'(t=0)] < 0
				Diversity Index	Shannon (H́)	[H'(t=n) - H'(t=0)] > 0
				Dominance Index	Simpson (D)	[D(t=n) - D(t=0)] < 0
				Equity Index	Pielou (J')	[J'(t=n) - J'(t=0)] > 0
2. Key areas have been protected for the reproduction, refuge, flow and feeding of wildlife.	2.1. Protect and increase wildlife habitat, allowing the growth of populations and gene flow between them.	Fauna	Threat	Decrease in the number of invasive species of mammals, birds and herpetofauna	Number of invasive species recorded by coverage	Records (t=n) - Records (t=n-1) > 0
3. Decrease in landscape heterogeneity	3.1. Strengthen the connectivity of the territory, measured through landscape units	Landscape	Landscape heterogeneity	Diversity	Shannon-Wiener Index (SHDI)	[SHDI(t=n) - SHDI(t=0)] < 0
				Fragmentation of the landscape	Contrast-Weighted Edge Density Index (CWED)	[CWED(t=n) - CWED(t=0)] < 0

Impact	Objective	Group	Variable	Indicator	Unit of Measurement	Expected Result
4. Socio-cultural links in the territory	4.1. Promote environmental awareness in the territory	Social	Socio-environmental	Disposal and proper management of hazardous waste due to the use of pesticides and fertilizers	RESPEL produced = total kg of waste generated / kg of waste correctly disposed of	[RESPEL (t=n) - RESPEL (t=n-1)] > 1
	4.2. Dignified working conditions and gender equity		Equity	Employment of 100% of the staff in compliance with applicable labor rights and obligations.	Meetings to discuss and clarify the working conditions of personnel associated with the project	100% of the staff linked to the project, ensuring compliance with legal and social obligations
				Involvement of women in socioeconomic activities, conducting training on financial topics to support the development of women-led enterprises	%Skilled women = # Trained women / # Adult women * 100	[%Women Trained (t=n) - %Women Trained (t=n-1)] > 0
				Conducting workshops to dignify the contributions of members of the community	%Trained people = # Trained people / # Adults * 100	[%Training (t=n) - %Training (t=n-1)] > 0

Note. The units of measurement and objectives are established to ensure that, as a long-term project, the study remains replicable and its data comparable over time. As can be seen, some are strictly ecological, while others relate to management. Social indicators will be associated with management milestones due to their legal components, whereas and abiotic and biotic indicators will be considered ecological milestones. The latter may also include regulations related to water quality, depending on the project's resource demands.

8.4. Release Scheme 20/20/20/20/20

This Protocol proposes a 20/20/20/20/20 release scheme. However, depending on the specific needs of the territory, the project may justify a different release scheme. The third verifier will oversee the validation and approval of compliance milestones for the release of Units. Information validation should be carried out in two steps: first, by verifying the quality of the information presented and ensuring that the rigor of data collection methods complies with established standards; and second, by verifying compliance with the milestones established in the project management plan. It is important to highlight that entities[32] assuming this role must not have any conflict of interest nor hold any other role within the development of the project.

This Protocol proposes a five-part BU Release Scheme (see Figure 12), with each phrase authorizing the release of 20% of the project's potential Units, validated by a third party.

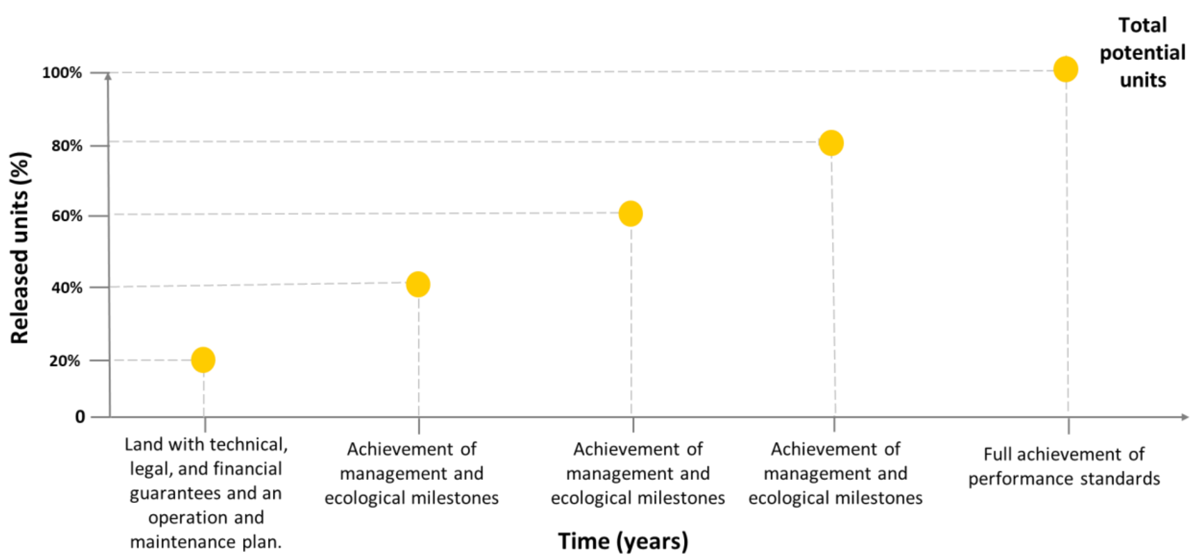

Figure 13. Voluntary Biodiversity Units Release Scheme.

Note. This chart presents the milestones that the conservation project must meet to achieve the release and commercialization of the project, ensuring alignment with the principles established in this Protocol.

The Protocol allows an initial release of BUs (up to 20% of the total projected) once the entire conservation project has been consolidated. This requires that the information detailed in section *10.1* Check List Registration Document, is available, including documentation on land tenure or the management agreements with the landowners for the duration of the project[33]*.* This initial release must take place once the conservation project site has been secured, appropriate financial guarantees have

[32] A project that issues BU can have two third-party verifiers. One that validates from a technical point of view (for example: Universities) the information collected in the actions determined by the management plan and another that verifies the legal information and the management milestones of the project (for example: KPMG).

[33] It is vital that the verifiable third party determines the traceability between land tenure and the duration of the BU project.

been established, and a structured and validated operations and maintenance plan is in place, along with other mechanisms to ensure legal and financial guarantees. The next three Unit release phases (phase 2, 3 and 4, totaling 60% of the potential Units) occur as the project meets the management and ecological milestones specified in the Scheme schedule of the *Registration Document.*

The final 20% of the BUs will only be released once the full Ecological Performance Standards are met, ensuring that the milestones triggering the previous releases have achieved the biodiversity objectives set by the project. To facilitate this, ongoing monitoring is required to determine if the project is meeting its Performance Standards and to assess whether additional measures are necessary to ensure that the conservation project is achieving its objectives. As detailed below, the monitoring process requires a third-party verifier to conduct site visits to the project site. It is important to consider environmental factors that may affect the effectiveness of primary data collection. For instance, in tropical regions, the hydrological cycle can influence monitoring results, thereby impacting measurements of the effectiveness of actions carried out by the project operator. Similarly, in regions with seasons, extreme temperatures can introduce bias into assessments of conservation actions.

8.5. Other considerations

With respect to the BU Release Scheme:

a) If the project does not achieve the compliance milestones or Performance Standards, the schedule for releasing Units may be modified and, if applicable, there may be a reduction in the number of Potential Units that the project can issue. There may also be a complete suspension of sales or transfers of Units, when necessary, to ensure that all sales of Units remain linked to conservation projects with a high probability of meeting the Performance Standards.

b) The Unit Release Scheme must not alter the project's monitoring schedule, nor must it alter the preparation and submission of monitoring reports against the registration platform, in accordance with the schedule specified in *the Registration Document*.

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

d) Conduct a spatiotemporal analysis using data collected during monitoring activities to establish the ecosystem’s rate of change based on the parameters established in the project's performance standards.

8.5.1. Performance-based payment

The commercialization of BUs must adhere to the principle of payment for results (also known as performance-based payment). To ensure this, a third-party verifier will be required to confirm the achievement of results in relation to the operation and maintenance plan, specific biodiversity conservation objectives, and performance standards, all in accordance with the terms, conditions, rights and obligations specified in the respective contractual agreement with potential users. As previously mentioned, the verification of information by the third-party verifier will lead to the release of Units that can be sold and traded once management and conservation milestones have been achieved.

Any project intending to implement this protocol as a financial mechanism for biodiversity must recognize that the unit of measurement for Biodiversity Units (BU) is 1 BU per $10m^2$. Based on this, the project costs and cash flow should be projected according to the specific release scheme presented in the registration document. The total credits should incorporate the necessary costs to implement preservation and restoration actions, and to achieve the conservation objectives set by the project operator. They should also encompass costs associated with ensuring transparency, traceability, sustainability, and permanence of investments, along with all other principles outlined in this Protocol. Additionally, this includes legal, financial, and monitoring costs, to ensure the viability of the conservation project, as well as the issuance and commercialization of the Units. It is important to note that the selected unit of measurement must remain consistent throughout the project's duration to avoid ambiguities and duplication in the number of Units issued.

In practical terms, compliance with conservation objectives and performance standards should be validated through: (1) establishing objectives, goals, and indicators; (2) planned monitoring by a third party; (3) generating compliance reports, carried out by a third party, and (4) uploading these reports to the registration platform, which must be chosen by the project manager as specified in section 10.2 Registration Platform.

All the information uploaded to the platform must be publicly accessible. Based solely on these reports, the administrator of the registration platform may determine whether or not to release Voluntary Biodiversity Units, as outlined in the Release Scheme proposed in the Registration Document (see section 10.1 Check List Registration Document). This process establishes contractual, administrative, and financial arrangements that ensure transparency and sustainability, as well as a clear allocation of risks, responsibilities, and defined deadlines.

8.5.2. Changes in the total number of Units

If a project issuing BUs decides to make any modifications to the initial conditions of the project, such as:

- Increasing the total project area
- Increasing project duration
- Expanding community participation in the area of impact or scope

it may increase the total number of potential Units available for commercialization, as these activities require greater investment. It is important to clarify that the principles established by the Protocol must still be respected, and that any new Units must ensure legal, financial and technical management for the duration of the project.

It should be noted that the following activities do not qualify for an increase in the total potential Units of a BU project:

- Change of threat category according to IUCN
- Modification of activities proposed in the Project Management Plan.

However, a project may be subject to a decrease in potential Units under the following conditions:

- Reduction in project duration, noting that the project cannot be shorter than 20 years
- Reduction in project area

Modifications can only be made to the total number of units that have not yet been sold. In other words, if 100% of the project's units have been sold, no changes to the project’s conditions are permitted. However, if 40% of the units remain unsold, modifications can be made to that specific portion. It is important to consider the project's efficiency in issuing units.

8.5.3. Risk Management Mechanisms: Buffer Units

Biodiversity is at significant risk of extinction, and its restoration may be affected and/or limited by the stresses caused by productive and extractive activities. This poses a risk to the successful implementation of the project's work plan, highlighting the importance of identifying strategies to mitigate these impacts.

Buffer or backup units serve as a risk management mechanism designed to mitigate uncertainty and risks that may arise during the project’s development. These units represent 10% of the project’s potential Units, and cannot be marketed unless a triggering event occurs. The release of these units must be approved by validation and verification bodies, ensuring that one of the following events occurred:

- Natural disasters or unforeseen events: fires, landslides, floods, among others.
- Environmental degradation due to climate change: El Niño and La Niña phenomena.

9. GENERAL CONCEPT OF THE PROCESS

Figure 14 illustrates the general activities that each stakeholder must undertake in the BU heat chain, along with the flow of interactions between the different roles.

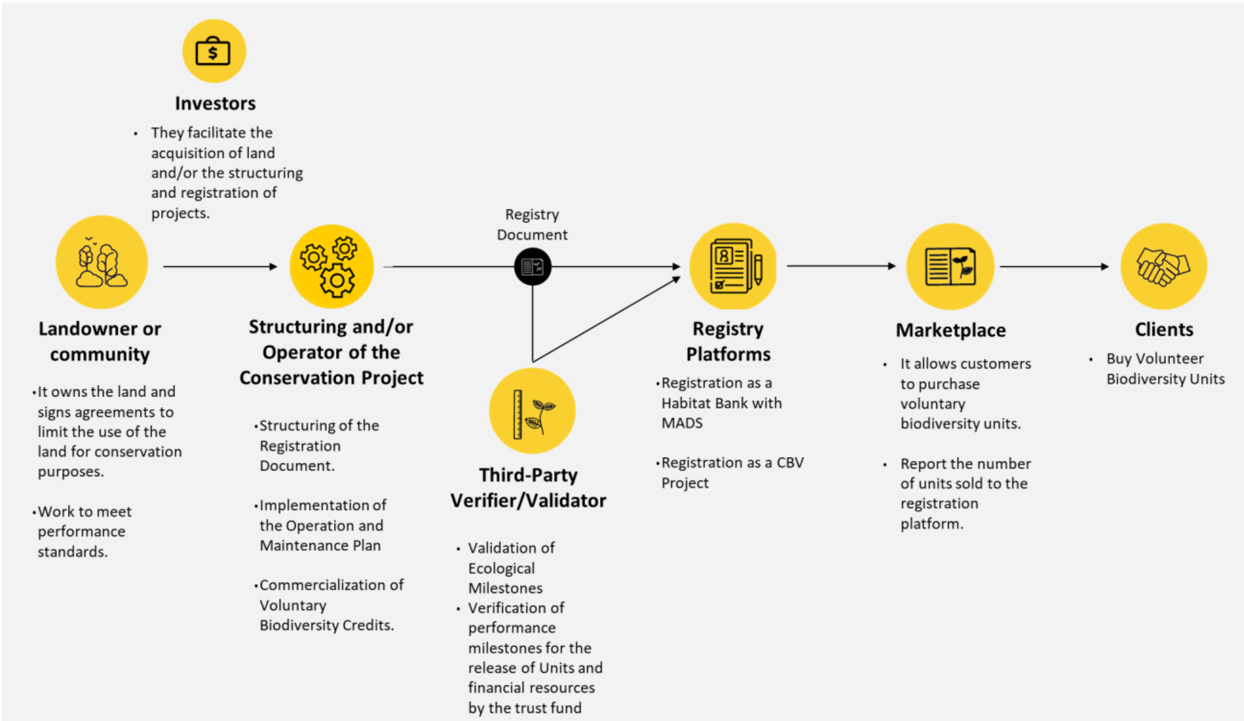

Figure 14. **Process of Registration and Issuance of Voluntary Biodiversity Units.**

Note. This illustrates the anticipated roles of the parties involved in the development of the project.

Each of the activities and tools involved in the BU registration and issuance process is described in detail below.

10. DOCUMENT AND REGISTRATION PLATFORM

In order to ensure technical rigor, additionality, complementarity, transparency, and traceability in any project utilizing this Protocol to issue and market BUs, the following mandatory requirements and procedures are established. These requirements serve as a starting point for third-party consultants conducting monitoring activities, reporting and verification of the conservation project. In addition, they provide interested users with a tool to generate timely information and increase confidence in the purchase of Units.

10.1. Check List Registration Document

Each conservation project that wishes to issue BUs under this Protocol must prepare a *Registration Document* containing the information detailed below. This information must be reviewed and approved by a third-party verifier through the registration platform selected by the project administrator. Only upon approval may the first 20% of Units be released, as specified in section 8.4 Release Scheme 20/20/20/20/20.

a) *Overview*

- Project Name
- Start date and project duration
- Location and typical characteristics of the project area, including the number of hectares and the identification of ecosystems present in the project area.
- Justification for the suitability of the selected area to achieve the expected environmental results (net gain in biodiversity), along with the aspects that demonstrate project's additionality and complementarity.
- Delimitation of the project, along with a list of the planar coordinates of the polygon(s) in the applicable national coordinate system, indicating its origin or the official system that takes its place.

b) *Physical-biotic baseline*

This section refers to the characterization of the area where the conservation project will be carried out, which must consider, at a minimum (but not limited to) the following criteria:

- Project area of influence: The area in which the positive impacts of the project are expected to manifest in relation to the abiotic, biotic, and socioeconomic components.
- Physicochemical properties of soil
- Analysis of land use and conflict in the area under study.
- Type of coverage and its condition.
- Types of water bodies associated with the project
- Structure and composition: This refers to the species richness and overall structure of plant communities and terrestrial fauna, including birds, mammals and herpetofauna. Each sampled taxonomic group must undergo a representativeness analysis that demonstrates a sufficient sampling effort based on the corresponding sampling unit (e.g., coverage, anthropized areas, and natural areas).
- Key elements of biodiversity (e.g., threatened species, species of use, endemism).
- Recommendation: Include a functional connectivity analysis for at least one keystone species found in the territory.

- Types of ecosystem services and their condition.

- Risks and threats to biodiversity in the absence of a conservation project. This should include strategies for controlling and minimizing these risks, using metrics related to the monitoring indicators to validate the implementation of the proposed strategies.

- Climate Change Vulnerability Analysis

- Characterization of the socioeconomic and cultural context of the communities associated with the project

c) *Project design and objectives*

- Type of action(s) to be undertaken to achieve quantifiable gains in biodiversity.

- Description of the expected objectives and quality of the project area, including the total number of hectares designated for restoration and preservation actions.

- Quantification of Voluntary Biodiversity Units

- Estimating *Project* Buffer Units

- Operations and Maintenance Plan, which must include, but not be limited to, the following components:
    - Introduction
    - Objectives
    - Management strategy
    - Delimitation and isolation
    - Details of activities and methodologies for conservation and restoration actions
    - Risk mitigation and mitigation strategies
    - Plan for the establishment and management of agreed quotas
    - Work schedule
    - Implementation budget
    - Profiles and type of workforce required for the development of the plan
    - General Establishment Plan
    - Conclusions and recommendations
    - References
    - Attachments (if applicable)

- Monitoring plan detailing the mechanisms and timing of measurements. For each established goal, indicators must be established to monitor and observe variations in the status of the processes related to the specific compensation action(s).

- Project monitoring indicators and metrics.

- Performance standards to ensure and demonstrate the expected gains in biodiversity and proposed schedule for the release of Units.

d) *Risk analysis*

- Risk analysis and contingency measures that clearly identify all associated risks, including technical[34], financial, and legal aspects. These should also address the stage of occurrence, consequences, probabilities, impacts generated (technical, financial, etc.), as well as the contingency and monitoring measures in place.

- Structuring of the long-term management plan, describing the management measures to be implemented once the performance standards have been met. The plan must ensure the sustainability of the conservation project area, including financing and operational mechanisms.

e) *Conditions of land tenure and assurance of permanence*

- Description of property characteristics and land tenure. Certificates of tradition and freedom must be provided in the case of privately owned or public properties. For collective properties or vacant lots, the relevant administrative act that recognizes ownership and/or provides legal authorization for developing the environmental conservation project on the property must be provided.

- Description of the legal or contractual mechanisms that will ensure the permanence of the area(s) designated for specific preservation and restoration actions.

- Description of the legal instrument that restricts land use on the property(ies), taking into account the duration of the specific preservation or restoration actions to be implemented.

5. *Environmental Registration and Accounting*

- Registration system describing the mechanism that will ensure the transparency and traceability of resources associated with investments and obligations resulting from administrative acts.

- Environmental accounting system detailing the procedures, mechanisms, and schedule for conducting and verifying the transactions of the Voluntary Biodiversity Units.

[34] Within the technical analysis, it is important to include an analysis of the risk and vulnerability of the project in relation to climate change.

10.2. Registration Platform

Environmental asset registration platforms are tools designed to ensure the transparency and traceability of results obtained in activities such as preservation, restoration, and greenhouse gas reduction/removal. To ensure these characteristics in the operation of the Biodiversity Units and to build confidence among potential customers and associated stakeholders, the Protocol proposes the implementation of a registration platform that fulfills the following functions:

a) Identify the characteristics and final ownership of each BU generated under the Protocol.

b) Provide a platform where different stakeholders involved in the BU (such as the project developer, third-party verifier, and client) can engage, and where their roles and responsibilities can be monitored.

c) Facilitate collaboration with the third-party verifier to ensure that all the information required in section 10.1 Check List Registration Document of this Protocol is provided before any conservation project can issue Voluntary Biodiversity Units.

d) Develop mechanisms to monitor compliance with management and ecological milestones, ensuring that a third-party verifier oversees their development and approval. The platform will have a system for recording periodic evaluation checkpoints and the reference values (performance standards) that must be achieved.

e) Maintain the environmental accounting for each conservation project, ensuring accurate traceability of Unit releases and transactions. This will prevent Unis from being marketed before the required performance milestones for their release are met, and ensure they are not sold more than once, thus avoiding double counting.

f) Serve as a repository where all information associated with each conservation project is stored, ensuring confidentiality and allowing consultation as applicable.

10.2.1. Registration Platform Requirements

The registration platform for each project must be selected by mutual agreement between the project owner and the project operator, and described and justified in the *"Environmental Registration and Accounting"* section of the *Registration Document.* However, any registry platform intended to support the information associated with this Protocol must comply with the established principles. Although a project may be associated with more than one registration platform, the third-party verifier is responsible for ensuring that the number of BUs traded does not exceed the amount that the project is authorized to issue under the Protocol. This should ensure that double accounting is avoided, upholding the principle of transparency.

10.2.1.1. *Timeliness and availability of information*

The information associated with the project must be available and accessible to all relevant parties, with viewing permissions restricted to authorized persons based on the definitions of each process. The registrar must ensure appropriate access to information systems according to the role of each user.

10.3. *Confidentiality of Information*

Access to information must be managed through security systems, in accordance with the different security levels and user roles. The registration platform must prevent unauthorized disclosure or access to information. Loss of data confidentiality may lead to operational, financial, and reputational risks, which the registration platform must analyze and manage.

10.4. *Immutability of information*

The registration platform must have the necessary mechanisms for data processing and transactions that enable the attribution of information authorship with absolute certainty, making it extremely difficult to alter after submission, thereby preventing unauthorized changes.

10.5. *Traceability of information*

The registration platform must implement procedures that allow the tracking and tracing of the history and trajectory of project information and Biodiversity Units at any given time, from issuance to cancellation, using specific tools.

10.6. *Basic functionalities*

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

- **Project flow:** The registration platform should be designed to reflect each stage associated with generation of Biodiversity Units, with each step requiring approval by the responsible user.

- **Self-management of automatic transactions:** For greater operational efficiency and security, the registration platform should allow users to conduct transactions automatically. These may include the issuance, transfer, withdrawal or cancellation of Biodiversity Units, among others that may be applicable.

- **Serialization of units:** Each unit or Biodiversity Credit issued must have a unique serial number for identification and traceability purposes. Each serial should contain elements that make it possible to recognize the fundamental characteristics of the project and the units issued.

- **Accounting module:** Once transactions involving Biodiversity Units have been conducted on the registration platform, the system must have an inventory control mechanism that prevents instances of double counting.

- **Generation of reports:** The platform must offer the option of generating reports based on criteria defined by the administrator. This feature should allow the historical movements and detailed data on projects and Biodiversity Units to be tracked.

- **Know-your-customer process:** To prevent the misuse of the Biodiversity Units framework as an instrument for money laundering, terrorist financing, or unethical practices, the registration service provider must carry out a Know-Your-Customer process. This process should include checks against binding and restrictive lists and media reviews to ensure compliance with ethics and transparency standards.

- **Various types of users and roles:** The platform must support different user types, allowing specific interactions according to each user's needs and obligations, based on their role within the Biodiversity Units framework.

- **Public and private sections:** The conditions for information disclosure must align with the publication requirements for each piece of information and document. The features of the public and private sections of the platform will be determined in accordance with the provisions of the Biodiversity Units Protocol.

- **Security standards and protocols:** To prevent information leaks, fraud, and manipulation that could lead to double counting or unauthorized transactions, the registration platform must incorporate digital security standards and protocols that ensure robust and reliable operation.

- **Information exchange:** As interoperability between information platforms becomes increasingly essential for effective data exchange and management, the system must include mechanisms for exchanging information through web interfaces.

It is important to note that the service provider must have the necessary capabilities to develop and deploy new functionalities that may be required by future updates to the Biodiversity Units Protocol.

10.7. Service Level Agreements and Terms and Conditions

Service Level Agreements (SLAs) must be in place to ensure the ongoing provision of registration services to platform users. SLAs should include a mission statement, specification of services, and the responsibilities of the both the service provider and the customer.

Preferably, SLAs should include specific metrics to be achieved by the various services included in the SLA. In addition, they should outline terms and conditions that detail the policies, procedures, and conditions of use for the registration service.

Likewise, it must include a personal data processing policy that recognizes every individual's right to access, update, and rectify the information collected about them in relation to the use of the registration service.

11. MONITORING, REPORTING AND VERIFICATION

Each conservation project that wishes to issue BUs under this Protocol must carry out monitoring, reporting and verification actions. This is necessary not only to ensure the project's integrity from a technical, legal, and financial perspective, but also to determine whether the project is complying with Performance Standards and achieving the objectives outlined in the *Registration Document*.

To this end, a monitoring plan must be developed for each conservation project in accordance with the Performance Standards. This plan is an integral part of the registration, issuance, and commercialization process and must include:

a) The parameters to be monitored
b) The frequency of monitoring
c) The data collection method
d) The individuals responsible for taking measurements
e) The data analysis method

All data must be collected by a third party responsible for overseeing quality control. This is especially important, given that these projects aim to achieve long-term objectives.

The monitoring plan also facilitates the early identification of problems, allowing for corrections to be made to address deficiencies identified during monitoring, and for the implementation of adaptive management activities These elements are critical for ensuring that a conservation project achieves its objectives and, therefore, gains in biodiversity.

It is important to note that this Protocol relies on third-party verifiers who are experts in biodiversity issues (see Figure 14). Therefore, the credibility of these third-party verifiers is critical to the overall credibility of the Protocol and the Voluntary Biodiversity Units.

Each project must conduct two types of follow-ups and monitoring: those related to management and ecological milestones, and the BU release scheme, which are described below.

11.1. Monitoring and tracking of management and ecological milestones

The first type of monitoring and follow-up involves evaluating progress in meeting management and ecological milestones (see section 8.3.1.1 Compliance milestones). This includes progress with land linkage, the implementation of the operations and maintenance plan, as well as progress in conservation and restoration actions. As mentioned above, the aim is to evaluate the achievement of short-, medium- and long-term objectives, while guiding the implementation of conservation and restoration measures. In addition, this process facilitates corrections and adjustments to procedures, thereby promoting adaptive management of the project.

The implementation of the monitoring plan should result in the generation of reports that demonstrate how the project is progressing 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 gains in biodiversity. These reports will be uploaded to the registration platform to demonstrate whether the goals associated with the performance standards are being met, thereby determining if the platform administrator can authorize the release of Units for sale and commercialization.

The information provided serves is a suggested example; however, it is recommended to assess its applicability to the specific context of the territory. It is important to ensure that the number of indicators is sufficient to effectively characterize and understand spatiotemporal changes in the project area.

11.1.1. Frequency of monitoring and reporting

The conservation project manager must outline the monitoring frequency and reporting schedule in the monitoring and follow-up plan, based on the planned preservation and restoration actions. This approach ensures that the results achieved are aligned with the ecological performance standards and the previously proposed Unit release scheme.

Monitoring should continue until compliance with all performance standards is demonstrated. The monitoring frequency will depend on the indicators and units of measurement selected, as outlined in Table 11, with a focus on optimizing information collection activities. This aims to describe changes in the territory and assess how the implemented actions lead to improvements in the ecosystem, and therefore, in the biodiversity of the territory.

In addition to the public report that must be uploaded to the registration platform and the reports required by contractual agreements with Units purchasers, the project manager must also publish the monitoring data in open biodiversity data portals, whether national (e.g. Colombian Biodiversity Information System - SiB[35]) or international (e.g. *Global Biodiversity Information Facility* - GBIF).[36]

[35] Website: https://biodiversidad.co/

[36] Website: https://www.gbif.org/es/

Table 11. Proposal for the frequency of measurement of the project's compliance indicators.

Impact	Objective	Group	Variable	Indicator	Measurement frequency
1. Restoration of degraded and/or artificial vegetation cover.	1.1. Increase in natural cover.	Flora	Composition and structure by vegetation cover	% of restoration area	Every 2 years
	1.2. Increase in plant biomass in the project area			Mortality and recruitment rates	
				Apical growth in restoration areas	
				Diametric growth in restoration areas	
				Biomass in the catering areas	
	1.3. Increase in species richness and abundance in the project area	Terrestrial and aquatic flora and fauna		Dissimilarity Index	
				Diversity Index	
				Dominance Index	
				Equity Index	
			Threat	Decrease in the number of invasive species of mammals, birds and herpetofauna	
3. Decrease in landscape heterogeneity	3.1. Strengthen the connectivity of the territory, measured through landscape units	Landscape	Landscape heterogeneity	Diversity	
				Fragmentation of the landscape	
4. Socio-cultural links in the territory	4.1. Promote environmental awareness in the territory	Social	Technician	Disposal and proper management of hazardous waste due to the use of pesticides and fertilizers	Annual
	4.2. Dignified working conditions and gender equity		Equity	Employment of 100% of the staff in compliance with applicable labor rights that obligations.	Annual
				Involvement of women in socioeconomic activities, conducting training on financial topics to support the development of women-led enterprises	Biannual

Impact	Objective	Group	Variable	Indicator	Measurement frequency
				Conducting workshops to dignify the contributions of members of the community	

Note. This shows the frequency of measurement for compliance indicators. It should be noted that, although milestones are verified every five years, indicators may be measured independently of this timeline.

11.2. BU monitoring and tracking available

To ensure transparency and traceability throughout the issuance and commercialization process of Voluntary Biodiversity Units, and to prevent double counting so that each credit is sold only once during the lifespan of project, ongoing monitoring and follow-up must be carried out to maintain a balance of Units. These Units can be classified as follows:

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

- **Released Units:** These Units can be traded and sold once the project achieves the management and ecological milestones established in the Unit Release Schedule. Units are released after a third-party verifier confirms that the ecological and management milestones have been met. The number of Released Units released cannot equal the total number of Potential Units until the project has fully satisfied all ecological performance standards.

- **Units Sold:** These are Units that have already been assigned to a user and buyer and cannot be remarketed. The number of Units available for sale is equal to the number of Released Units at the time of balance, even if the number of Potential Units is greater.

- **Available Units:** These are the Units remaining after deducting the Units Sold from the Released Units. The number of Available Units may vary as more Units are released.

The monitoring and follow-up of the BU must be carried out by the registration platform administrator, who is solely authorized to release Units. This release relies on information provided by the project administrator to the platform and the corresponding verifications and validations carried out by the third-party verifier.

11.3. Third party verifier

As mentioned above, this Protocol requires project developers to appoint informed and impartial third-party auditors to assess whether their conservation project can be registered on the selected platform, and to verify compliance with management and ecological performance milestones in order to approve the release and commercialization of BUs. Independent evaluation increases the credibility of projects;

however, this also means the credibility of the evaluators is critical to the overall credibility of the Protocol[37]. The third-party verifier must, therefore, operate according to the following guiding principles:

a) Independence
- Remain impartial with respect to the activity being validated or verified, and free from bias and conflicts of interest.
- Maintain objectivity throughout the validation or verification process, ensuring that findings and conclusions are based solely on objective evidence.

b) Integrity
- Demonstrate fairness through trust, honesty, and by working diligently and responsibly, observing the law, maintaining confidentiality, and making all necessary disclosures required by law and professional standards throughout the validation or verification process.

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

d) Due professional care
- Exercise due care and judgment in line with the risks associated with the task being performed and the trust placed in them by the clients and intended users.
- Ensure they have the necessary competence to conduct validation or verification effectively.

e) Professional judgment
- Be able to draw meaningful and accurate conclusions, give opinions, and interpret findings based on observations, knowledge, experience, literature, and other sources of information.
- Demonstrate professional skepticism.

f) Evidence-based approach
- Ensure that all evidence is verifiable and that information sampling is carried out appropriately. Effective sampling is closely related to the confidence placed in the conclusions drawn from the validation and verification processes.

In addition, third-party verifiers must demonstrate that they have:

[37] The third-party assessment methodology is widely used, an example of which is the *Climate, Community and Biodiversity (CCB) Standards.*

a) The authority to perform the functions specified later in this Protocol, as well as any additional functions required by current legislation.

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

c) Experience in developing methodologies for evaluating biodiversity conservation strategies.

d) A work team that is large enough and possesses the required general and specialized knowledge to evaluate various biodiversity components. The team should also demonstrate ethical and professional conduct.

e) The expertise needed to develop field methodologies that allow them to obtain the necessary data to evaluate the outcomes of the actions proposed in the conservation project's *Registration Document*.

f) Proficiency in auditing data and information provided by project developers, as well as data they acquire independently, in order to verify compliance with ecological performance standards.

In the event that no single entity in the project's country of origin possesses all the required attributes, this Protocol allows for the involvement of two types of verifiers. One verifier would be in charge of the technical aspects, such as *in situ* monitoring and follow-up of activities carried out by the project operator, and the ecological milestones achieved. The other verifier would focus on the financial and legal aspects, addressing the management milestones.

11.3.1. Responsibilities of the Third-party Validator

The third-party validator is responsible for collecting primary information to assess the progress of the activities outlined in the Project Management Plan. As an independent, impartial entity–whether an individual or organization–they are characterized by technical rigor, ensuring the effectiveness of the measures established in the Project Management Plan. This role involves collecting primary information and generating technical reports that determine and quantify biodiversity gains.

a) <u>Evaluate the milestones and guidelines established in the registration document</u>. The third-party validator should understand the scope of the activities necessary for collecting the required information and clearly define the sampling effort that will be implemented to ensure quality results that align with the objectives of the project.

b) <u>Conduct independent and objective monitoring</u>. The third-party validator is in charge of obtaining the necessary information, both in the field and from secondary sources, to evaluate whether compliance milestones are being met and contributing to the effective revitalization of the project areas, as reflected by biodiversity gains.

c) <u>Submit the results of ecological milestones to the registration platform and the client's operator</u>. Once monitoring activities and their respective reports have been completed, the information must be submitted to the registration platform in such a way that ensures transparency.

d) Validate information associated with risks or unforeseen events. Given the current climate change scenario, natural disasters or other risk events may have a higher probability of occurring and impacting a project. The third-party validator should determine whether the risk management plan remains adequate throughout the monitoring period. If not, the project operator will be responsible for updating it in line with the validator's expert recommendations.

e) Validate the correct execution of the Project Management Plan. Ensure that the proposed activities are being implemented as planned and assess the progress of each, including completion percentages.

11.3.2. Responsibilities of the Third-Party Verifier

Third-party verifiers are defined as legal experts whose main objective is to carry out independent and objective monitoring of each project's compliance with both management and ecological milestones, and documenting their findings. They also validate whether the ecological performance standards are being met. Costs associated with the third-party verifier(s) must be included in the project's financial model. Accordingly, the third-party verifier must:

1. Evaluate the registration document based on the information provided by the project developer. The third-party verifier will have to carefully review the compliance milestones, performance standards, Unit release scheme, and monitoring plan. Once these methodologies and objectives have been approved, the third-party verifier will be able to approve the registration of the project on the selected platform.

2. Issue an assessment authorizing the release of Voluntary Biodiversity Units. Once monitoring activities have been carried out, the third-party verifier must approve the release of Units, as appropriate, in line with the scheme proposed by the project developer.

3. Validate information associated with risks or unforeseen events. Given the current climate change scenario, natural disasters or other risk events may have a higher probability of occurring and impacting a project. The third-party verifier should validate the information presented by the project operator and assess whether the release of buffer units is possible.

4. Ensure the correct application of the protocol. The third-party verifier must ensure that the methodology for quantifying Biodiversity Units is applied accurately and in accordance with the protocol.

12. SAFEGUARDS

Indigenous, Afro-descendant, and ethnic communities have long safeguarded the planet's biodiversity through their ancestral practices and lifestyles on their lands. Their traditional knowledge and deeprooted relationship with the land and natural resources are both invaluable and fundamental to biodiversity conservation. Berkes et al. (2000) and Berkes (2018) have demonstrated that the presence and participation of these communities in conservation projects lead to better management of natural resources and greater effectiveness in the protection of biodiversity. Likewise, in a meta-analysis on the role of indigenous and local communities in conservation processes, Dawson et al. (2021) found that the inclusion of these communities in ecological conservation processes brings benefits ranging from improved quality of life to greater effectiveness in the restoration of both biotic and abiotic environments within these projects.

Social safeguards facilitate dialogue among stakeholders to reach agreements relating to project development, especially when it involves vulnerable communities. This ensures the non-transgression of human and territorial rights, promoting transparency in the execution of projects that apply this Protocol. The Social Factor, as mentioned, does not replace a project's safeguards, since not all projects that intend to issue BUs have the same level of community participation. However, it seeks to align the project's commitments with performance milestones, upholding the principles of transparency, equity and democratization established by the Protocol. The reasons and benefits of involving communities in preservation and restoration activities are explained below:

1. **Local Knowledge:** These communities have extensive knowledge of the biodiversity within their territories. Their ability to identify species, habitats and ecological patterns is invaluable for documenting and describing changes in ecosystems, and therefore, in the biodiversity of these territories. This type of influence facilitates the dissemination and replicability of this knowledge to strengthen current and future conservation projects.
2. **Sustainable Practices**: Traditionally, these communities have developed sustainable natural resource management practices that facilitate the regeneration of resources and minimize the ecosystem degradation. The implementation of these practices can improve ecosystem health, thereby increasing the number of Units issued.
3. **Continuous Monitoring:** The constant presence of these communities in their territories allows for ongoing monitor of changes in biodiversity. This approach makes it easier to identify threats and adapt conservation strategies accordingly, transforming conservation efforts from being merely restorative to preventative and accelerating biodiversity gains.
4. **Community Engagement:** The inclusion of these communities in conservation projects increases local acceptance and reduces conflict, which, in turn, improves the viability and sustainability of these projects.

As part of the Project Registration document, whether the project is a community initiative or led by an investor or structurer, it is important to include a section that outlines the safeguards mechanism. This section must show a contextual understanding of the territory, based on the project area's established baseline. It should also include evidence from stakeholder working groups to increase understanding of the project and outline an agreement on the governance of the project, specifying how the project's benefits will be distributed. In addition, it should present the guidelines and methodologies for implementing the safeguards mechanism. This last component may be updated as necessary based on ongoing assessments and its relevance throughout the execution of the project[38].

12.1. Work Path

To ensure transparency in the development of a project involving local communities, refer to the work route presented in Figure 15.

1. Community Motivation

- Understanding/contextualization between the community and the investor and/or structurer of conservation projects
- The community's governance system must be defined, along with how it will be integrated into the structuring of the project
- Inform relevant stakeholders, such as territorial entities, landholders, property owners, and other local organizations

2. Formulation of the business model - Pre-feasibility

- Definition of the project area
- Social, biotic and economic scope of the project
- Analysis of opportunities, risks and threats to biodiversity in the study area
- Preliminary financial analysis of the project

3. Definition of governance model

- Determination of project *stakeholders*, with functions
- Definition of the distribution of benefits resulting from the execution of the project

4. Signing of Agreements between the parties

- Signed document describing the agreements established between the parties
- Project performance milestones (management and ecological)
- Voluntary Biodiversity Units Project Registration Document

5. Project Structuring

- Study Area Management Plan
- Guidelines on communication and information required for stakeholders for accountability purposes

Figure 15. Work scheme for the structuring of a BU Project with IPLC.
Source: Modified from WWF Colombia & CCAP (2024).

[38] It is important to note that only the performance milestones associated with the safeguards mechanism are subject to modification, as these must ensure the satisfaction of the community and that it feels represented. In case the community requests changes, the necessary modifications can be made to increase their sense of inclusion.

12.2. Guidelines for structuring the safeguards mechanism

To ensure the successful implementation of projects with high biological integrity and social responsibility, it is important that projects required to implement safeguards include the following information in the Registration Document:

1. **Validation of the regulatory context.** Although the safeguards mechanism follows international guidelines, it is important to review and incorporate the regulations specific to the project's country or region of origin, as well as the community's own norms. This approach seeks to guarantee the sovereignty and ancestry of the communities within the territory. It also provides a roadmap for structuring, consolidating, and validating the governance framework that the project requires.

   It is important that the agreements approved by the community for the structuring of a project include a legal framework guaranteeing the long-term duration of the project, whether through a usufruct structure or another form the community considers legitimate. Investors and buyers must have guarantees regarding their investment, as any project implementing this methodology must ensure a high level of ecological integrity that is sustainable over time, with a minimum duration of 20 years). It is therefore important to conduct a due diligence process to establish ownership of the territory, or failing that, to rely on a national regulatory mechanism that provides these guarantees[39].

   Finally, it is important to consider the language used relating to the technical information that forms the basis of the project's technical documents, particularly concerning the biotic, abiotic, and socioeconomic baseline. It is essential that the project respect and incorporate the ancestral knowledge and language of the community and, if necessary, standardize concepts. This includes using the community's own language where applicable, respecting their ancestral ties to nature and avoiding any form of colonialism that might be masked within the financial mechanism that this Protocol presents.

2. **Mechanism for participation, dissemination of information, communication, and accountability.** Agreements must be presented to demonstrate and guarantee that the community has been, and will continue to be, duly informed throughout the structuring and development of the project. These agreements should specify the frequency and level of detail required for presenting information to the various stakeholders within the established governance structure.

   It is important that the Registry document includes evidence of the working groups conducted and the Agreements established, demonstrating due diligence within the community and ensuring the participation of not only leaders but also of various other members of the community (beyond landholders or owners). In addition, the document should outline the participation and communication mechanisms in place, as the community must have the right

[39] Community ownership of land by restitution for victims of armed conflict or formation of collective property titles formalized via legislative acts.

to vote or reevaluate the Agreements if, during the execution of the project, it becomes evident that their rights are being violated or that agreements are not being upheld.

3. **Community governance model[40] and binding community structure.** To ensure respect for the communities' ancestral heritage, it is important to establish a governance structure, formulated through agreements (or any form the community considers legitimate), that ensures the community is adequately represented and their rights are safeguarded throughout the project's execution. Should this not be the case, the community must be informed of the communication mechanisms available during project execution, allowing them to reevaluate any commitments they consider inappropriate.

4. **Defining the benefits generated by the project and how they will be distributed.** The financial model developed for the project's structuring and operation should be presented, detailing responsibilities, expense allocations, and cost percentages. This information must be shared with project stakeholders for joint approval.

   To guarantee restoration and preservation activities in the project area, it is important to engage in dialogue with the project stakeholders and owners to establish the necessary commitments to support these actions. It is important to consider benefits as incentives, outlining the actions required by the stakeholders to facilitate a transition from extractive activities to sustainable practices that are aligned with the project's objectives.

   It should be noted that the benefits envisioned by the project must extend beyond economic gains and should not be confined solely to suppliers of goods and services, nor limited to community leaders, landholders, and/or landowners. On the contrary, it is important to incorporate training or environmental education strategies that expand the project's reach to other members of the community who can support its operation. This approach allows the investor or structurer to guarantee community autonomy in relation to management, promoting good practices throughout the implementation of the Environmental Management Plan.

5. **Socialization of the distribution of specific benefits to the community and stakeholders.** The governance structure, along with the level of responsibility and obligations within the project, will determine how benefits are distributed. This is a key factor in the project's viability and sustainability, as it is essential that the community confirms its agreement through the established commitments and agreements.[41]

13. NATIONAL AND INTERNATIONAL BENCHMARKS AND REGULATIONS

[40] When specifying the functions of the project's governance structure, it is important to define the process for conflict resolution between the parties.

[41] The established agreement must involve members of the community and not only its leaders, guaranteeing transparency in the structuring process.

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., Manual of compensations of the biotic component, Decree 2099 of 2016, Resolution 1051 of 2017 and Resolution 256 of 2018, which recognizes and regulates 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 (e.g., PNGIBSE, National Restoration Plan)

h) The Declaration on Race and Racial Prejudice (UNESCO, 1978)

i) Convention 169 of the International Labor Organization (ILO) (adopted in 1989 and ratified in Colombia by Law 21 of 1991)

j) The United Nations Declaration on the Rights of Indigenous Peoples (2007)

k) The American Declaration on the Rights of Indigenous Peoples (adopted by the OAS in 2016)

l) The United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas (2018)

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15. GLOSSARY

- **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.

- **Area of impact or scope of the project** [Carlin, 2004]: Delimits the geographical area over which the impacts of a project are manifested and can be quantified. The impacts may be negative and/or positive.

- **Barriers to restoration** [SER, 2019]: Factors that prevent the restoration of an ecosystem or specific ecosystem attributes.

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

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

- **Biodiversity conservation** [Mendoza et al, 2012]: An emerging factor or property resulting from preservation, sustainable use, knowledge generation, and restoration activities. It is the primary goal of integrated management of biodiversity and its ecosystem services.

- **Ecological Connectivity** [Taylor, 1993]: Connectivity is the degree to which the movement of energy and the flow of living matter through source patches within a landscape matrix is helped or impeded.

- **In situ *conservation*** [FAO 1992]: Conservation of genetic resources of selected species "on the ground", meaning within their natural or original ecosystems, or in areas previously occupied by that ecosystem. Although this concept is most often applied to naturally regenerated populations, *in situ* conservation can also include artificial regeneration if planting or sowing is done without deliberate selection and within the same area where the seeds or other reproductive material were originally collected.

- ***Potential Units:*** This refers to the total number of Units that a conservation project can issue in accordance with the quantification methodology described in this Protocol

- ***Released Units:*** These are the Units that can be marketed and sold once the project has met the management and ecological milestones established in the Unit Release Scheme. The release of these Units must be approved by a third-party verifier. The number of Units released cannot equal the number of potential Units until the project has met all its ecological performance standards.

- ***Units sold:*** This refers to Units that have already been assigned to a user and buyer and cannot be remarketed. The number of Units that can be sold is equal to the number of released Units at the time of balance, even if the number of potential Units is greater.

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

- **Ecosystem degradation** [Reid, 2005]: The ongoing decline of an ecosystem's capacity to provide services.

- **Economic Law** [López-Medel, 1966]: This refers to benefits obtained by being a shareholder in a legally constituted company.

- **Political Law** [Fayt, 1985]: Participation in the organization and consolidation of the ethical and legal norms of a legally constituted company with respect to the applicable constitutional and administrative laws.

- **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 assemblage of populations of species that occur together in space and time.

- **Ecosystem approach** [Reid, 2005]: A strategy for the integrated management of land, water areas, and living resources that promotes conservation and sustainable use. This approach is based on the application of scientific methodologies focused on levels of biological organization, which include essential structures, processes, functions, and the interactions between organisms and their environments.

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

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

- **Integrated biodiversity management** [Mendoza et al, 2012]: The process by which actions for the conservation of biodiversity (including knowledge, preservation, sustainable use, and restoration) and its ecosystem services are planned, executed and monitored within a defined social and territorial context. This approach aims to maximize social well-being by maintaining the adaptive capacity of socio-ecosystems at local, regional and national levels.

- **Habitat** [UN] refers to the place or type of environment in which an organism or population naturally exists.

- **Baseline Inventory** [SER, 2019]**:** An investigation of a site's biotic and abiotic elements prior to initiating restoration actions, which includes assessing composition, structure, and function attributes. The baseline inventory is carried out in the planning phase of a restoration project, and involves creating a reference model to guide planning, set restoration goals, establish measurable aims, and outline treatment development.

- **Red List of Ecosystems (LRE)** [https://iucnrle.org/es]: This is a global standard for assessing ecosystem risk. It allows us to identify common symptoms (both spatial and functional) to understand the level of risk faced by a specific ecosystem.

- **Adaptive management** [SER, 2019]: A continuous process of improving practices by applying insights gained from the evaluation, monitoring, and implementation of previously applied practices and techniques. It is the practice of reviewing management decisions based on updated information.

- **Reference model** [SER, 2019]: A model that indicates the expected condition of a restoration site had degradation not occurred. This encompasses flora, fauna, other biota, abiotic elements, functions, processes and successional states. It does not aim to replicate historical conditions, but rather establishes a baseline based on previous environmental conditions.

- **Ecological restoration project** [SER, 2019]: An organized effort to achieve the goal of recovering a native ecosystem, including a planning, implementation, and monitoring phase. A restoration project can include several agreements and funding cycles.

- **Assisted regeneration** [SER, 2019]: A restoration approach that focuses on actively stimulating any natural regenerative capacities of the remaining biota in or around a site, without reintroducing new biota to the site or relying solely on passive regeneration. While this approach is typically applied to sites with low to medium levels of degradation, even some highly degraded sites have demonstrated capacity for assisted regeneration, as long as adequate treatments are performed within a sufficient time frame.

- **Rehabilitation** [SER, 2019]: Management actions aimed at recovering some level of ecosystem functionality in degraded sites. The goal is the renewal and provision of ecosystem services rather than the full restoration of biodiversity and ecosystem integrity as defined by a reference ecosystem.

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

- **Ecosystem services** [UN]: The processes and functions of ecosystems that offer direct or indirect benefits to humans, whether ecological, cultural, or economic. These services include provisions such as food and water; regulatory services such as flood, drought, land degradation and disease control; supporting services such as soil formation and nutrient recycling; and cultural services, including recreational, spiritual, religious, and other non-material benefits.