Umbrella Species Stewardship

BIODIVERSITY CREDITING PROTOCOL

VERSION II.II

AUGUST 2025

ACKNOWLEGEMENTS

The Biodiversity Crediting Protocol for Umbrella Species Stewardship was created by numerous professionals who contributed their time and skills in the ideation and development of the Biodiversity Protocol. We would like to thank the following people and organizations:

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DISCLAIMER

ERA and the Regen Network are pleased to release the 2.1 version of the Biodiversity Crediting Protocol for Umbrella Species Stewardship (USS). Given the pioneering efforts of creating one of the first voluntary biodiversity credit protocols, ERA and the Regen Network are continuously improving the document given the ever-evolving nature of building a new market. This document is intended to be used in combination with the most up to date Regen Registry Program Guide[1].

[1]Accessed at: https://registry-program-guide.regen.network/

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1. BIODIVERSITY PROTOCOL OVERVIEW

The Biodiversity Crediting Protocol for Umbrella Species Stewardship (henceforth called the "**Biodiversity Protocol**") provides a holistic assessment of ecological indicators as well as management interventions to conserve, improve and restore habitat, crucial for the persistence and resilience of wildlife and biodiversity.

This Biodiversity Protocol sets the basis for the continuous monitoring of Umbrella Species on a specific Project Timeframe, which, coupled with targeted Stewardship interventions, creates a favorable net outcome for the chosen Umbrella Species (USp) and the whole ecosystem under management.

To apply this Biodiversity Protocol to a specific biodiversity conservation project, it is necessary to produce and submit evidence of the presence of the chosen Umbrella Species (see Section 1.5) in the Project Area. This is the main requirement to initiate this Biodiversity Protocol. Once the project is validated, data and evidence must be collected and exhibited in the Monitoring Reports to prove the Umbrella Species (USp) has been monitored and stewardship interventions have been implemented. These Monitoring Reports will be verified by external auditors to ensure all guidelines have been followed in accordance with this Biodiversity Protocol.

The objective of this Biodiversity Protocol is to deliver a **Nature-Positive Contribution Credit** to the market, so that companies and individuals can go beyond simply offsetting their environmental impact, but really drive investment to maintain habitat crucial for biodiversity to flourish. As such, this Biodiversity Protocol is not meant for biodiversity offsetting claims. Once a USS credit is purchased, it is immediately retired, avoiding speculative secondary markets to emerge.

The **pricing of the USS credits** under this Biodiversity Protocol is designed to reflect the true cost of implementing conservation activities while providing a transparent and fair mechanism for all stakeholders. Credits are priced based on actual implementation costs to ensure they represent real conservation efforts. This approach prevents the credits from becoming speculative assets and maintains their integrity as representations of concrete conservation actions. By requiring detailed cost reporting, the Biodiversity Protocol fosters trust among stakeholders and enables informed decision-making by credit buyers. The pricing structure balances the need to incentivize project developers with the goal of maximizing funds directed towards conservation activities. The variable profit margin mechanism encourages continuous improvement in conservation outcomes by linking financial rewards to ecological performance. This cost-based, transparent approach ensures that credit prices reflect the true value of conservation efforts while providing a sustainable model for long-term ecological stewardship.

This Biodiversity Protocol is not applicable to aquatic ecosystems, currently.

1.1 DEFINITIONS

- **Biodiversity Credit** – as defined by the Biodiversity Credit Alliance (2024), is a certificate that represents a measured and evidence-based unit of positive biodiversity outcome, durable and additional to what would have otherwise occurred. The unit underpinning a credit provides a quantifiable measure of outcomes, defined as reduction in threats to biodiversity, prevention of anticipated declines in biodiversity, or uplifts in biodiversity resulting from project interventions such as ecological restoration.
- **Buffer Pool** – A tool to mitigate credit class or project-specific risk factors associated with unintentional or intentional reversal events, or overestimation of credits issued. Buffer pools hold credits that cannot be sold to buyers, and reserve credits for potential cancellation from the Registry System to maintain accurate credit accounting.
- **Buyers** – An individual or organization that is purchasing USS credits from the Regen registry.
- **Consolidated Area** – The part of a property that is defined as an anthropic area, infrastructure area, agricultural or wood plantation, and/or pasture.
- **Habitat Area** – The Habitat Area is defined as any spatial boundary where the resources and conditions present in an area produce species occupancy, which may include survival and reproduction by a given species (see Section 4.1.1.1).
- **Habitat Quality (HQ)** – The Habitat Quality is defined as the capacity of the environment to support the ecological requirements of the umbrella species, including the availability of resources, habitat structure, and environmental conditions necessary to sustain its presence over time. HQ refers exclusively to environmental conditions and suitability of the habitat, and does not require demographic data (e.g., population size, density, or viability of the umbrella species) for its assessment (see Chapter 5).
- **Host Country** – Country where the Project Activities are implemented.
- **Land Steward** – Person or organization involved in the caretaking and maintenance (stewardship) of a Project Area. This can ultimately be the Project Developer or the Landowner.

- **Landowner** – The individual or organization that holds title to the Project Area. This can be the Land Steward or a third party that rents the land to the Land Steward.
- **Monitoring Period** – Annual or every two years timeframe in which the monitoring of Project Activities occurs.
- **Monitoring Plan** – Section within the Project Plan with the proposed monitoring, and reporting plan for the next Monitoring Periods, including the Project Activities to be implemented in the next Monitoring Period.
- **Monitoring Report** – Report which contains all the monitored data and information related to Project Activities during the proposed Monitoring Period required by this Biodiversity Protocol and includes the Umbrella Species Credit Calculator.
- **Project Activity** – An intervention adopted by the Land Steward as identified in the Theory of Change to protect an Umbrella Species, maintain and improve its habitat and/or producing monitoring data for scientific purposes.
- **Project Developer** – The individual or organization responsible for the detailed management of the project. The project developer, who can be the land steward or a third party, handles detailed planning, design, construction and implementation of the project.
- **Project Initiation Date:** The date on which the project is formally initiated and becomes publicly verifiable, defined as the earliest verifiable evidence of project existence (e.g., a Data Stream post on the Regen Project Page). This date marks the beginning of the formal registration process, distinct from the Project Start Date when crediting activities commence.
- **Project Plan** – The document used to apply for Project Registration under this Biodiversity Protocol. The Project Plan describes proposed Project Activities, including the process of developing the Theory of Change, demonstrates project eligibility requirements, establishes project boundaries, specifies stakeholders, defines the Monitoring Plan.
- **Project Proponent** – The individual or organization that advocates for a project, identifies its requirements, and drives its initiation. The Project Proponent serves as the main point of

contact with the Registry Agent throughout the course of the project and is responsible for initiating project registration, submission of all materials required by the Biodiversity Protocol and Regen Registry Program Guide and coordinating project actors. The Project Proponent also works with other project stakeholders to ensure correctness and compliance of all submitted documentation with the standards outlined in the Biodiversity Protocol and Regen Registry Program Guide prior to to ensure credit quality. The Project Proponent receives the credits upon issuance and is responsible for coordinating sale and distribution between project actors. The project proponent can be the project developer, land steward or a third party.

- **Project Registration Date** – The date the project is registered on the Regen Registry.
- **Project Start Date** – The date on which the project commences and begins accounting for biodiversity credits, marking the beginning of the Crediting Period. The Project Start Date is stipulated as the date of the first proof of existence of the USp within the Project Area.
- **Project Timeframe** – The finite length of time for which a Project Plan is valid, and during which a project can generate credits. The Project Timeframe is the period during which the Project Proponent will undertake the Proposed Activities, which is defined as five years. Projects can be renewed indefinitely.
- **Project Area** – The entire area of the project including Consolidated Area and Habitat Area. This is the total properties areas under legal ownership of the landowner supported by ownership documents.
- **Regen Network Scientific Community** – Decentralized scientific community providing feedback to projects and methodologies registered in the Regen Registry.
- **Regen Registry** – A comprehensive program, blockchain-based platform, and process designed to support communities in developing standards and legal frameworks for quantifying, monitoring, and trading ecological credits and managing other types of ecological claims. The Regen Registry provides the technical infrastructure responsible for

tracking information and claims backing projects and credits registered under this Biodiversity Protocol. Built atop Regen Ledger, the Regen Registry's technical capabilities include, but are not limited to, registering projects, monitoring the issuance, ownership, transfer, and retirement (or cancellation) of ecological credits, anchoring and signing data, and transparently tracking decision-making practices.

- **Stakeholder** – Community group or party of interest involved and/or affected by Project Activities.
- **Umbrella Species (USp)** – Defined in Section 1.5 as organisms that have great and sensitive habitat needs or other requirements whose protection results in the conservation of many other species at the level of the ecosystem or landscape.
- **Umbrella Species Theory of Change (USpToC)** – Defined in Chapter 6 as strategic framework developed through a theory of change tailored to the unique realities and particularities of each project, USp, ecosystem, and habitat. This approach includes specific strategic lines and involves communities and stakeholders, making it more flexible, adaptable, and collaborative.
- **Umbrella Species Health (USH)** – The framework defined in Chapter 4 for USp conservation projects to maintain monitoring practices throughout the Project Timeframe, creating continuous production of scientific knowledge, enhancing data about specific USp, and offering important inputs for conservation strategies across diverse bioregions.
- **USS Credits** – The biodiversity credit type issued under the Biodiversity Crediting Protocol for Umbrella Species Stewardship. Each USS credit represents the stewardship of approximately one hectare of umbrella species habitat for one year, measured through a composite index that tracks improvements in Umbrella Species Health (USH), Habitat Quality (HQ), and the implementation of conservation interventions (USpToC).
- **Validation** – The systematic, independent, and documented process for the evaluation of the Project Plan and the USp Credit Calculator against the criteria of the Biodiversity Protocol.

- **Verification** – The systematic, independent, and documented process for the evaluation of the Monitoring Report and the USp Credit Calculator of the Project Activities and the observance of the validated Project Plan and Monitoring Plan against the criteria of the Biodiversity Protocol.
- **Verifier** – Responsible Third-Party auditor that will perform Validation and Verification process. The verifier will validate and verify the Project Plan and Monitoring Plan, the Monitoring Reports, USp Credit Calculator and evidence of Project Activities.

1.2 ACRONYMS

- **CBD –** United Nation´s Convention on Biological Diversity.
- **CICES –** Common International Classification of Ecosystem Services.
- **EBV –** Essential Biodiversity Variables
- **GBF –** Global Biodiversity Framework.
- **HQ –** Habitat Quality
- **MRV –** Monitoring, Reporting, and Verification activities.
- **PES –** Payments for Environmental Services.
- **SDG –** The United Nation´s Sustainable Development Goals.
- **USp –** Umbrella Species
- **USpToC –** Umbrella Species Theory of Change
- **USH –** Umbrella Species Health

1.3 INTRODUCTION

Nature is composed of ecosystems that harbor diversity of biotic and abiotic elements. According to the Convention on Biological Diversity (**CBD**)[2], biodiversity can be explained as the variability of living organisms of all origins. The interactions between organisms are responsible for ecosystem functions, which generate ecosystem services[3].

Ecosystem services are the benefits that nature provides for humanity. These services are of great importance for human well-being and economic activities. According to the Common International Classification of Ecosystem Services (**CICES**), three categories are considered: **(i)** provision; **(ii)** regulation & maintenance; and **(iii)** cultural[4]. Human actions that favor and enhance the conservation or improvement of ecosystems and maintenance of ecosystem services are known as environmental services.

The Payment for Environmental Services ("**PES**") is an economic instrument that, following the "protector-receiver" principle, rewards and encourages individuals and/or entities that promote environmental services, improving the profitability of activities for the protection and sustainable use of natural resources[5]. Nevertheless, biodiversity stewardship is seldom recognized or compensated. In fact, in our carbon-centric PES global agenda, it is usually relegated to the background as a preferable outcome for nature-based solutions, but rarely as the main goal of projects.

Moreover, the Aichi Biodiversity Targets established through the Strategic Plan for Biodiversity 2011-2020 have not been met, bringing global multilateral organizations to a general standstill on biodiversity. Seeking to update the global targets for biodiversity, the United Nations, through the CDB, is preparing the Post-2020 Global Biodiversity Framework (**GBF**), with the following stated theory of change[6]:

"The framework is built around a theory of change (see figure 1) which recognizes that urgent policy action globally, regionally and nationally is required to transform economic, social and financial models so that the trends that have exacerbated biodiversity loss will stabilize in the next 10 years (by 2030) and allow for the recovery of natural ecosystems in the following 20 years, with net improvements by 2050 to achieve the Convention's vision of "living in harmony with nature by 2050". It also assumes that a whole-of-government and society approach is necessary to make the changes needed over the next 10 years as a steppingstone towards

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[2] United Nations (1993). Multilateral Convention on Biological Diversity (with annexes): Concluded at Rio de Janeiro on 5 June 1992, Treaty Series, 1760: 142–382, I-30619, New York (United Nations). Online version (accessed 25 October 2023): http://treaties.un.org/doc/Publication/UNTS/Volume1760/v1760.pdf.

[3] Weiskopf, S. R. et al. (2022). A conceptual framework to integrate biodiversity, ecosystem function, and ecosystem service models. BioScience, 72(11), 1062-1073.

[4] Haines-Young, R. & Potschin-Young, M. (2018). Revision of the common international classification for ecosystem services (CICES V5. 1): a policy brief. One Ecosystem, 3, e27108.

[5] Engel, S., Pagiola, S. & Wunder, S. (2008). Designing payments for environmental services in theory and practice: An overview of the issues. Ecological economics, v. 65, n. 4, p. 663-674.

[6] The first version of this theory of change was made in 2021, as part of the first draft of the post-2020 global biodiversity framework, the draft is available at: https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf. This document was updated in 2022, containing a more robust version of the theory of change and relevant updates to the proposed Milestones. This version of the draft document is the most recent at the time of writing and is available at: https://www.cbd.int/doc/c/409e/19ae/369752b245f05e88f760aeb3/wg2020-05-l-02-en.pdf

*the achievement of the 2050 Vision. **As such, Governments and societies need to determine priorities and allocate financial and other resources**, internalize the value of nature, and recognize the cost of inaction." (P.7)*[7]

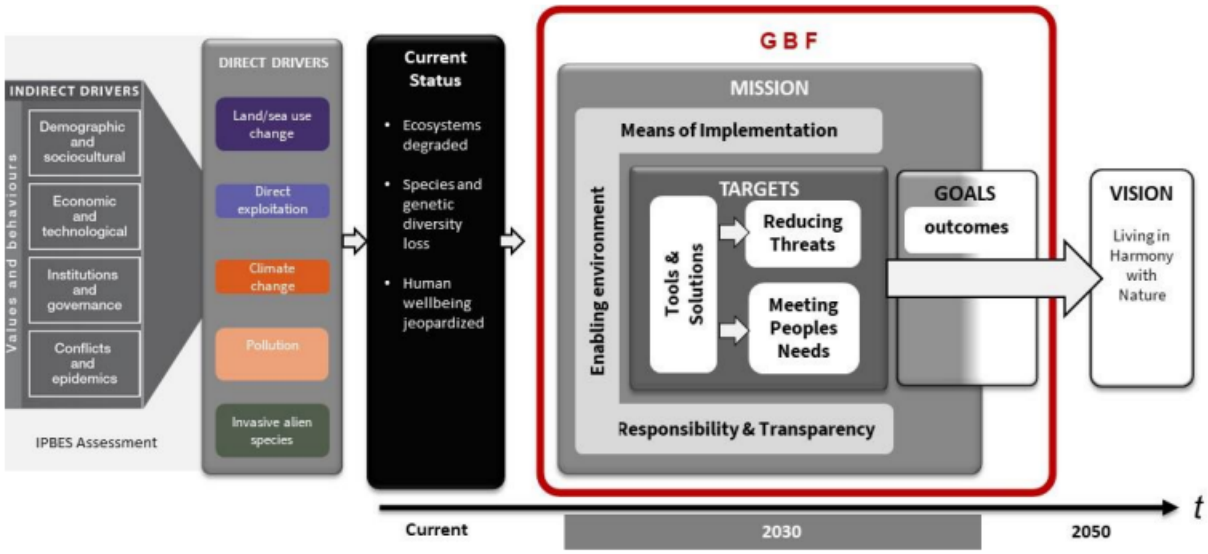

Figure 1 *Extracted Theory of Change figure from the last draft of the Post-2020 Global Biodiversity Framework*[8].

The above citation showcases the urgency for reliable and actionable tools to promote the allocation of resources for biodiversity protection and regeneration. Biodiversity loss needs to be stabilized by 2030, an ambitious yet crucial measure for avoiding ecological collapse in this century.

Considering these premises, the development of a PES framework which support the development of solutions to this challenge is urgently needed. Therefore, this Biodiversity Protocol is intended to contribute Milestones A.1 and A.2 of Goal A and D.1 and D.2 of Goal D of the GBF, as stated, in order[8]:

(A.1) The integrity, connectivity and resilience of ecosystems are maintained, restored or enhanced, increasing by at least 5 per cent by 2030 and 15 per cent by 2050

(A.2) The human-induced extinction of species is halted, and the extinction risk is reduced by at least 10 per cent by 2030 and by 2050, extinction rate and risk of species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels;

(D.1) Adequate means of implementation, including financial resources, capacity-building, technical and scientific cooperation, and access to and transfer of technology to fully implement the Kunming-Montreal global biodiversity framework are secured and equitably accessible to all Parties, especially developing

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[7] United Nations (2021). First Draft of the Post-2020 Global Biodiversity Framework. Montreal, Canada. Available at: https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf

[8] United Nations (2022). Post-2020 Global Biodiversity Framework. Montreal, Canada. Available at: https://www.cbd.int/doc/c/409e/19ae/369752b245f05e88f760aeb3/wg2020-05-l-02-en.pdf

countries, in particular the least developed countries and small island developing States, as well as countries with economies in transition, progressively closing the biodiversity finance gap of 700 billion dollars per year, and aligning financial flows with the Kunming-Montreal Global Biodiversity Framework and the 2050 Vision for Biodiversity

(D.2) Adequate means of implementation to fully implement the post-2020 global biodiversity framework are secured and employed by all Parties with public and private financial flows aligned with the 2050 Vision.

The intent of this Biodiversity Protocol is to create a mechanism that will significantly increase the number of protected hectares of habitat for a given Umbrella Species (**USp**), providing a general framework to incentivize the monitoring and assessment of Umbrella Species Health (**USH**) and Habitat Quality (**HQ**) in various biomes, so that Land Stewards can receive PES for becoming stewards of a chosen USp occurring in the Project Area. USH and HQ monitoring will be coupled with Stewardship Activities defined by a Theory of Change to improve the USH and the HQ of the Project Area, besides building and improving interactions between humans, communities, and USp.

1.4 SCOPE

Ecosystem management includes a wide variety of measures for the protection of living beings and their natural environments, including the conservation of animal and plant species[9]. All species of an ecosystem maintain direct or indirect relationships with each other and are important for the existence and balance of a given environment. However, within this network of relationships there are some specific species that directly or indirectly establish fundamental connections with others and become a cornerstone for the balance and maintenance of the ecosystem. These species are known as Umbrella Species and play a vital role in the structure, function, and productivity of the ecosystem[10].

By the standards of scientific literature, USp are species that require a large habitat area whose ecological protection and stewardship results in the conservation of many other species at the ecosystem level[11]. As they tend to have large ranges, protecting endangered USp also indirectly conserves the habitat of many other species of fauna and flora, being good indicators for assessing the environmental quality of a determined ecosystem.

Another widely used parameter for determining the urgency of preserving specific species is the identification of their conservation status, usually divided between Rare, Threatened or Endangered (RTE). Threatened and endangered species include species classified by the Red List of the International Union for Conservation of Nature (IUCN) as Vulnerable (VU), Endangered (EN) or Critically Endangered (CR) at a global or regional level, as well as nationally protected species. The conservation status can complement USp classification, since it demonstrates the importance of the species not only for ecosystems, but at a national, global or biome level.

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[9] Brussard, P. F., Reed, J. M., & Tracy, C. R. (1998). Ecosystem management: what is it really?. Landscape and Urban Planning, 40(1-3), 9-20.

[10] Frankel, O.H. & M.E. Soule. (1981). Conservation and evolution. Cambridge University Press, Cambridge, UK.

[11] Roberge, J. M. & Angelstam, P. E. R. (2004). Usefulness of the umbrella species concept as a conservation tool. Conservation biology, 18(1), 76-85.

Projects that assess habitat quality with a focus on species that are good indicators for environmental health have the advantage of numerous indirect benefits. However, the bottleneck of conservation projects is to ensure the sustainability of long-term actions that generate stable, positive changes in the environment, thus guaranteeing the occurrence of a multitude of species along with the ecosystem services they provide.

This Biodiversity Protocol is intended to be a practice-based Biodiversity Protocol (one which will be referred to as "**Environmental Stewardship**"), understanding that biodiversity stewardship is a complex and holistic endeavor, which can be deployed and fulfilled through a mix of indicators that make use of quantitative and qualitative data, using a holistically assessed and technology-driven monitoring approach.

Additionally, the Biodiversity Protocol aims to provide a general framework for the monitoring of USH and HQ, as well as the assessment of ESI, so that *Land Stewards* can receive PES for becoming stewards of a chosen Umbrella Species occurring in the Project Area.

The **Umbrella Species Health (USH)** indicator detailed in Chapter 4 has the following mandatory parameters:

- Ecosystem Distribution
- Species Populations

The **Habitat Quality (HQ)** indicator detailed in Chapter 5 has the following mandatory parameters:

- Community composition
- Ecosystem structure

Each project will have a specific **Umbrella Species Theory of Change (USpToC)**, developed through a theory of change tailored to the unique realities and particularities of each project, USp, ecosystem, and habitat. This approach includes specific *Strategic Lines* and involves communities and stakeholders, making it more flexible, adaptable, and collaborative.

The Habitat Health (USH) and Habitat Quality (HQ) indicators are available only in the general document of the current Biodiversity Protocol, as well as the guidelines for the development of the USpToC, which aims to provide a system of continuous improvements to the USH and HQ of the Project Area, besides building and improving interactions between human and animal communities, especially considering the Umbrella Species (USp).
Biodiversity Protocol
Figure 2 illustrates the structure of the Biodiversity Protocol, Biodiversity Protocolwith the Umbrella Species Theory of Change, Umbrella Species Health and Habitat Quality indicators, as described above.

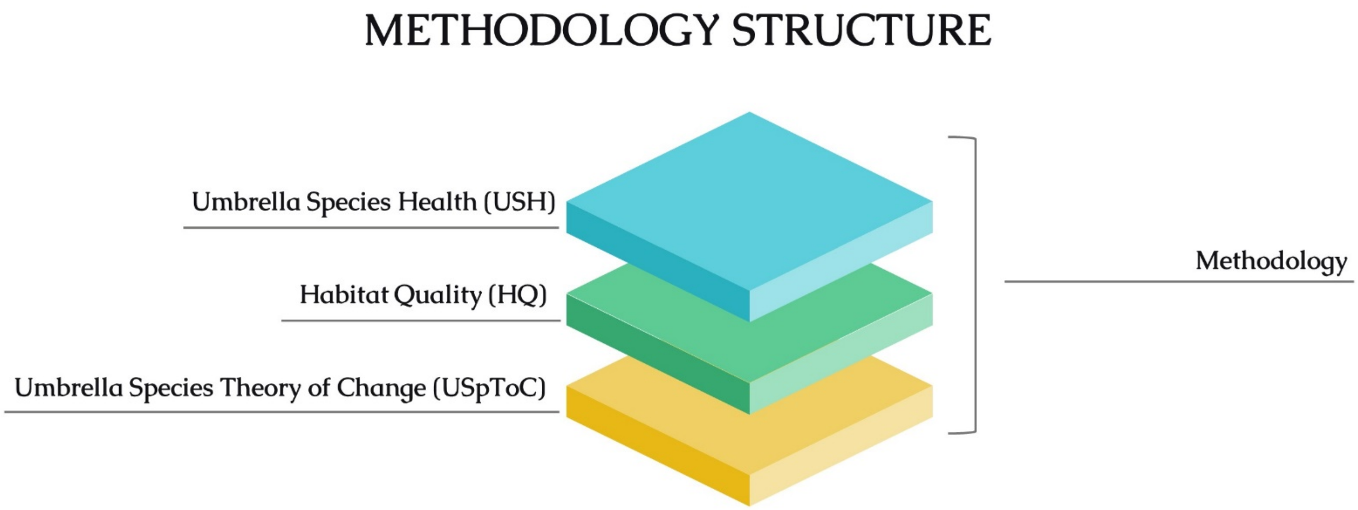

Figure 2 *Illustrative representation of the structure of the Biodiversity Crediting Protocol for Umbrella Species Stewardship*.

This general guidance of the Biodiversity Protocol is intended to assist *Project Proponents* in applying scientifically rigorous and technology-driven monitoring, reporting and verification (**MRV**) that focuses on maximizing data collection over time to evaluate the presence and health of a USp in a Project Area.

Field monitoring activities will be coupled between ongoing remote sensing data and innovative technology such as camera traps and GPS collars. When necessary, field samples and observation methods such as recordings of sightings and vocalizations, feces collecting, fur-traps, observation of footprints and birth dens and nests, will also be used to assess USH while remote MRV data and peer reviewed literature will provide an assessment for species health.

1.5 UMBRELLA SPECIES DEFINITION

The concept of umbrella species was first used in 1981 by Frankel and Soule[10]. The term is used to represent species that need large areas for their conservation, so that, by protecting these areas, it is also possible to conserve the other species that inhabit them. They are species that have high life expectancy, are sensitive to changes in the environment and are of great importance for their ecosystem.

An **Umbrella Species** is defined in this Biodiversity Protocol as **an organism that acts as a representative for the entire ecosystem**. Conservation actions targeting the USp help promote functional diversity of the ecosystems within its range and thus improve ecosystem service provisions.

The USp focused on for this Biodiversity Protocol are birds and mammals whose importance to the ecosystem is demonstrated by scientific evidence and/or expert assessment. There are no international criteria for the selection of animals to serve as umbrella species, but in general they are large mammals or birds, since these tend to have large ranges that encompass a wide variety of environments.

As an additional criterion, eligible species should be classified as Rare, Threatened or Endangered (RTE), as defined below:

Rare is scale dependent and includes species that are:

- Naturally rare, existing only at very low densities in undisturbed habitat (e.g. endemic species), or
- Rare because of human activities (e.g. habitat destruction, overhunting, climate change)
- At the limit of their natural distribution (even if they are common elsewhere)

Threatened and endangered species include species classified by IUCN Red List as:

- Vulnerable (VU).
- Endangered (EN).
- Critically endangered (CR).

Other species may additionally be covered by this Biodiversity Protocol, provided they meet at least one of the following criteria:

- Near-threatened species (NT), if the need for preventive action is justified to prevent them from being categorized as threatened.
- Species that are threatened on official state lists (according to the legislation of each country) and that are not listed on the IUCN Red List of Threatened Species but that present unique situations with risk of local extinction and global impact on the species.

1.6 GENERAL FRAMEWORK AND BIODIVERSITY PROTOCOL STEPS

A general framework for the Biodiversity Protocol is presented in **Figure 3**. The Project Timeframe begins with a feasibility analysis of the Project Area, to identify what Umbrella Species are present. This is shown in diagram below as the "Pre-Stages" and is characterized by two activities, that might be combined or not:

1) Literature review of the existing academic research and/or definitive environmental studies performed by independent third parties that have been completed in the micro and mesoregion (defined in this Biodiversity Protocol as a radius of no more than 200 km to the Project Area) to identify what USp may exist and are already recorded with photographic evidence; and/or,

2) Specialized field campaign to detect the presence of an USp, in order to obtain photographic evidence with a geographic coordinate of the same. Photographic evidence can be obtained through direct recording of the animal, such as with the use of camera-traps, drones, radio/GPS collars, or through photographs of indirect records, such as photograph of the field samples of feces collection, fur-traps, footprints and birth dens/nests and photograph of the installation of bioacoustics equipment together with the sound registration. Once **photographic evidence** with GPS coordinates has been established of a USp within the Project Area, the Start Date can be defined. Project Proponents must then develop the specific USpToC that will be applied, by following the steps outlined in Chapter 6.

In both afore mentioned scenarios, photographic evidence may be supported by other evidence such as collected fur, paw tracks, feces, and bioacoustics monitoring. The preliminary activities above will be cited in the Project Plan and Monitoring Report.

Once the Project Proponent has evidence of the presence of USp in the Project Area, as per the guidance above, the Project Plan and Monitoring Plan (PP) must be developed with the Umbrella Species Credit Calculator. The initial Project Activities are implemented, and its associated technology is deployed to the field. The Project Proponent creates a monitoring framework on the basis of continuous improvement of the USH/HQ indicators and development of the activities associated with the Strategic Lines within the Theory of Change.

The first monitoring period must implement the minimum requirements of this Biodiversity Protocol, to facilitate the adoption of Project Activities over time, as the Land Steward builds revenue from the sales of the biodiversity credits. One calendar year of monitoring data must be captured and reported following the Project Reporting templates and the USp Credit Calcultaor, for the Project to undergo verification. If the verification is successful, biodiversity credits will be issued accordingly in the Project Proponent’s wallet. The second monitoring period begins, and additional Project Activities must be implemented following the indicators of this Biodiversity Protocol. Subsequent yearly MRV takes place, with biodiversity credits issuance only following a positive verification statement.

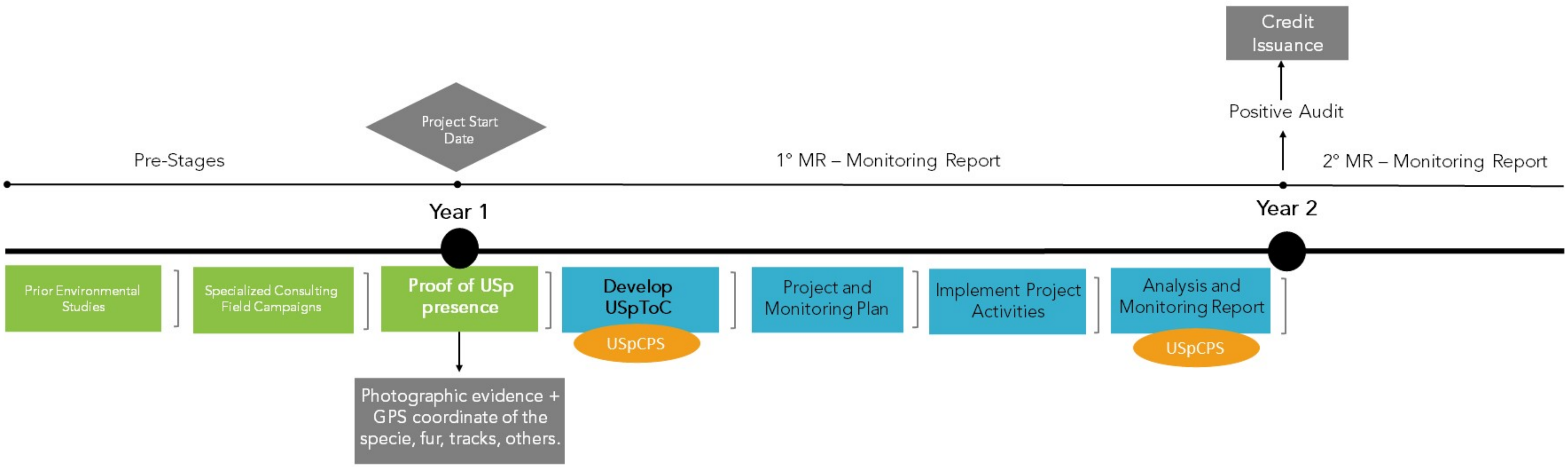

Figure 3 *Illustrative representation of the Biodiversity Protocol framework.*

To summarize how to implement the Biodiversity Protocol in the Project Area, the following steps are required:

1. Carry out a prior biodiversity campaign to assess the Project Area (optional pre stages above).
2. Choose USp and prove presence in Project Area.
3. Develop the USp Theory of Change according to Chapter 6.
4. Develop the **Project Plan and Monitoring Plan (PP)** and the **Umbrella Species Credit Calculator**.
5. Implement the Project Plan and Monitoring Plan, by deploying monitoring technology and implementing Project Activities for the Project Area according to Chapter 4 to 6.
6. Data Analysis and Report.
7. Validation and verification of data and evidence of the **Monitoring Report (MR)** and updated **Umbrella Species Credit Calculator** by an approved Verifier for biodiversity credit issuance.

2. PROJECT ELIGIBILITY

Project proponents must describe in the Project Plan how each of the following eligibility criteria are met, with evidence to support the claims.

2.1. ECOSYSTEM TYPE CLASSIFICATION

Application: This Biodiversity Protocol can be developed in any terrestrial biome in the world.

Definition: Biome is a biological unit or geographic space whose specific characteristics are designated by macroclimate, vegetation class, soil, and altitude, as well as other criteria. They can be defined as types of ecosystems, habitats, or biological communities within a certain level of homogeneity[12].

2.2. FOREST/VEGETATION REQUIREMENTS

Criteria regarding the vegetation eligible for the project can be found in Section 3.1 below, under the "Habitat Area" definition.

2.3. LAND OWNERSHIP TYPE

This Biodiversity Protocol accepts projects with all land ownership types, including private, public, and tribal, provided the Project Proponent demonstrates adequate documentation for proof of ownership and/or approval by landowners.

2.4. PROOF OF OWNERSHIP

Landowners and/or Project Proponents will prove land ownership or title with the available legal documents as per the host country´s legislation. Landholders and/or Project Proponents will need to prove at least basic and documented land tenure rights, in order to avoid double-counting, double-claiming, and improve permanence aspects of the Project Activities.

2.5. REGULATORY COMPLIANCE

The Project Area must adhere and provide attestation of compliance to the local laws, regulations, and other legally binding mandates directly related to Project Activities.

2.6. PERMANENCE OF PROJECT ACTIVITIES

Project proponents and Land Stewards must prove the minimum Project Timeframe of five years is sustained by an irrevocable and legally enforceable agreement between the Project Proponent, Land Steward and/or any other relevant parties that ensures that the Project Activities will be undertaken and that the Habitat

[12] Mucina, L. (2019). Biome: evolution of a crucial ecological and biogeographical concept. New Phytologist, 222(1), 97-114.

Area will be protected, or any other legal or regulatory remedy, public or private in nature, that entails this specified outcome.

2.7. PROJECT START DATE AND RETROACTIVE CREDITING

Project Start Date: The date on which the project commences and begins accounting for biodiversity credits, marking the beginning of the Crediting Period. The Project Start Date is stipulated as the date of the first proof of existence of the USp within the Project Area.

Retroactive Crediting: This Biodiversity Protocol will accept a Start Date that goes back up to 3 years prior to the Project Initiation Date. To claim a retroactive Start Date, the Project Proponent must have maintained clear historical records to prove USp existence during all years and monitoring efforts of USH and HQ, implementation of the requirements within the USpToC and overall eligibility to this Biodiversity Protocol. Additionally, for projects that already generate other Payments for Environmental Services (e.g., carbon credits), the retrospective period is permitted only if project activities can be transparently separated for each PES scheme within the USp Credit Calculator, such as the Climate, Community & Biodiversity Standard activities part of a Verified Carbon Project. The three years that the Biodiversity Protocol can retrocede do not count within the minimum Project Timeframe of five years.

Note: More information on stacking Payments for Ecosystem Services (PES) will be provided in Section 8.7.

2.8. CREDITING TERM

The Crediting Term for this Biodiversity Protocol for the issuance of biodiversity credits is of 5 years, from the moment of Project Initiation Date, this does not include issuances that are claimed prior to this date. Each renewal period will be 5 years and there is no limit to the number of renewals. At the time of renewal, the Theory of Change must be revisited, and the strategies must be reassessed.

3. PROJECT AREA BOUNDARY

This chapter presents the definitions of spatial boundaries and temporal boundaries of the defined Project Area.

3.1. SPATIAL BOUNDARIES

Project Area: It comprises the entire area of the property bounded by spatial boundaries, including all Consolidated Areas and Habitat Areas.

Consolidated Area: The Consolidated Area is defined as any spatial boundary where human interference occurred such as infrastructure area, agricultural cultivation, planted forests, animal husbandry, mining, and areas of human occupation.

Habitat Area: The Habitat Area is defined as any spatial boundary where the resources and conditions present in an area produce occupancy, which may include survival and reproduction by a given organism. Habitat is organism-specific and is more than vegetation or vegetation structure[13]. **Furthermore, it is the main datapoint for the calculation of the USH indicator, as per Chapter 4.**

The Project Proponent may include more than one property in the Project, provided that the additional areas fall within a 200 km range and share the same associated entities (Project Developer, Landowner and/or Land Steward). Furthermore, at least one of the same core threats specified in the Theory of Change must remain applicable across all project areas to ensure the strategic lines remain relevant and coherent with the overall conservation logic of the Project. While at least one core threat to the umbrella species must be present across all areas, specific interventions may vary based on local contexts, practices, and resource availability.

3.2. TEMPORAL BOUNDARIES

The Project Timeframe is the period during which the Project Proponent will undertake the Proposed Activities.

Current available data from scientific literature on permanence aspects of biodiversity projects are scarce. Although there are mathematical models for predicting the potential for restoration and conservation of biodiversity[14], few projects have sufficient longevity and permanence to monitor the change of the pattern of biodiversity distribution, or the structuring of ecosystems. Considering this, it is very important to understand and define what the feasible temporal window is to identify changes in the community and effects on the conservation status of the species[15].

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[13] Hodgson, J. A., Moilanen, A., Wintle, B. A., & Thomas, C. D. (2011). Habitat area, quality and connectivity: striking the balance for efficient conservation. Journal of Applied Ecology, 48(1), 148-152.

[14] Sequeira, A. M., Bouchet, P. J., Yates, K. L., Mengersen, K., & Caley, M. J. (2018). Transferring biodiversity models for conservation: Opportunities and challenges. Methods in Ecology and Evolution, 9(5), 1250-1264.

[15] Dornelas, M. et al. (2013). Quantifying temporal change in biodiversity: challenges and opportunities. Proceedings of the Royal Society B: Biological Sciences, 280(1750), 1931 -2012.

Many projects have the challenge of raising funds for the maintenance of conservation activities. Therefore, the proposal to submit monitoring reports in short periods of time (annual or every two years) permits faster pipelines for the validation and verification of Project Activities and consequent generation of biodiversity credits, allowing conservation finance to be streamed to Project Proponents and Landowners in a reasonable amount of time.

Therefore, the Monitoring Period and frequency defining the temporal boundaries should adhere to the following guidelines:

- The minimum Project Timeframe must be 5 years and there is no maximum limit.
- Monitoring and Verification frequency must be annual or every two years.

Although this methodology addresses the Project Timeframe of 5 years, there is a common understanding that the permanence of biodiversity projects should be higher. The 5 years period comes into an early biodiversity market moment and intends to facilitate the adoption of this Biodiversity Protocol. Once the market evolves in its maturity this Biodiversity Protocol intends to adopt a higher project timeframe and hence, increase the permanence of the projects.

4. EVALUATING UMBRELLA SPECIES HEALTH (USH) AND DEVELOPING A MONITORING PLAN

This chapter presents the mandatory parameters of the USH indicator, as well as the suggested *best practices* for the use of technologies in monitoring and conservation of biodiversity. This chapter will address parameters of identification, monitoring and conservation of USp individuals. **The overall scoring method is provided at the end of this chapter**.

The main pillar of this Biodiversity Protocol is to produce scientific knowledge over the Project Timeframe in order to incentivize the accumulation of data capture as important inputs for scientific research. The data produced on USp shall be reportedin the Monitoring Reports. All monitoring data must be anchored on Regen Ledger to ensure transparency, traceability, and permanence. Projects are encouraged to use the Data Stream feature on their Regen Marketplace page to share data publicly, but may also leverage other tools or platforms, provided the data remains anchored on Regen Ledger and is publicly accessible. Certain sensitive data may be marked as "available upon request", with ownership and access conditions clearly specified.

The Monitoring Plan should include the following objectives:

- Describe how changes in a chosen population of USp will be monitored, as well as other species of communities. This description could serve as an indicator of habitat quality and disturbance.
- Describe the methods that will be used to monitor USH. The methods should be repeatable, minimally susceptible to observer bias.

4.1. BASELINE MONITORING PARAMETERS

There are **mandatory USH parameters** that must be measured in the field to compose the baseline calculation for the number of biodiversity credits that will be issued.

The parameters used by this Biodiversity Protocol are based on the Essential Biodiversity Variables (**EBV**), which assess biodiversity change over time in different dimensions and across multiple scales[16]. They can be used to monitor progress with respect to the Sustainable Development Goals (**SDG**), or determine adherence to biodiversity policy, and to track biodiversity responses to disturbances and management interventions. The EBVs summarize a minimum set of essential measurements to capture the main dimensions of the change in biodiversity, complementary to other initiatives to observe the change in the environment.

The Group on Earth Observations Biodiversity Observation Network (GEO BON) indicates six EBV Classes[16]:

- Genetic composition
- Species populations
- Species traits
- Community composition

[16] Pereira, H.M. et al. (2013). Essential biodiversity variables. Science, 339, 277–278.

- Ecosystem structure
- Ecosystem function

From these classes, specific EBVs were chosen to provide the Biodiversity Protocol with an accessible framework for monitoring:

- Ecosystem structure, characterized by the
  - Ecosystem's distribution

- Species populations, characterized by the
  - Presence or absence data
  - Size of the population
  - Movement and distribution

4.1.1. ECOSYSTEM STRUCTURE

4.1.1.1 ECOSYSTEM DISTRIBUTION

The ecosystem distribution is characterized through the assessment of land use and coverage and the types of vegetation in the Project Area with the aid of remote sensing. Two general features are evaluated in each Project Area: a) Habitat Area and b) Consolidated Area.

Habitat Area is defined as any spatial boundary where the resources and conditions present in an area produce occupancy, which may include survival and reproduction by a given organism.

This Biodiversity Protocol considers that an eligible Habitat Area can include all the suitable areas of the USp in different biomes and in the specific growth stages of the vegetation

- Native vegetation in an old-growth stage.
- Water resources.
- Regenerative agroforestry systems
- Natural or assisted regenerating areas in a regrowth stage (young forest) or in a canopy transition stage (mature forest).

The characterization of the Habitat Area must be presented through remote sensing by satellite images in association with Environmental Information Vector Database. The different areas must be identified and classified according to type of vegetation, land use and coverage, and hydrography. Spatial boundaries defining the Project Area should be provided by the Project Proponent in accordance with the property's title document. Data formats may include polygon shapefiles, KML/KMZ files, or other GIS vector files.

The objective of this step is to collect and analyze spatial data to identify the current conditions of the Habitat Area of the property. For the Project Plan, the date of the satellite images should be as close as possible to the project start date (≤ 6 months), while for each Monitoring Report cycle, the images should be as close as possible to the end of the monitoring period (≤ 6 months). In both cases, high resolution images (minimum of 0.30 centimeters, maximum of 15 meters). The mapping of forest successional stages using optical remote sensing images can be carried out through the classification of vegetation reflectance spectra[17]. The process requires the selection of appropriate variables and the use of refined algorithms to improve classification performance[18].

The table below must be completed and inserted into the Project Plan:

Habitat Area Classes	Hectares
Native Vegetation	
Water Resources	
Regenerative Systems	
Degraded areas in a State of Regeneration	
Total	

For the scoring method of this section, the total size of the areas in hectares will be considered.

If any portion of the Habitat Area is officially designated or recognized as an ecological corridor, this information must be clearly indicated in the Project Plan and/or Monitoring Report. Recognition may occur through instruments such as public environmental planning documents, ecological-economic zoning (ZEE), municipal or state conservation plans, or legal designations (e.g., Permanent Preservation Areas, Legal Reserves with corridor function, or private conservation agreements). When applicable, specify the area (in hectares), legal or institutional basis for the designation, and its role in connecting habitats or supporting species movement.

Consolidated Areas are related to the areas of interaction with the USp and the entire anthropic intervention area of the property such as:

- Plantations (monoculture agriculture, forest plantations or otherwise) and/or pasture.
- Infrastructure areas.

Remote sensing with current satellite images (≤ 6 months) and with good spatial resolution (minimum of 0.30 cm, maximum of 30 meters) should be used to identify the areas. Spatial boundaries defining the Consolidated Area should be provided by the Project Proponent with any parcels or stratification schemes defined. Data formats may include polygon shapefiles, KML/KMZ files, or other GIS vector files.

[17] Vieira, I. C. G. et al. (2003). Classifying successional forests using Landsat spectral properties and ecological characteristics in eastern Amazonia. *Remote Sensing of Environment*, 87(4), 470-481.
[18] Sothe, C. et al. (2017). Evaluating Sentinel-2 and Landsat-8 data to map sucessional forest stages in a subtropical forest in Southern Brazil. *Remote Sensing*, 9(8), 838.

The table below must be completed and inserted into the Project Plan:

Consolidated Area	Hectares
Agriculture and/or pasture	
Infrastructure areas	
Total	

For the scoring method of this section, the total area's size in hectares will be considered.

4.1.2. SPECIES POPULATIONS

4.1.2.1 PRESENCE / ABSENCE DATA

This parameter is understood as the basic and obligatory datapoint that confirms if chosen Umbrella Species (USp) is present or not in the Project Area.

Confirmation of the USp presence may be obtained via many types of accessible methods associated with geographic coordinates, such as camera-traps, drones, radio/GPS collars, bioacoustics and/or field samples such as feces collection, fur-traps, identification of footprints and birth dens/nests.

Expert advisory reports or GPS-located evidence presented by the Project Proponent will be accepted as proof of the presence of the USp in the area. Regardless of the size of the Project Area, the presence of a single individual of USp will be valid for access to the Biodiversity Protocol and eventual issuance of biodiversity credits. For species that live in groups, the presence of at least one group must be identified and documented.

It is mandatory to record the presence of the USp in the Project Area in the first Monitoring Report. After this period, it is permitted by the Biodiversity Protocol that the USp is not registered in the Project Area for up to 2 years, still being eligible for the Biodiversity Protocol in this timeframe. However, it is mandatory for the Project Proponent to have to implement a system of continuous improvement in the application of the Umbrella Species Credit Calculator.

In case the host country has a national action plan aimed at the conservation of the USp, the occurrence of the individual's presence in the Project Area must be reported to the national database.

The presence of the USp in the area will count as **2 points** in the equation of the Section 4.3.

4.1.2.2 SIZE OF THE POPULATION

Under this crediting protocol, each individual of the USp that is identified and recorded within the Project Area contributes to the assessment of USH. By tracking identified individuals over time, the project generates valuable insights into population dynamics, habitat use, and conservation impact. A point is awarded for each individual that is monitored and identified within the Project Area.

Each identified individual of the same USp within the Project Area will count as **1 point** in the equation of Section 4.3.

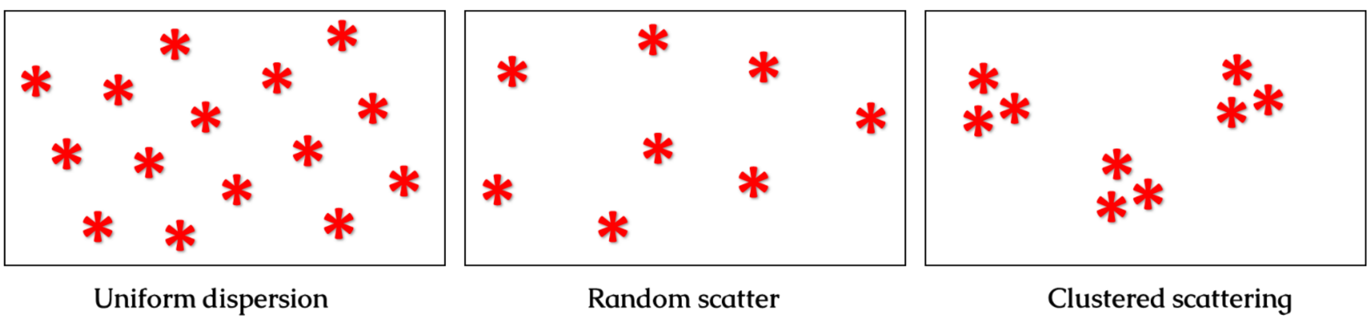
For species that live in groups, the group will be considered as a single unit rather than counting each individual separately.

4.1.2.3 MOVEMENT AND DISTRIBUTION

Movement is an integral process to consider when monitoring animals, particularly for birds and mammals with large home ranges. Animal movement is motivated by complex interactions of internal and external factors, including food availability, reproduction and risk avoidance, variation in the sex ratio of the population as well as seasonal or annual changes in biotic and climatic features might influence average movement speeds[19]. Movement is defined by the animal's behavior (foraging, resting, and walking) based on tracking data[20].

Scatter patterns or distribution patterns refer to how individuals in a population are distributed in space at a given time.

The individual organisms that make up a population may be evenly spaced, dispersed randomly with no predictable pattern, or clustered in groups. These patterns are known as uniform, random, and cluster patterns, respectively.



With technological advances, it is possible to obtain various data on the behavior of monitored individuals, such as daily movement, size of the area they circulate and what relationships they have with the environment that characterize their habitat preferences. Movement is typically measured via telemetry, which requires capture of individuals and application of tracking devices. The analysis of this information makes it possible, for example, to determine the impact of human development, or even help in understanding whether an area has a sufficient number of individuals of a species to allow its survival.

[19] Nathan, R. et al. (2008). A movement ecology paradigm for unifying organismal movement research. Proc. Natl. Acad. Sci. U. S. A. 105, 19052–19059. doi: 10.1073/pnas.0800375105

[20] Teimouri, M., Indahl, U. G., Sickel, H., & Tveite, H. (2018). Deriving animal movement behaviors using movement parameters extracted from location data. ISPRS International Journal of Geo-Information, 7(2), 78.

Movement of large animals in some habitats can also be monitored with drones or through other forms of remote sensing (e.g., aircraft, satellites).

Statistical modeling can be used to estimate range size and habitat preferences based solely on species' occurrence data and environmental variables. Species distribution models can make predictions of habitat suitability for areas and times with no current samples based on estimated relationships between the environment and species' occurrence.

Species distribution models are typically built with machine learning algorithms that estimate ecological niche relationships between environmental variables (e.g., climate, topography, soils, vegetation cover) and species' occurrence data. Based on existing data, these models can predict the potential distribution of species in a given area of interest, and can even make predictions for areas (and times) with no available sampling data based on the environmental conditions there. Species distribution modeling has many current applications, including estimation of range extents and area for conservation of rare species, prediction of climate change or land-use change impacts to species' ranges, and forecasting invasion potential of alien species.

Species' occurrence data for species distribution modeling can be collected via direct observations; camera traps; detection of scat or fur, etc.; or via online biodiversity databases.

The application of any method that involves the capture and handling of individuals must be carried out by authorized and competent institutions.

This is a mandatory item that the Project Developer and Project Proponent can choose the moment most appropriate to implement.
The analysis and discussion of this parameter will count **1 point** per individual in the equation of the Section 4.3.

4.1.3. CONTINUOUS IMPROVEMENT THROUGHOUT THE PROJECT LIFETIME

The aforementioned mandatory parameters should be implemented throughout the Project Timeframe, so that by the end of the Project, all parameters have been applied to monitor USH.

It is mandatory to record the presence of the USp in the Project Area in the first Monitoring Report. The size of the population and movement are parameters that the Project Developer and Project Proponent can choose the moment most appropriate to implement.

The Project Plan must address how the Project Proponent will implement the monitoring strategies throughout the Project Timeframe so that during each Monitoring Report there is an increment of new strategies implemented, and that by the end of the Project Period, all strategies will have been implemented.

4.2. MONITORING METHODS

The USH monitoring methods can be chosen by the Project Developer and Project Proponent according to the available financial resources and workforce. It is suggested to apply traditional fauna monitoring methods associated with technological techniques to achieve the implementation of all parameters described in **S**ection 4.1.2. Details about how to apply the traditional methods consolidates in the scientific literature can be found in the technical guides provided by Van Horne et al.(2005)[21] and Gaur et al. (2017)[22]. Other less technologically heavy methods with respective protocol or scientific literature can be accepted such as a robust technique to implementation the monitoring parameters of Species Populations.

A guidance of some traditional and technological tools for assessing Species Populations parameters is provided in this **chapter**. The technological methods can minimize monitoring implementation costs and implement non-invasive techniques throughout the Project Period. Guidelines are provided below to ensure the methods and technologies are applied correctly. Most of the methods must be applied by experts who have gone through appropriate training to apply the technique.

Each monitoring method used can count as 1 point in the crediting formula (item 4.3.1), and it is not limited to the methods described below.

4.2.1. FECES SAMPLE COLLECTION

Noninvasive sampling is a strategy widely used in field studies, since this method allows studies of free-ranging animals without the need to capture, manipulate, or even observe them[23]. In this context, the analysis of noninvasive samples becomes an alternative with great cost-benefit for monitoring and, consequently, for the conservation of species, mainly free-living animals with nocturnal, elusive habits and that present low population densities, like carnivores, and those living in places of difficult access[24]. Among the different types of noninvasive samples, feces are ideal tools for indirectly analyzing free-ranging wild animals.

The presence and identification of the USp can be carried out using feces collected in the environment. One of the ways to identify animal taxa is to analyze the morphology of feces or dietary remains in these samples. The dietary components evidenced, such as claws, bones, teeth and feathers, as well as the shape, size and odor of the feces are peculiar characteristics that can help in identifying the animal. All this information must be noted. Also, the geographic coordinate, date, photographer must be registered to each feces sample in the field. Subsequently, all the information obtained can be compared with the literature for the taxonomic classification of the fecal material of the animal.

This method can be used to evaluate the presence of the USp in the Project Area.

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[21] Van Horne P. et al. (2005). Multiple species inventory and monitoring technical guide. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5162596.pdf

[22] Gaur A. et al. (2017). Manual for Biological Sample Collection and Preservation for Genetic, Reproductive and Disease Analyses. Central Zoo Authority and the Laboratory for Conservation of Endangered Species, Centre for Cellular and Molecular Biology. Available at: https://cza.nic.in/uploads/documents/publications/english/Fina%20A5%20Manual%20(1)%20(1).pdf

[23] Taberlet, P., Waits, L. P., & Luikart, G. (1999). Noninvasive genetic sampling: look before you leap. Trends in ecology & evolution, 14(8), 323-327.

[24] Chame, M. (2003). Terrestrial mammal feces: a morphometric summary and description. Memórias do Instituto Oswaldo Cruz, 98, 71-94.

4.2.2. FOOTPRINT IDENTIFICATION TECHNIQUE

Footprint identification technique is a low-cost, non-invasive, and effective, without negative impacts. Footprints are ubiquitous on suitable substrates, cheap to collect, and can provide good biometric markers. Every species has a unique footprint anatomy, and every individual of a species a unique footprint. In addition, every footprint produced by an individual is also unique because of the substrate, gait, weather conditions, and terrain[25].

The digital images of the footprints can be done along several different trails, according to a standardized photo protocol. A metric ruler on the horizontal and left axes of the footprint can be places before the photography. An information slip recording geographic coordinate, date, photographer must be noted to each footprint sampled in the field.

The footprint samples can be evaluated by specialist to do a correct identification of the animal or can be used in a software of species identification, such as Footprint Identification Technology (FIT) [26]. The FIT is a smartphone app based on photographs of footprints, using cutting edge technology statistical analysis and artificial intelligence. This app can collect images of animal footprints to determine their species, which individual they are, which sex, and sometimes their age-class also. FIT works for any species that leaves a clear footprint.

This method can be used to evaluate the presence of the USp in the Project Area.

4.2.3. IDENTIFICATION OF ACTIVES BIRTH DENS/NESTS

Many animals are rare or nocturnal, making them difficult to direct observation. However, animals leave signs that show they live in or have visited an area. Field evidence includes birth dens and nests. To prove that it is an active den and/or nest, signs of food and feces must be found at the site[27].

The digital images of the dens or nest must be done according to a standardized photo protocol. A metric reference can be place next to the dens/nest before the photography. An information slip recording geographic coordinate, date, photographer must be noted to each photograph. The samples should be sharing and evaluated by specialist to do a correct identification of the animal.

The presence of USp can be proven through photographic records of active dens and/or nests with their respective geographic coordinate.

4.2.4. BIOACOUSTIC SENSORS

[25] Jewell, Z. & Alibhai, S. (2013). Identifying endangered species from footprints. International Society for Optics and Photonics (SPIE) Newsroom, 2013, 1-3.

[26] FIT technology was developed by WildTrack Company and is an Artificial Intelligence tool that identifies species through footprint photographs. More information at: https://www.wildtrack.org/our-work/fit-technology

[27] Bain, K. (2018). Training Manual: Fauna Monitoring in the Karri Forests of Western Australia. Forest Products Commission, Western Australia. Perth

Bioacoustic monitoring is a tool based on technology and analytical approaches. Acoustic data can be collected autonomously and remotely with minimal human effort. This method can be used for any sound-producing species, especially those that are rare, cryptic or difficult to observe. Bioacoustic monitoring through autonomous recording units is becoming increasingly popular to measure metrics such as presence-absence data of species in the environment[28].

A typical equipment to study animal sounds starts with a microphone (or hydrophone) and a recording device. Progressively more specialized material like directional microphones or parabolas may come into use. For ultrasound generated by many insects, bats and marine mammals, 'bat detectors' and specialized equipment for the recording of ultrasounds are needed. The recordings require hard- and software for replay, visualization, and analysis of the signals. The technical workflow in bioacoustics research is sound pick-up, recording, storing, and analysis. More details to use this method can be found in (Obrist et al., 2010) [29]. Each bioacoustic recording sites in the field must have their geographic coordinate registered together with photographic records.

This method can be used to evaluate the presence of the USp in the Project Area.

4.2.5. CAMERA TRAPS

The use of camera traps in conservation projects has grown in recent times because it is a noninvasive and cost-effective technique that provides reproducible and high-frequency monitoring data, and it also allows for observation of natural behavior.

The benefits of using camera traps are[30]:

- Monitors and records for long periods of time.
- Relatively non-invasive.
- Records undisturbed behavior.
- Produces verifiable data.
- Offers a highly repeatable method of data collection.

Camera traps vary a lot in their specifications, and this can have important consequences for how well perform for a given research objective or on a given species. The best approach to identifying which camera trap to choose is to identify the broad type of camera that you require, and then the specific features required to achieve your study's specific aims. Below are some suggestions[8]:

- Most research and monitoring purposes call for a mid- to high-end camera trap, equipped with an infrared flash, large detection zone and fast trigger speed. Important exceptions to this broad

[28] Sebastián-González, E., Pang-Ching, J., Barbosa, J. M., & Hart, P. (2015). Bioacoustics for species management: two case studies with a Hawaiian forest bird. Ecology and evolution, 5(20), 4696-4705.
[29] Obrist, M. K. et al. (2010). Bioacoustics approaches in biodiversity inventories. Abc Taxa, 8, 68-99.
[30] Oliver R. Wearn & Paul Glover-Kapfer. (2017). *Conservation Technology Camera-Trapping*. WWF Conservation Technology Series 1(1). Available at: https://www.wwf.org.uk/sites/default/files/2019-04/CameraTraps-WWF-guidelines.pdf

recommendation include: a white flash (in most cases) for capture-recapture studies, and a video or "near-video" mode for studies intending to use random encounter modeling.

- For mammals or small birds, a high-end camera trap with a good infrared sensor and fast trigger speed is required; white flash should be considered to aid species identifications.
- For arboreal camera-trapping in trees, required camera trap features include a large detection zone, fast trigger and recovery speeds, and wide field of view.
- Ectothermic species remain a challenge for most commercial camera traps, as they traditionally rely on detecting animal movement through temperature variations. Therefore, specific methods, such as deploying them at particular times of the day or using time-lapse, must be combined to overcome this limitation. A more effective alternative could be a direct-trigger setup, such as an active infrared sensor or a pressure pad.
- Environments with high rainfall, snowfall or humidity will be problematic for most commercial camera traps; a high-end camera trap with good protection against the elements is recommended (e.g., a fully sealed casing and conformal coating on the circuit board).
- In hot environments, passive infrared sensors may fail to detect a difference between the surface temperature of target animals and the background; a camera setup with a direct trigger may be more effective.
- In open environments, and when camera-trapping in trees, a high-end camera trap which is less prone to misfires from moving vegetation will be beneficial (although all camera traps are susceptible to this problem); it may also be helpful to use cameras which allow the sensitivity of the infrared sensor to be reduced.
- For camera-trapping in areas which come with a high risk of theft, consider the security options that are compatible with a given camera trap model (e.g., cable locks and security cases).
- It is recommended to use a robust sampling design to capture species detections in a structured way. This design can inform the minimum number of camera traps necessary for a given area and how far apart they should be spaced to avoid pseudoreplication. Considerations of effort required to install, move, and collect cameras in the field is recommended.
- Published studies comparing camera trap models often become quickly out-of-date; a better option is to reach out to the camera-trapping community to gauge opinions about a specific camera trap model for a given task.

Camera traps can be used as a technological technique to facilitate fauna monitoring. To provide the necessary data for implementing the Species Populations parameters requested in Section 4.1.2, the geographic coordinates of each photo/video must be registered automatically in the media generated by the camera. If it is not possible, it is necessary to collect the geographic point of each camera in the field. More details for the use of data from cameras traps can be found bellow:

- Presence or absence data: It is suggested that a carefully planned sampling protocol be drawn up to detect the chosen USp. The sampling design must address camera locations, quantity, spacing and duration of deployment. It is suggested that cameras be positioned where there are natural attractions, such as trails, roads, water sources or other specific features of the habitat, as well as providing artificial attractions, such as olfactory and aromatic baits to increase the probability of detecting the animal[31].

- Size of population: Sampling data using camera traps can be used in statistical models to estimate the size of the population of the chosen USp. These models could be analytical methods that do not depend on individual recognition, such as the random encounter model (REM)[32], the random encounter and staying time model (REST)[33], the association model (AM)[34] and time-to-event model (TTE)[35]. It is noteworthy that if this approach is chosen, the camera traps must be placed randomly with respect to the spatial distribution of USp, so that all individuals are at risk of being detected and the inference obtained from the sample can be unbiasedly extended to the rest of the population. Usually, this is done using a random grid of camera traps or a stratified random sampling. This assumption rules out the use of baited trap cameras or placement of cameras on trails or other special locations. More details about the comparison of these models can be found in Santini et al.(2022)[36]. Another technique to estimate the size of the USp population is through the spatially explicit capture-recapture (SECR) method. SECR analysis requires tagging a sample of individuals and monitoring their presence in multiple surveys and study sites[37].

  Other methods consolidated in the scientific literature for analyzing images sampled by trap cameras can be used to estimate the size of the USp population. In general, we recommend incorporating new technologies such as machine-learning, web-based data entry to help obtain accurate estimative.

- Movement and distribution: The movement of the USp can be estimates by the camera trap distance sampling (CTDS) [38]. Animals are counted during so-called snapshot moments, i.e., at known intervals at which they can be potentially photographed. Each snapshot moment may coincide with an observation of one or more animals. The number of snapshot moments with observations of the same animal crossing the field of view can thus be regarded as an indicator of that animal’s movement speed and behavior.

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[31] Burton, A. et al. (2015). REVIEW: Wildlife camera trapping: a review and recommendations for linking surveys to ecological processes. *Journal of Applied Ecology*, 52,675–685.
[32]Rowcliffe, J. M., Field, J., Turvey, S. T. & Carbone, C. (2008). Estimating animal density using camera traps without the need for individual recognition. *Journal of Applied Ecology*, 45, 1228-1236.
[33] Nakashima, Y., Fukasawa, K. & Samejima, H.(2018). Estimating animal density without individual recognition using information derivable exclusively from camera traps. *Journal of Applied Ecology*, 55, 735-744
[34] Campos-Candela, A., Palmer, M., Balle, S. & Alós, J.(2018). A camera based method for estimating absolute density in animals displaying home range behavior. *Journal of Animal Ecology*, 87, 825-837.
[35]Moeller, A. K., Lukacs, P. M. & Horne, J. S). Three novel methods to estimate abundance of unmarked animals using remote cameras. *Ecosphere*, 9, 735-744.
[36] Santini, G. et al. (2022). Population assessment without individual identification using camera-traps: A comparison of four methods. *Basic and Applied Ecology*, 61, 68-81.
[37] Green, A. M., Chynoweth, M. W. & Şekercioğlu, Ç. H. (2020). Spatially Explicit Capture-Recapture Through Camera Trapping: A Review of Benchmark Analyses for Wildlife Density Estimation. *Front. Ecol. Evol.*, 8.
[38] Howe, E. J., Buckland, S. T., Després-Einspenner, M. & Kühl, H. S. (2017). Distance sampling with camera traps. *Methods Ecol. Evol*. 8, 1558–1565.

The distribution of USp can be estimated through the hierarchical modeling approach[39]. This modeling requires that the ecological process that influences occupancy be modeled separately from the observation process[40].. Other analyze methods consolidated in the scientific literature that use images sampled by trap cameras can be used to estimate the movement and distribution of the USp population.

This Biodiversity Protocol entails that camera-trap-based monitoring will provide a foundation for long-term research of numerical trends and demographic patterns. Furthermore, this technology can offer additional benefits to Project Activities such as:

- The captivating images and videos of USp are effective for public engagement and environmental awareness, contributing to Project Activities in USpToC.
- The camera traps can be used as surveillance tools in the Habitat Area, addressing item 4.2, **especially to combat illegal hunting and deforestation, as per each individual USpToC.**

4.2.6. TELEMETRY

Telemetry can be used to monitor movement and distribution of the USp, the parameter mentioned in item 4.1.2.3 of this Biodiversity Protocol. Wildlife tracking technologies have been used to estimate home-range size, daily and dispersal movement distances, and habitat associations. Radiotelemetry, including very-high frequency (VHF) and Global Positioning Systems (GPS), provides the opportunity to monitor and map detailed movements of the most highly mobile and cryptic animals. These data provide the opportunity to answer behavioral and ecological questions and to promote quantitative and mechanistic analyses. Telemetry provides the ability to remotely monitor elusive, wide-ranging species while they conduct their normal movements and activities, and, through active, near-continuous tracking, can reveal details that spatially stationary camera-trap stations will not[41].

To use this method, the animals are captured, manipulated, and carry the transmitter over an extended period. Many capture methods can be used, and these differ according to the characteristics of the environment where the animals are[42]. The installation of biotelemetry sensors must be preceded by authorization of public environmental authorities and wildlife management and the data collected with the sensors must be included in wildlife management reports submitted to the responsible environmental agencies.

It is strongly recommended that all studies involving radiotelemetry of wildlife be subjected to peer and veterinary review before commencement, this review should include consideration of research objectives and methods, assessment of expected ecological effects, approvals, and authorization from public

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[39] Ahumada J.A., Hurtado J., & Lizcano D. (2013). Monitoring the status and trends of tropical forest terrestrial vertebrate communities from camera trap data: a tool for conservation. *PLoS ONE*. 8. 7

[40] Steenweg R. et al. (2016). Scaling-up camera traps: monitoring the planet's biodiversity with networks of remote sensors. *Frontiers in Ecology and the Environment*. 15 (1), 26-34.

[41] Cagnacci F., Boitani L., Powell RA & Boyce MS. (2010). Animal ecology meets GPS-based radiotelemetry: a perfect storm of opportunities and challenges. *Philos Trans R Soc Lond B Biol Sci*. 65(1550):2157-62.

[42] Gutema, T.M. (2015). Wildlife radio telemetry: use, effect and ethical consideration with emphasis on birds and mammals. *Int J Sci Basic Appl Res*, 24(2), 306-313.

environmental authorities, as well as relevant organizations for wildlife management, consulting experienced researchers about transmitter weight, method of attachment and capture protocol. Radiotelemetry use should assure that the animals are affected as little as possible by the transmitter and are handled humanely and efficiently during the transmitter attachment procedures.

Telemetry equipment can collect samples of animal locations systematically throughout the day and night with high precision. These data can be analyzed using kriging or nonlinear generalized regression models to estimate the movement and distribution of USp[43]. Other analyze methods consolidated in the scientific literature that use telemetry data can be used to estimate the movement and distribution of the USp population.

4.2.7. DRONES

Currently, drones are used as an important monitoring tool in biodiversity and conservation studies. Below are some precautionary principles listed to guide the application of the use of drones in the development of this Biodiversity Protocol[44].

- Increased care is required in cases involving threatened animals or sensitive habitats.
- Choose a sensor that allows sufficient data collection from a safe distance.
- Choose the right drone to reduce sound and visual stimuli to a minimum for both target and non-target organisms. Consider modifying the drone if necessary to reduce noise and interference.
- Characterize the noise profile of the drone of your interest while also considering the auditory extension of the species surveyed.
- Test and evaluate the response of the species to the drone and minimize behavioral changes of the animal in response to the drone.
- Determine the take-off and landing locations in advance and make sure they are away from the animals (out of sight if possible).
- Avoid threatening approach trajectories and develop protocols that minimize interference with your target species and those who live nearby.

Even though it is a promising technology that promotes cost reduction in a significant way and improves the delivery of results, it is still necessary that legal, regulatory, and ethical issues of use of this technology be considered, such as:

- Drone use must be in accordance with approved regulatory and institutional licenses.
- Observe local restrictions and national laws.
- Keep records of maintenance and flights.
- Seek flight approval with indigenous or local communities when appropriate.

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[43] Hebblewhite M. & Haydon D.T. (2010). Distinguishing technology from biology: a critical review of the use of GPS telemetry data in ecology. *Phil. Trans. R. Soc*. B3(65),2303–2312.
[44] Duffy, J.P., et al.(2020). *Drone Technologies for Conservation*. WWF Conservation Technology Series 1(5).

Drones can be used as a technological technique to facilitate fauna monitoring. The spatial data used to do the sampling design of the use of drone and the drone track in the field must be registered to provide the necessary data for implementing the Species Populations parameters requested in Section 4.1.2. More details for the use of data from drones can be found bellow:

- Presence or absence data: The increase range of drone models allows adaptation of the airframe and sensors carried to the specific needs of the study project, the target species or the climatic conditions and temperature range of the environment in which the drone will be operated[45]. The presence of USp can be realized with the help of learning algorithms that perform automated detection of target species with the visible spectrum and thermal videos recorded during aerial surveys[46]. Other methods consolidated in the scientific literature that use drone data can be used to detected presence of the USp.

- Size of population: Automatically detecting and counting species with drones has the potential to increase the accuracy of population estimates[47]. However, these tools remain limited by how species can be recognized against their habitat's typical background and to what extent opaque habitats cover parts of a surveyed population[48].

- Movement and distribution: Software has been developed to track the movement, body orientation and approximate visual fields of individuals from drone footage[49]. Drones may even track and monitor groups independently, as demonstrated by attempts to equip drones with radio-telemetry sensors that automatically find and follow tagged individuals[50,51].

4.2.8. ENVIRONMENTAL DNA (eDNA)

eDNA method have advantages over conventional collection-based biomonitoring methods in many aspects, such as higher accuracy of species detection and non-destructivity. Among these advantages, the most important one is probably that it does not require specialist knowledge, techniques, or tools in field work. The field survey can be done without field specialists because it is basically collect water samples, and organisms are identified based on genetic information. By maximizing these advantages, eDNA surveys can be labor-saving, resulting in more survey opportunities with low-cost budgets, allowing multiple-site and high-frequency surveys.

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[45] Linchant, J., Lisein, J., Semeki, J., Lejeune, P. & Vermeulen, C. (2015). Are unmanned aircraft systems (UASs) the future of wildlife monitoring? A review of accomplishments and challenges. *Mammal Review*, 45, 239–252.
[46] Corcoran, E., Winsen, M., Sudholz, A. & Hamilton, G. (2021). Automated detection of wildlife using drones: Synthesis, opportunities and constraints. *Methods in Ecology and Evolution*, 12, 1103–1114.
[47] Dujon, A. M. et al.(2021). Machine learning to detect marine animals in UAV imagery: Effect of morphology, spacing, behaviour and habitat. *Remote Sensing in Ecology and Conservation*, 7, 341–354.
[48] Schad, L. & Fischer, J. (2023). Opportunities and risks in the use of drones for studying animal behaviour. *Methods in Ecology and Evolution*, 14(8), 1864-1872.
[49] Graving, J. M. et al.(2019). DeepPoseKit, a software toolkit for fast and robust animal pose estimation using deep learning. *ELife*, 8, e47994.
[50] Cliff, O. M., Saunders, D. L. & Fitch, R. (2018). Robotic ecology: Tracking small dynamic animals with an autonomous aerial vehicle. Science Robotics, 3, eaat8409.
[51] Hui, N. T. et al.. (2021). A more precise way to localize animals using drones. *Journal of Field Robotics*, 38, 917–928.

To this tool be used to detect the presence of USp, each water sample must have their geographic coordinate collected in the field together with photographic records. Methodological details including the selection of sampling sites, sampling methods, filtration methods, DNA extraction, species-specific detection by real-time polymerase chain reaction hit can be found in the manual for environmental DNA research[52].

4.3. UMBRELLA SPECIES HEALTH SCORING METHOD

4.3.1. CALCULATING THE UMBRELLA SPECIES HEALTH SCORE

The tables below are a general overview of the scoring system.

Ecosystem Structure Section 4.1.1	Acronym	Score
Habitat Area	HA	Number of hectares.

Species Populations Section 4.1.2	Acronym	Score
Presence or Absence data	PA	2 points when present.
Size of the population	SP	1 point per individual/group in the area.
Movement	MO	1 point per individual/group monitored in the area.
Monitoring Methods	MM	1 point per monitoring methods implemented

The formula below considers the score obtained in each of the parameters arranged in this chapter in Sections 4.1.1 and 4.1.2.

The USH scoring shall be applied within the following equation:

$$USH = (PA + SP + MO + MM)$$

USH = Umbrella Species Health indicator.
SP = Size of the population.
PA = Presence or Absence data.
MO = Movement.
MM = Monitoring Methods

If there is no confirmation of the USp presence (PA) then the Project will not be eligible to continue in the validation and verification process of this Biodiversity Protocol. The Biodiversity Protocol allows for up to 2 years without evidence of presence, but verification can only proceed when proof of presence is provided.

[52] Minamoto T. et al. (2020). An illustrated manual for environmental DNA research: Water sampling guidelines and experimental protocols. *Environmental DNA,* 8-13.

Size of Population (SP) cannot be more than the capacity of the territorial area specified at the PP Umbrella Specie Section. For example, the jaguar has a territorial area of 100km² (10,000 ha) therefore if the habitat area has 50.000 ha, the maximum number of jaguar (SP) should be 5 individuals. Project Proponent's should use the best available scientific research to establish the carrying capacity. If this data is unavailable at the time of monitoring, than it can be unconsidered and included in the Theory of Change.

For species that live in groups, such as the Gorillas or Mandrills, which can move in troops of up to 200 individuals, the Biodiversity Protocol will consider the group as a single unit instead of counting each individual separately. This reflects a more realistic and accurate approach for social species whose group dynamics are essential for their survival and natural behavior. For example, if a specific area has the territorial capacity for a troop of mandrills, the group size will be considered as a whole, respecting the area's carrying capacity, rather than limiting the number of individuals as if they were territorial species like the jaguar. In this way, the territorial capacity specified in the PP Usp Section will be adjusted to reflect the social structure and spatial needs of group-living species.

4.3.2. CALCULATING THE UMBRELLA SPECIES HEALTH FACTOR

The USH Factor represents the project's success in improving or maintaining Umbrella Species Health. This factor contributes to the final credit calculation by quantifying the project's direct impact on the target species, ensuring that species-specific outcomes influence credit issuance.
The USH Factor incentivizes continuous improvement in Umbrella Species Health throughout the project's lifetime while acknowledging the inherent variability in ecological systems. Comparing the current year's USH score to the first-year baseline quantifies relative improvement. The factor ranges from 0.5 for no improvement to 1.0 for over 100% improvement, rewarding progressive enhancements in species health indicators.

This approach avoids penalizing projects for maintaining consistent USH levels; the minimum 0.5 factor ensures projects receive substantial credit for their conservation efforts even without improvement. Ecological improvements often plateau, particularly in well-managed habitats. The 1.0 cap for improvements over 100% recognizes that exponential growth in species health rarely occurs and may not benefit many ecosystems. The final credit calculation balances this cap by incorporating other factors and Habitat Area, allowing larger or more complex projects to increase their credit yield through alternative means.

Percent improvement compared to Year 1	USH Factor
No improvement	0.5
1-25% improvement	0.6
26-50% improvement	0.7
51-75% improvement	0.8
76-100% improvement	0.9

> 100% improvement	1.0

$$Improvement = \left(\frac{Current}{Baseline}\right) \times 100$$

USHCurrent = The USH score for the current monitoring year
USHBaseline = The USH score for the baseline year defined as the first monitoring year

The USH Factor is determined using the table above.

$$USH_{factor} = Score\ based\ on\ Improvement$$

5. EVALUATING HABITAT QUALITY AND DEVELOPMENT OF THE MONITORING PLAN

Habitats with high quality have the ability to maintain their structure (organization) and function (vigor) over time under external stress and maintain equilibrium (resilience). Habitat Quality represents the sustainability of an ecosystem as a whole that needs minimal external support through management measures[53].

As habitat quality cannot be measured or observed directly, surrogate measures (indicators) must be applied to assess it. These indicators must be supported by ecological principles and systems theory and must be

[53] Hodgson, J. A., Moilanen, A., Wintle, B. A., & Thomas, C. D. (2011). Habitat area, quality and connectivity: striking the balance for efficient conservation. Journal of Applied Ecology, 48(1), 148-152.

suitable for applications at varied temporal and spatial scales. The EBVs parameters will also be used to assess habitat quality[54].Two classes of EBV will be considered:

- Community composition
- Ecosystem functioning

From these classes, specific EBVs were chosen to provide the Biodiversity Protocol an accessible framework for monitoring:

- Community composition, characterized by the
  - Taxonomic diversity
- Ecosystem functioning, characterized by the
  - Ecosystem disturbance mitigation

This chapter presents parameters of the HQ indicator and scoring method. This Biodiversity Protocol provides the framework for Usp conservation projects to maintain monitoring practices of the HQ throughout the Project Timeframe, **creating continuous production of scientific knowledge, enhancing data about HQ, and offering important inputs for conservation strategies across diverse bioregions and landscapes.** The data produced considering HQ shall be reported in the Monitoring Reports. All monitoring data must be anchored on Regen Ledger to ensure transparency, traceability, and permanence. Projects are encouraged to use the Data Stream feature on their Regen Marketplace page to share data publicly, but may also leverage other tools or platforms, provided the data remains anchored on Regen Ledger and is publicly accessible. Certain sensitive data may be marked as "available upon request", with ownership and access conditions clearly specified.

5.1. COMMUNITY COMPOSITION

The term community means a set of species that occur in the same place and that can interact strongly as consumers and resources or as competitors. Understanding how communities vary from place to place is the first step in understanding the processes that influence the structure and functioning of ecological systems. The focus of this Biodiversity Protocol is to evaluate the community composition through the parameter of taxonomic diversity. Knowing the taxonomic diversity in the Project Area helps to understand which species are being influenced by the presence of the USp.

5.1.2 TAXONOMIC DIVERSITY

Taxonomic diversity is quantitatively measured using two parameters: 1) species richness, that is, the number of species, and 2) diversity of species, that is, indices that describe the relationship between richness and the distribution of relative abundance of species in the habitat area[55]. Diversity indices assess, in addition to richness, the dominance or rarity of species in the community. The two most used diversity indices are:

[54] Pereira, H.M. et al.(2013). Essential biodiversity variables. Science, 339, 277–278.
[55] Magurran, A. E., & McGill, B. J. (Eds.). (2010). Biological diversity: frontiers in measurement and assessment. OUP Oxford.

Shannon-Wiener Index (H’)

Quantifies the uncertainty associated with predicting the identity of a species given the number of species and the distribution of abundance for each species. This index is more sensitive to changes in rare species in the community.

$$H' = -\sum_{i=1}^{S} pi * lnpi$$

where:

H' = does not have a maximum value and its interpretation is comparative, with higher values indicating greater diversity.

pi = relative abundance of each species, calculated as the proportion of individuals of a species to the total number of individuals in the community.
ln = natural logarithm, but other logarithmic bases can be used.

Simpson Index (D)

Quantifies the probability that two individuals randomly removed from the community belong to the same species. This index is a measure of dominance.

$$D = \sum_{i=1}^{S} pi^2$$

where:

D = varies from 0 to 1, with values close to 1 indicating less diversity while values close to 0 indicate greater diversity.

pi = relative abundance of each species, calculated as the proportion of individuals of a species to the total number of individuals in the community.

Taxonomic diversity in this Biodiversity Protocol must be determined through the calculation of species richness and by some diversity index of the inventoried species. The indexes can be those exemplified above or any other that has scientific proof of use.

The Project Developer and Project Proponent must choose how the fauna inventory will be done in according to the available financial resources and workforce. This Biodiversity Protocol considers mammal species inventory mandatory to determine the taxonomic diversity. Other groups inventories are optional, for example, arthropods, fish, birds, insects, reptiles, amphibians, can be sampled to estimate the taxonomy diversity of the community.

There are several methodologies to sample each group based on approaches from the scientific literature[56]. Techniques include direct observations by the sighting and listening to the animal, and/or indirect evidence by the traces such as feces, fur, feathers, nests, footprints. More details about monitoring methods can be found in the Section 4.2 of this Biodiversity Protocol. The minimum sampling effort must be 5 days in each seasonal climatic period. The 5-day minimum quantity may vary depending on the inventory area. For example, if the area is very large, more days of sampling effort must be made. The fauna inventory can be carried out by researchers or specialist professionals. It is recommended to hire other collaborators, such as, indigenous peoples and people with knowledge of local nature.

The report must contain the Biodiversity Protocol used for the survey and all results of the taxonomic diversity in the community inventoried. It is suggested that the inventory results be presented in accordance with the sampling design of the field survey. All these information must be included in the Monitoring Reports.

The species inventoried must be classified in according to conservation and endemism status in a global and local scale. The IUCN Red List of Threatened Species and official state lists (according to the legislation of each country) can be used to do this classification. These data are of great relevance for the creation of protection and conservation areas. The results must be included in the Monitoring Reports.

This Biodiversity Protocol considers it mandatory to determine the taxonomic diversity in the Project Area. Compliance with this parameter scores **1 point (per seasonal climatic period)** in the equation of the Section 5.3.

5.2. ECOSYSTEM FUNCTIONING

Ecosystem functioning reflects the collective life activities of plants, animals, and microbes and the effects these activities have on the physical and chemical conditions of their environment. Ecosystem functions are an integral part of biodiversity, and can thus be broadly defined as the biological, geochemical and physical processes that take place or occur within an ecosystem[57].

Biodiversity is a key driver of ecosystem functioning, while disturbances are a key driver of biodiversity. Consequently, disturbances crucially influence ecosystem functioning, both directly via affecting ecosystem processes but also indirectly via altering biodiversity[58]. Therefore, the focus of this Biodiversity Protocol is evaluated the ecosystem functioning through an ecosystem disturbance mitigation.

5.2.1. MITIGATION MEASURES OF ECOSYSTEM DISTURBANCES

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[56] Van Horne P. et al. 2005. Multiple species inventory and monitoring technical guide. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5162596.pdf

[57] Tilman, D., Isbell, F. & Cowles, J. M. (2014). Biodiversity and ecosystem functioning. Annual review of ecology, evolution, and systematics, 45, 471-493.

[58] Banitz, T., Chatzinotas, A. & Worrich, A. (2020). Prospects for integrating disturbances, biodiversity and ecosystem functioning using microbial systems. Frontiers in Ecology and Evolution, 8, 21.

Species coexist in space and time through interactions with each other and with abiotic factors. One of the ways in which these networks of interactions undergo modifications is through disturbances that can affect the entire biological organization, causing changes in ecosystems[59].

These disturbances can be defined as an abrupt event that causes changes in the physical structure of the environment such as vegetation and soil surface, which can cause a reallocation of the resources of a system[60]. To be characterized as a disturbance, the event needs to be abrupt, compared to gradual changes like seasons.

Disturbances can be caused by natural and/or human causes[61]. Natural disturbances have natural causes such as climate, geological forces or biological changes. Fires (lightning strikes) and floods are examples of natural disturbances that force changes in an ecosystem. They are also caused by diseases, severe storms, insects outbreaks, volcanic activity, earthquakes, droughts and long-term freezing.

However, not all changes in an ecosystem are caused by natural forces. Ecosystems are also affected by humans, and examples are pollution, urbanization, deforestation, mining, etc.

The occurrence of a disturbance can harm or benefit species. Thus, some groups will suffer reduction and others will increase their population, benefiting from the new conditions.

This Biodiversity Protocol considers, as an important factor, the environmental characterization after the occurrence of a disturbance within the Project Area and/or of direct influence on the habitat areas of the umbrella species in order to understand which impacts can directly affect the permanence of the species in the area and ecosystem response. Also, mitigation strategies should be implemented to minimize disturbance.

The disturbance monitoring must be done through geospatial analyses. High-resolution satellite images (minimum of 0.30 centimeters, maximum of 15 meters) together with official databases from the monitoring period should be used. Also, for identify conversions of vegetated areas into non-vegetated areas can be consulted official deforestation databases. Official alerts, such as Fire Information for Resource Management System from NASA[62], must be used to identify occurrences of fire disturbances. Climatic and hydrologic disturbances can be monitored through WorldClim database[63]. This monitoring must be done in each seasonal climatic period after the occurrence of a disturbance event during the monitoring period to be verified.

It is necessary to quantify the size of the disturbed area and create a spatial file (shapefile, KML, KMZ, others geospatial extensions) of the corresponding area. Other information must also be recorded, such as date of

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[59] Wohlgemuth, T., Jentsch, A. & Seidl, R. (2022). Disturbance Ecology: A Guideline. In Disturbance Ecology (pp. 1-7). Cham: Springer International Publishing.
[60] White, P.S. & Jentsch, A. (2004). Disturbance, succession and community assembly in terrestrial plant communities.
[61] Wohlgemuth, T., Jentsch, A., & Seidl, R. (2022). Disturbance Ecology: A Guideline. In Disturbance Ecology (pp. 1-7). Cham: Springer International Publishing.
[62] https://firms.modaps.eosdis.nasa.gov/
[63] https://www.worldclim.org/

disturbance, location of disturbance, size of disturbance in the Habitat Area, and size of disturbance in the Project Area. The results of the disturbance monitoring with a brief description of the disturbance, possible environmental impacts and corrective mitigation measures must be recorded.

This Biodiversity Protocol considers mandatory to monitor disturbances; however, if there is a disturbance event, environmental characterization and the implementation of mitigation strategies are optional but highly recommended.

The scoring for the equation in Section 5.3 is as follows for each monitoring year:

- Zero (0) points if there is a disturbance(s) and no mitigation measures were implemented by the land steward
- One (1) point if there is a disturbance within the project area but corrective mitigation measure were adopted by the land steward.
- Two (2) points if there is no disturbance in the project area, because it is assumed that proper mitigation measures were adopted by the land steward.

5.3. HABITAT QUALITY SCORING METHOD

5.3.1. CALCULATING THE HABITAT QUALITY SCORE

The formula for HQ considers the score obtained in each of the parameters arranged in Chapter 5. The table below is a general overview of the scoring system.

Community Composition Section 5.1	Acronym	Score
Taxonomy diversity	TD	1 point for each mammal inventory carried out per seasonal climatic period + 1 point per optional inventory carried out

Ecosystem Functioning Section 5.2	Acronym	Score
Ecosystem disturbance	ED	1 point for each disturbance reported with the corrective mitigation measures of the area after the occurrence of an event

The equation for HQ considers the score obtained in each of the parameters arranged in this chapter:

$$HQ = (TD + ED)$$

Being,

HQ = Habitat Quality

TD = Taxonomy diversity – Section 5.1

ED = Ecosystem disturbances – Section 5.2

5.3.2. CALCULATING THE HABITAT QUALITY FACTOR

The HQ Factor mirrors the USH Factor approach, reflecting Habitat Quality improvements compared to the baseline year. The HQ Factor signifies the project's effectiveness in enhancing or preserving Habitat Quality. Like the USH Factor, the HQ factor is included in final credit calculation to ensure broader ecosystem improvements, which support the Umbrella Species and other biodiversity, are adequately recognized and rewarded. The 0.5 to 1.0 range correlates to the percentage improvement in HQ scores. This structure incentivizes projects to enhance overall habitat quality while valuing the maintenance of high-quality habitats.

The 0.5 minimum factor for no improvement prevents undue penalization of projects maintaining already high-quality habitats. This proves particularly important where optimal habitat conditions exist and further improvement might yield marginal or potentially unnecessary ecological changes. The 1.0 upper limit for over 100% improvement acknowledges the natural ceiling to habitat quality enhancements. This cap discourages overemphasis on unrealistic or potentially detrimental habitat alterations. Within the overall credit calculation, this balanced approach rewards both improvement and maintenance of high-quality habitats.

Percent improvement compared to Year 1	HQ Factor
No improvement	0.5
1-25% improvement	0.6
26-50% improvement	0.7
51-75% improvement	0.8
76-100% improvement	0.9
> 100% improvement	1.0

$$Improvement = \left(\frac{Current}{Baseline}\right) \times 100$$

HQCurrent = The USH score for the current monitoring year
HQBaseline = The USH score for the baseline year defined as the first monitoring year

The HQ Factor is determined using the table above.

$$HQ_{factor} = Score\ based\ on\ Improvement$$

6. UMBRELLA SPECIES THEORY OF CHANGE DEVELOPMENT AND APPLICATION

For the implementation and development of this Biodiversity Protocol, in addition to the score and requirements set out in this main overarching document, as per the requirements addressed in Chapters 4 and 5, for USH and HQ, there is the development and application of specific theory of change for each project, addressing the complexity and specificity of the challenges inherent to each project, USp, ecosystem, and habitat, ensuring a tailored approach that considers local nuances and community needs for more effective conservation outcomes.

This chapter presents:

- Understanding the Theory of Change (ToC) Framework.
- Process of developing a USpToC.
- Scoring method for this chapter.

6.1. THE THEORY OF CHANGE (ToC) FRAMEWORK

The Theory of Change (ToC) framework is a process used in project planning and evaluation to link program goals to specific interventions and outcomes. It ensures transparency and clarity throughout the process. ToC uses backwards mapping requiring planners to think in backwards steps from the long-term goal to the intermediate and then early-term changes that would be required to cause the desired change. This creates a set of connected outcomes known as a “pathway of change”.

A “pathway of change” graphically represents the change process as understood by the initiative planners and serves as the framework around which the other elements of the theory are developed. A ToC is divided into five steps, which are outlined in general terms below[64]:

1.**Long-Term Goals**: Stakeholders articulate their long-term impacts they desire with their conservation project.

2.**Desired Outcomes**: They identify conditions necessary for achieving those goals, modeling them as desired outcomes.

3.**Interventions**: The theory describes the interventions, activities or practices that will be adopted by the land steward that lead to the depicted outcomes, through the proposed “pathway of change”.

4.**Indicators (outputs)**: Each intervention has a quantitative indicator to measure success.

5.**Adaptive Management**: As implementation proceeds, data on key indicators are collected to monitor progress. Adjustments are made based on what works and what doesn’t.

6.2. DEVELOPING THE UMBRELLA SPECIES THEORY OF CHANGE (USpToC)

The process of developing the Umbrella Species Theory of Change (USpToC) is crucial for tailoring conservation efforts to the unique realities of each project, species, ecosystem, and habitat. This section aims to break down these steps in detail, focusing on their application within the Biodiversity Protocol.

6.2.1. IDENTIFYING THREATS TO UMBRELLA SPECIES

This section presents the framework for the Project Proponent to identify threats, agents, and causes of habitat destruction or degradation as well as create a plan to address these threats through the implementation of Project Activities in the Project Area.

This Biodiversity Protocol identifies three main systemic causes of direct threats to USp, being: **(i)** Deforestation and Forest Degradation; **(ii)** Fires; and **(iii)** Illegal Hunting. Addressing these causes with assertive and strategic actions will ensure the long-term success of USp conservation projects. Project Proponent is free to list more than one of the causes, as deemed fit in accordance with Project´s circumstances.

[64] www.theoryofchange.org

Project Activities that are prescribed in the USpToC that address the threats to USp described in this section will be mandatory as per the 1st Monitoring Period of the Project.

Below are some exemplifications of strategies that might be addressed in the USpToC, pertaining to the specificities of the USp and bioregional aspects of such threats under analysis.

(i) Deforestation and Forest Degradation

- Security patrols and surveillance inside the Project Area.
- Use of remote sensing tools to identify deforestation and forest degradation.
- Use deforestation detection technologies such as bioacoustics to identify agents, including machinery sounds, such as tractors or chainsaws.

(ii) Fire Management [65]

- Water truck availability.
- Creation of fire breaks and constant maintenance.
- Trained local fire brigade with equipment available for use.
- Observation towers to detect fire outbreaks.
- Sensors with alerts to detect fire prone conditions.
- Use of technologies such as drones for fire detection or data from a host country's national fire monitoring database.

(iii) Illegal Hunting[66]

- Security patrols and surveillance inside the Project Area.
- Environmental education strategies raising community awareness.
- Insertion of information panels at strategic points of the Project Area showcasing poaching and fauna interference prohibition.
- Use deforestation detection technologies such as bioacoustics to identify gunshots and other associated sounds.

6.2.2. CONSULTATION PROCESS FOR ADAPTING STRATEGIC LINES AND INTERVENTION ACTIONS

[65] Some ecosystems have natural fire dynamics, such as the Brazilian Cerrado Biome. In this context, we are referring to the prevention of man-made fires, or fires outside the ecosystem's standards, which must be properly managed to avoid habitat damage.

[66] Hunting and fishing can be part of the livelihoods of local communities, and when related to food supply and cultural values, they are legalized in several states. Usually carried out on an isolated basis and with low frequency, these activities have a low impact on the local biodiversity. However, illegal hunting for sale or leisure has a high impact to local biodiversity since it is carried out frequently and for commercial purposes. Poaching causes predation of animal species and prevention and mitigation measures must be set to avoid illegal activities.

The USpToC provides a system of continuous improvements to the USH and HQ of the Project Area, besides building and improving interactions between humans and animal communities, especially considering the USp. Each project will have specific strategic lines developed through a collaborative process, ensuring flexibility and relevance. Additionally, new strategic lines may be added as needed to address unique project requirements, making the approach more adaptable and inclusive.

To develop the ToC based on this Biodiversity Protocol, follow these steps:

Step 1: Long Term Goals
The land steward, project developer, and applicable stakeholders discuss, agree on, and get specific about the long-term goals for the conservation of the selected Umbrella Species. Setting clear desired impacts is crucial.

Step 2: Desired Outcomes
Building upon the initial framework, continue mapping backwards until a comprehensive framework is established. This may require identifying root causes and detailing early and intermediate steps toward the long-term goal.

Step 3: Interventions
Detail the activities and practices to be implemented to achieve the desired outcomes.

Step 4: Indicators (Outputs)
Add details to the change framework by focusing on measuring implementation. Remember that evidence must be provided by the land steward or the project developer to prove to the auditor that the intervention took place, in the Project Area, and on the communicated date.

Step 5: Adaptive Management
Adaptive management is a structured, iterative approach to decision-making that emphasizes learning from the outcomes of previous actions to improve future management practices. It involves continuously monitoring and adjusting strategies in response to new information and changing conditions.

For more information on how to create a ToC and tips for the consultation process, visit:

- Center for Theory of Change
- United Nations Development Assistance Framework

6.3. USPTOC SCORING METHOD & SCORING FACTOR

The scoring method for the Umbrella Species Theory of Change (USpToC) is based on the implementation of Intervention Activities described in each strategic line. The score will be determined by the number of intervention actions carried out during the monitoring period, with 1 point awarded for each implemented action.

The implementation of actions must be properly documented and evidenced for verification both in the Monitoring Plan, within the Umbrella Species Credit Calculator and in the Monitoring Report, as demonstrated by the provided templates.

The USpToC Factor measures the project's adherence to its planned conservation activities. By incorporating this factor into the final credit calculation, the Biodiversity Protocol rewards projects for following through on their commitments and implementing targeted conservation actions. The USpToC Factor calculation uses the ratio of implemented Intervention Activities to total proposed activities in the Umbrella Species Conservation Planning Spreadsheet. This method links credit issuance directly to the implementation of conservation actions, rewarding projects based on their follow-through of planned interventions.

Unlike the USH and HQ factors, the USpToC factor lacks a predetermined minimum or maximum. This design choice reflects the importance of project-specific conservation actions and accommodates diverse conservation strategies. It encourages projects to set ambitious yet achievable goals, as the factor can reach 1.0 when projects implement all planned activities. This approach balances standardization across projects with recognition of unique conservation contexts requiring varied levels of intervention.
The factor score for USpToC is given by the following equation:

USpToCFactor =PO/PT

Where:
PO = Points obtained from the sum of Intervention Activities implemented by the project to date
PT = Total number of Intervention Activities proposed in the USp Credit Calculator for the entire project

7. BIODIVERSITY CREDITS ISSUANCE

7.1. CREDIT CALCULATION

The final credit calculation integrates the Biodiversity Protocol's three key components - Umbrella Species Health, Habitat Quality, and Theory of Change implementation - into a comprehensive metric. Taking the geometric mean of the three factors and multiplying by the Habitat Area ensures equal weighting of all project aspects in credit issuance.

This holistic approach incentivizes balanced improvement across all project areas, preventing overperformance in one area from compensating for underperformance in another.
The biodiversity credits emission will be calculated using the formula below:

$$Final\ Number\ of\ Biodiversity\ Credits\ Issued\ = \left(\frac{USH_{factor} + HQ_{factor} + USpToC_{factor}}{3}\right) \times HA$$

Where:
USHfactor was calculated at Section 4.4.
HQfactor was calculated at Section 5.3.
USpToCfactor was calculated at Section 6.3.
HA is the Habitat Area

The geometric mean's use significantly impacts the final calculation if any factor falls notably lower than others, encouraging high standards across all areas.

Habitat Area serves as a multiplicative component in the final calculation, rather than a factor, to directly scale credit issuance with project size. This approach recognizes that larger conserved areas generally provide greater ecological benefits and face increased management challenges. The multiplicative effect ensures that projects can increase their credit yield through expansion of protected areas, even when other factors reach their maximum values. This method balances the need to reward quality improvements with the importance of quantity in conservation efforts.

This balanced, multifaceted credit calculation approach reflects biodiversity conservation's complexity. It rewards improvement and maintenance of high-quality habitats and species populations while encouraging implementation of well-planned conservation strategies. The resulting credit issuance system accurately represents overall ecological impact and conservation success, adapting to various project sizes and context.

The factor-based approach standardizes credit calculations across diverse project types and sizes. Factors convert absolute improvements into relative measures, allowing fair comparison between projects with different baselines or scales. This method incentivizes continuous improvement regardless of a project's starting point, while acknowledging that ecological enhancements often follow non-linear trajectories. By using factors, the Biodiversity Protocol adapts to various conservation contexts while maintaining a consistent framework for credit issuance.

The figure below has a scheme of the total biodiversity credits that is possible to issue.

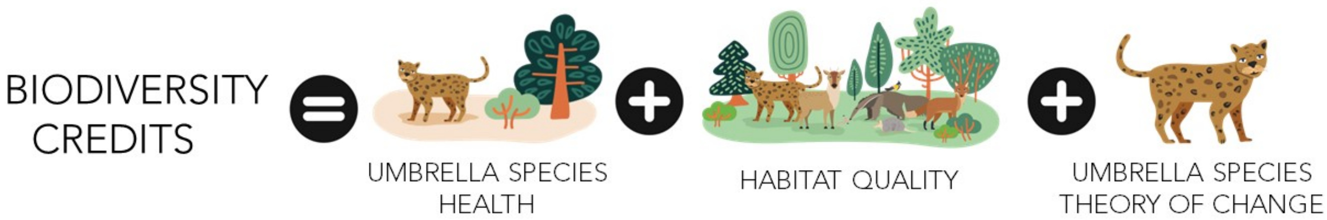

Figure 4 *Biodiversity credits calculation summary*.

All calculations must be done for a year period even though the verification can be done annually or every two years.

It is mandatory to calculate the price per credit based on the USp Credit Calculator provided as an attachment to this Biodiversity Protocol.

7.2. PROJECT COST & CREDIT PRICE CALCULATION

The pricing of USS credits under this Biodiversity Protocol is designed to reflect the true cost of implementing conservation activities while providing a transparent and fair mechanism for all stakeholders.

To ensure consistency and accuracy in pricing, all projects must use the Umbrella Species (USp) Credit Calculator provided with this Biodiversity Protocol to transparently report credit prices. This section outlines the process for calculating credit prices.

7.2.1. PRINCIPLES & REASONING

The pricing for USS credits under this protocol is designed with several key principles in mind:

1. **Cost-Based Pricing**: Credits are priced based on actual implementation costs to ensure they represent real conservation efforts. This approach prevents the credits from becoming speculative assets and maintains their integrity as representations of concrete conservation actions.
2. **Transparency**: By requiring detailed cost reporting, the Biodiversity Protocol fosters trust among stakeholders and enables informed decision-making by credit buyers.
3. **Fair Compensation**: The pricing structure balances the need to incentivize project developers with the goal of maximizing funds directed towards conservation activities.
4. **Performance Incentives**: The variable profit margin mechanism encourages continuous improvement in conservation outcomes by linking financial rewards to ecological performance.
5. **Sustainable Funding**: The inclusion of a mandatory credit class fee ensures ongoing support for the protocol and creates a pool of resources for community projects.

This cost-based, transparent approach ensures that credit prices reflect the true value of conservation efforts while providing a sustainable model for long-term ecological stewardship.

7.2.2. CALCULATING TOTAL PROJECT COST

The total project cost for a given monitoring year is divided into two main categories:

A) Project Development Cost (Flat Fees)

Flat fees are fixed costs associated with specific project activities or services. These costs are predetermined and do not change based on the total project cost or credit price. They represent direct expenses for project development and implementation and are easier to budget and forecast. Flat fees may include, but are not limited to:

1. Baseline Biodiversity Study (optional)
2. Field Campaign
3. Development of the Umbrella Species Theory of Change (USpToC)
4. Professional Species Guideline Advisory
5. Project Plan and Monitoring Plan creation
6. Implementation of Project Activities
7. Analysis and Monitoring Report preparation
8. Verification
9. Community Benefit Sharing Fund
10. Sales and Marketing expenses

The sum of the flat fees determines the Project Development Cost.

B) Percentage Fees

Percentage fees, in contrast, are calculated as a proportion of the total project cost. They scale with the size and complexity of the project and often represent ongoing or variable costs. Percentage fees include:

1. **Credit Class Fee**: This mandatory 5% fee supports the ongoing maintenance and improvement of the Biodiversity Protocol for Umbrella Species. It also contributes to a community pool that can support smaller projects or those in need of additional resources.

2. **Regen Registry Fee**: This mandatory fee compensates for the services provided by the Registry Agent, as defined in the Regen Registry Program Guide (currently set at 10% of the total project cost). The Registry Agent is responsible for maintaining accurate accounting and ensuring compliance of registered projects, issued credits, and other ecosystem service claims as set forth in the Regen Registry Program Guide, Credit Class, Approved Biodiversity Protocol, and Project Plan. Furthermore, this fee supports the operation and maintenance of the Regen Registry platform, which provides the infrastructure for credit issuance, tracking, and retirement. The exact percentage is set by Regen Registry and may be adjusted over time to reflect operational costs.

3. **Buffer Pool**: This mandatory 12.5% contribution from credit sales revenues is designed to mitigate credit class or project-specific risks related to unintentional or intentional reversal events, as well as

potential overestimation of issued credits. Buffer Pool contributions are held in USDC (a stable cryptocurrency) on Regen Ledger, ensuring transparency, permanence, and auditable balances. These contributions are non-tradable and reserved for potential cancellation within the Registry System. The Buffer Pool is established at the project level, managed under Registry Agent custodianship, with governance by project stakeholders. Detailed mechanisms are outlined in Section 7.2.3.

4. **Sales Commission (optional**): This fee compensates parties involved in marketing and selling the credits. It can be adjusted based on the specific sales arrangement for each project but must not exceed 5% of the total project cost.

5. **Profit Margin**: This fee allows project developers and proponents to earn a return on their investment and effort. It is variable based on project performance to incentivize ongoing improvements in conservation outcomes (See section 7.2.4 for calculation details).

As percentage fees are calculated based on the final total project cost, which includes the percentage fees themselves, the percentage fee must be initially calculated as a percentage of the sum of all flat fees (Project Development Cost, then adjusted to reflect the total project cost. Percentage fees can be calculated using the following formula.

As percentage fees are calculated based on the final total project cost, which includes the percentage fees themselves, an adjustment is necessary. Percentage fees can be calculated using the following formula:

$$Percentage\ Fee\ Amount = \frac{(Project\ Development\ Cost\ \times Percentage)}{(1 - Total\ Percentage)}$$

Where:
- "Percentage" is the specific fee percentage
- "Total Percentage" is the sum of all percentage fees

The total project cost is calculated as follows:

$$Total\ Project\ Cost = Project\ Development\ Cost + Sum\ of\ All\ Percentage\ Fee\ Amounts$$

7.2.3. BUFFER POOL MECHANISM

To ensure financial resilience and the long-term permanence of stewardship actions, a Buffer Pool will be established at the project level. This mechanism safeguards the continuity of conservation efforts and mitigates project-related risks such as unintentional or intentional reversals and overestimation of issued credits.

Contribution and Structure

For each Umbrella Species Stewardship Credit (USp Credit) sold, 12.5% of the transaction revenues will be allocated to the project's Buffer Pool. Contributions are held in USDC (a stable cryptocurrency) and anchored on Regen Ledger to ensure transparency, traceability, and permanence. When credits are sold through the Regen Marketplace, transfers to the Buffer Pool may be automated. For OTC or third-party marketplace sales, the seller is responsible for transferring the required USDC contribution to the Buffer Pool.

Conditions for Use

The Buffer Pool may be accessed to address material risks to project continuity or permanence. Eligible circumstances include difficulty financing verification or third-party audits, unforeseen events requiring urgent conservation expenditures, or budget shortfalls that jeopardize essential stewardship activities.

Access Rules

The Buffer Pool is maintained under the custodianship of the Registry Agent and managed at the project level by project stakeholders, according to governance rules established during project validation. Governance mechanisms must clearly define how decisions are made (e.g., stakeholder voting or consensus rules) regarding access to the Buffer Pool. Access to funds requires transparent justification and stakeholder approval. Up to 60% of the total buffer value accumulated from project credit sales may be accessed, subject to: submission of formal justification and financial disclosure (e.g., proof of insufficient funds relative to operational costs), and a description of the activities to be financed and their relevance to project permanence. The requested amount cannot be included in the valuation model of the USp Credit Calculator. Once requirements are met and approved under the agreed governance mechanism, the Registry Agent will disburse funds within 30 days.

Buffer Reversion

If no disbursement is requested, the unused buffer amount will be returned to the Project Proponent at the end of the credited project timeframe (e.g., five years), unless the project opts to continue into a new cycle. In cases of early project termination, the buffer may be partially or fully redirected to support regional biodiversity stewardship efforts, in alignment with the protocol's purpose.

7.2.4. PROFIT MARGIN MECHANISM

The profit margin percentage fee is a unique feature of this Biodiversity Protocol, designed to incentivize continuous improvement in conservation outcomes. It allows project developers and proponents to earn a return based on project performance, linking financial rewards directly to ecological improvements.

Baseline Year: In the first year of the project, the initial profit margin percentage is set by the project developer and proponent. Unlike other fees, this baseline profit margin refers specifically to the project implementation costs, not to the total project cost. This baseline percentage must be transparently reported in the USp Credit Calculator and may range from 0% to 45%.

Subsequent Years: In following years, the profit margin can increase based on improvements relative to the baseline year. This adjustment is calculated using performance scores derived from the project's Umbrella Species Health (USH), Habitat Quality (HQ), and Umbrella Species Theory of Change (USpToC) factors.

To calculate the profit margin percentage allowed each year:

$$Performance\ Score_{baseline} = \left(\frac{USH_{factor} + HQ_{factor} + USpToC_{facotr}}{3}\right)$$

Where:
USH_{factor} is the factor calculated in Section 4.4. for the baseline year
HQ_{factor} is the factor calculated at Section 5.3. for the baseline year
$USpToC_{factor}$ is the factor calculated at Section 6.3. for the baseline year

$$Performance\ Score_{current} = \left(\frac{USH_{factor} + HQ_{factor} + USpToC_{facotr}}{3}\right)$$

Where:
USH_{factor} is the factor calculated in Section 4.4. for the current year
HQ_{factor} is the factor calculated at Section 5.3. for the current year
$USpToC_{factor}$ is the factor calculated at Section 6.3. for the current year

$$Profit\ Percentage = PMp_{baseline} + \left(\frac{Performance\ Score_{baseline}}{Performance\ Score_{current}}\right) + PMp_{baseline}$$

Where:
$Performance\ Score_{Baseline}$ = performance score for the baseline year
$Performance\ Score_{Current}$ = performance score for the baseline year
$PMp_{baseline}$ = the profit margin percentage set in the baseline year

This mechanism serves several purposes:

1. It provides a financial incentive for project developers to continually improve their conservation outcomes.
2. It aligns the economic interests of project developers with the ecological goals of the project.
3. It rewards projects that demonstrate measurable improvements in umbrella species health, habitat quality, and adherence to their theory of change.

By tying profit to performance, this approach encourages long-term commitment to conservation goals and incentivizes the adoption of best practices in project management and ecological stewardship.

7.2.5. CREDIT PRICE CALCULATION & REPORTING REQUIREMENTS

The USp Credit Calculator must be used as it has all the formulas already built into it. Once the total project cost is calculated, the price per credit is determined by dividing the total project cost by the number of credits issued:

$$Credit\ Price = \frac{Total\ Project\ Cost}{Number\ of\ Credits\ Issued}$$

To ensure transparency and accountability, the following reporting requirements must be met:

1. All costs and fees must be clearly itemized in the USp Credit Calculator. This includes a breakdown of all flat fees and percentage fees.
2. The calculation of performance scores and the resulting adjustment to the profit margin must be clearly shown and explained.
3. The final credit price calculation must be presented, showing how the total project cost and number of credits issued result in the per-credit price.
4. Any additional factors affecting the credit price, such as market conditions or project-specific circumstances, should be noted and explained.
5. The completed USp Credit Calculator, along with all supporting documentation, must be submitted as part of the project's annual reporting process.

By adhering to these calculation methods and reporting requirements, project developers ensure that credit prices accurately reflect the costs and value of their conservation efforts, while providing transparency and accountability to credit buyers and other stakeholders.

8. VALIDATION AND VERIFICATION

This chapter presents the general guidelines for the validation and verification process for the Biodiversity Protocol for Biodiversity Stewardship Credits. For more information on the rules and requirements for project verification within the Regen Registry, please refer to Chapter 9 of the Regen Registry Program Guide[67].

[67]Accessed at: https://registry.regen.network/v/regen-registry-handbook/regen-registry-overview/program-rules-and-requirements

The application of this Biodiversity Protocol requires that independent Verifiers determine conformance with the Biodiversity Protocol at two stages: validation and verification.

• Validation is understood as the systematic, independent, and documented process for the evaluation of the Project Plan and Monitoring Plan (PP) and the Umbrella Species Credit Calculator against the criteria of the Biodiversity Protocol, happening once in the beginning of the project.

• Verification is understood as the systematic, independent, and documented process for the evaluation of the Monitoring Report (MR) and the updated Umbrella Species Credit Calculator of the Project Activities.

The verification must be initiated within two years from the date of the last Verification Report. The protocol defines "initiated" as the date registered in the auditor's Audit Plan. The final verification may take place up to six months after the end of the project timeframe, to ensure that the final monitoring cycle includes the complete final year of project activities.

Both validation and verification may be jointly assessed in the first audit, as chosen by the Project Proponent.

8.1. ROTATION OF VALIDATION/VERIFICATION ENTITIES

The initial validation and the first verification of a project can be carried out by the same validation/verification entity. However, subsequent verifications must be conducted by different validation/verification entities. Thus, the same verifier cannot be repeated in two consecutive Monitoring Reports.

8.2. VERIFIER CREDENTIALS

Verifiers shall be any impartial, lawful, and competent organization with a proven background on socioenvironmental audit. Project Developer's must prove the Verifier's expertise and experience as an annex to the documentation presented to the Regen Registry. Regen shall then feature and list the verifier in this Biodiversity Protocol´s official Biodiversity Protocol page[68].

8.3. VERIFIER RESPONSIBILITIES

The main objective of the Verifiers is to execute impartial, objective, and documented audits of the Project Activities, and to validate and verify whether the requirements of this Biodiversity Protocol are being achieved. Therefore, the Verifier must perform the follow activities:

a) Documental Audit: Analyze the PP, USp Credit Calculator, and the MR and all its attached accessory evidence, evaluating whether the requirements of this Biodiversity Protocol are being achieved.

[68] Accessed at: https://registry.regen.network/v/Biodiversity Protocol-library/

b) Field Audit: The Verifier is responsible for obtaining through data analysis the necessary evidence to assess whether Project Activities are being executed and in compliance with the requirements of this Biodiversity Protocol. If necessary, the auditor may ask for a field visit.

c) Final Audit Report: Development of audit report informing the compliance of the Project with the requirements of the Biodiversity Protocol and communicating to the Regen Registry an authorization for the issuance of the biodiversity stewardship credits, once the audit had been carried out.

8.4. DATA SUBMISSION PROCESS

Data collection, for both validation and verification, is stored by the Regen Registry.

- **a)** Data may be collected using any qualified procedure specified in Biodiversity Protocol and included in the monitoring reports as supplementary material. This data must be duly digitized and georeferenced and can be made available by digital formats as web/mobile apps.
- **b)** Data will not be considered as submitted until it has been received electronically by the Regen Registry.
- **c)** The validation/verification entity must securely store and make accessible all documentation and records for a minimum of two years after the completion of the entire project crediting period, even if they do not perform verification for the entire project crediting period.

8.5. VALIDATION OF PROJECT PLAN

The Verifier will address and analyze the Project Plan and USp Credit Calculator as per the submission to the Regen Registry[69].

8.6. VERIFICATION OF MONITORING REPORT

After each Monitoring Period, a Monitoring Report and the updated USp Credit Calculator must be submitted to the Verifier through the Regen Registry[70]. The reported results for each section of this Biodiversity Protocol must be accompanied by all the information that supports them. In the case of GIS or remote sensing data, it is required that the maps are included as images within the report for illustrative purposes. The original vector and raster files must be kept by the Project Proponent.

Monitoring reports and updated USp Credit Calculator need to be verified (audited) annually or every two years.

8.6.1. DATA VERIFICATION

For each data sample selected, the Verifier should verify the veracity of the data based on the type of data submission (ex: cross-referencing camera trap photographic evidence with GPS location). The Verifier will sign the data sample indicating that it meets the requirements in one of the following types of data indicators:

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[69] Accessed at: https://registry.regen.network/v/Biodiversity Protocol-library/
[70] Accessed at: https://registry.regen.network/v/Biodiversity Protocol-library/

8.6.1.1. UMBRELLA SPECIES HEALTH

Refer to this Biodiversity Protocol **and** the USpToC to assess USH as per the Monitoring Report.

8.6.1.2. HABITAT QUALITY

Refer to this Biodiversity Protocol **and** the USpToC to assess HQ as per the Monitoring Report.

8.6.1.3. UMBRELLA SPECIES CONSERVATION PLANNING SPREADSHEET

Review score in the Strategic Lines within the Theory of Change and analyze evidence provided to ensure requirements were met.

8.7. EXPANDING THE PROJECT AREA OF A PREVIOUSLY VALIDATED PROJECT

New Project Areas can be added to a previously validated project in accordance with the concepts outlined in section 4.1.1. and if the additional areas fall within a 200 km range and share the same associated entities (Project Developer, Landowner and/or Land Steward). Furthermore, at least one of the same core threats specified in the Theory of Change must remain applicable across all project areas to ensure the strategic lines remain relevant and coherent with the overall conservation logic of the Project. While at least one core threat to the umbrella species must be present across all areas, specific interventions may vary based on local contexts, practices, and resource availability.

These areas should be assessed based on the information reported in the monitoring report. The validation/verification body must specify which instances meet the eligibility criteria for inclusion of the area in the project. This validation can be reported in the verification report.

For new Project Areas the verification report should document and explain the evidence collection methods employed by the validation/verification body to verify the biodiversity credits statement generated by the project. Such methods must be statistically robust. Any subsequent changes to the evidence collection methods required as a result of verification findings should be documented.

8.8. STACKING PAYMENTS FOR ECOSYSTEM SERVICES

The growing global awareness of the central importance of biodiversity in maintaining various ecosystem services, including climate regulation, signals that it is time to think beyond carbon. Biodiversity credits, integrated with other Payments for Ecosystem Services (PES), emerge as a powerful solution to this challenge.

The stacking of different PES can potentially expand incentives for biodiversity conservation by valuing a wider range of ecosystem services that a protected area can offer. By monetizing not only carbon sequestration or water provision services but also biodiversity-related benefits, these practices encourage land managers to maintain and improve the quality of natural habitats. This can lead to more holistic and integrated landscape management, promoting the conservation of species and ecosystems on a broader scale.

The synergy between biodiversity credits, carbon credits, and other ecosystem services is crucial for creating an economic model that not only protects but also sustainably values nature. This integration broadens the available financial incentives, making conservation a more attractive and financially viable option compared to environmentally harmful land-use alternatives (e.g., monoculture plantations, mining).

In this way, the integrated approach not only addresses the climate and biodiversity crises more holistically but also establishes a new paradigm where conserving nature becomes economically preferable to depleting it. It is a strategy that promotes conservation as a profitable and sustainable investment, essential for reversing environmental degradation and ensuring the well-being of future generations.

Given this context, this Biodiversity Protocol can be used in conjunction with other PES. However, since each biodiversity credit is priced based on the costs of implementing strategic conservation activities, it is essential to have the costs of each PES separated and transparently documented. This ensures traceability and clarity about which actions and costs pertain to each PES. Projects that are already linked to other payments for ecosystem services (such as carbon credits) must separately disclose the activities of these PES within the Credit Calculator, scoring only for the additional activities that this Biodiversity Protocol brings to the Project Area.

9. BIODIVERSITY CLAIMS AND CREDIT RETIREMENT RULES

This chapter describes the general rationale behind how the biodiversity credits are retired and their nature as digital assets representative of specific attributes of biodiversity conservation, more specifically, USp stewardship activities.

9.1. NATURE OF THE CREDITS

The objective of these Umbrella Species Stewardship credits are so that companies and organizations can make Nature-Positive Contribution Claims, rather than biodiversity compensation claims and cannot be used as “offsetting” for negative biodiversity impacts. Corporates must move beyond compensation and neutralization of negative environmental impacts, towards Nature-Positive Contributions to support the transition to a regenerative future.

The USS credits herein described are representative of the environmental stewardship, more specifically, USp stewardship activities, meaning they showcase the virtues of specific Project Activities that have a net positive impact on a USp of a given ecosystem.

9.2. CREDIT PRICING

USS credits are priced based on the total project cost, adjusted to incorporate the following components: (i) Buffer Pool allocation, (ii) Regen Registry fees, (iii) Credit Class Fee, and (iv) optional Sales Commission — each applied over the total project cost. In addition, a (v) Profit Margin is applied specifically to the project implementation cost, supporting project scaling and financial viability (See section 7.2.2). The resulting amount is then divided by the total number of credits.

9.3. BIODIVERSITY CREDIT RETIREMENT RULES

The USS credits are automatically retired when purchased, meaning they cannot be bought, held and sold. This prevents speculative secondary markets from emerging, highlighting the real and immediate commitment to biodiversity conservation.

Unlike commodities, USS credits are considered 'assets' that can be included in the companies' balance sheets.

Therefore, any end-user buyer that is making a Biodiversity Claim, with regards to the acquisition of the biodiversity credits, will need to retire them and Project Proponent or Seller shall retire them on the Regen Registry[71].

Biodiversity Claims shall be deemed effective on one or more of the following scenarios:

[71]Accessed at: https://registry.regen.network/v/regen-registry-handbook/credit-issuance/credit-issuance

a Claiming the acquisition of the biodiversity credits and the financing of Project Activities represent investments of the company in SDG 13 or 15, “climate action” or “life on land”, respectively.

b Claiming the acquisition of the biodiversity credits and the Project Activities on any biodiversity, nature or ecological disclosure agency or organization, public or private, ex: B-Corp Impact Assessment or Taskforce on Nature-Related Financial Disclosures.

c Claiming the acquisition of the biodiversity credits and the financing of Project Activities on the company´s sustainability report.

Appendix 1: Summary of the Monitoring Activities

This annex provides a summary of the activities required for the successful implementation and monitoring of biodiversity projects under the Biodiversity Protocol. The activities are categorized into mandatory, highly recommended, and optional actions, ensuring a structured approach to achieving conservation goals.

Item		Actions	Frequency	Score	Category
1. UMBRELLA SPECIES HEALTH (USH)					
1.1	Presence Or Absence Data	Confirmation of the USp presence.	In the first MR and minimum every 2 years	2 points	*Mandatory*
1.2	Size of The Population	Analyze the size of the USp population in the Project Area.	At least once during the project's lifetime	1 point per individual/group monitored in the area	*Mandatory*
1.3	Movement And Distribution	Analysis and discussion of Movement And Distribution	At least once during the project's lifetime	1 point per individual/group monitored in the area	*Mandatory*
1.4	Monitoring Methods	Feces Sample Collection	The USH monitoring methods can be chosen by the Project Developer and Project Proponent according to the available financial resources and workforce. It is suggested to apply traditional fauna monitoring methods associated with technological techniques to achieve the implementation of all parameters described in 1.1, 1.2 and 1.3	1 point	*Optional*
		Footprint Identification Technique		1 point	*Optional*
		Identification of actives birth des/nests		1 point	*Optional*
		Bioacustic Sensors		1 point	*Optional*
		Camera Traps		1 point	*Optional*
		Telemetry		1 point	*Optional*
		Drones		1 point	*Optional*
		Environmental DNA (eDNA)		1 point	*Optional*
2. HABITAT QUALITY					
2.1	Community Composition (Taxonomic diversity)	Inventory and classification of mammal species according to conservation status	Minimum sampling effort of 5 days in each seasonal climatic period	1 point for each mammal inventory carried out per seasonal climatic period	*Mandatory*

		and endemism on a global and local scale.			
		Other groups inventories (arthropods, fish, birds, insects, reptiles, amphibians)	No defined frequency	1 point per optional inventory carried out	*Optional*
2.2	Ecosystem functioning (Ecosystem disturbance mitigation)	Disturbance monitoring	Each seasonal climatic period	Zero points if there is a disturbance(s) and no mitigation measures were implemented by the land steward 1 point if there is a disturbance within the project area but corrective mitigation measure were adopted by the land steward. 2 points if there is no disturbance in the project area, because it is assumed that proper mitigation measures were adopted by the land steward.	*Mandatory*
		Environmental characterization and mitigation strategies implemented to minimize disturbance	After the occurrence of a disturbance		*Optional*
3. UMBRELLA SPECIES THEORY OF CHANGE					
3.1	Developing the Umbrella Species Theory of Change (USpToC)	Project planning process to define the Strategic Lines & interventions of the Theory of Change to meet project goals	During the development of the USpToC	Not applicable	*Mandatory*
		Adaptive management to adjust intervention actions as needed, based on lessons learned and results obtained	Every MR cycle	Not applicable	*Mandatory*

3.2	ToC Strategic Lines	Intervention Activities	Every MR cycle. And it is mandatory that the final score in subsequent monitoring periods be higher than the period before.	1 point per intervention action	*Mandatory*

Appendix 2: Summary of Biodiversity Protocol Updates

As of Version II.II, the full history of methodological updates to the Biodiversity Protocol will be recorded in this appendix to ensure transparency and traceability.

Version	Date	Comment
II.II	Aug 2025	Updates listed below are effective immediately: **Section 1.1 — Habitat Quality Definition:** The definition of Habitat Quality was revised to avoid potential misinterpretation that demographic data were required. While mammal inventories are required under Section 5 to assess community composition, demographic data (population size/density) of the umbrella species itself are not required for HQ evaluation. These relate instead to Umbrella Species Health (USH), which must be assessed at least once during the project's lifetime (see Section 4). **Section 2.7 — Start Date and Retroactive Crediting:** Clarifies the distinction between Project Initiation Date (the earliest verifiable dated evidence of project initiation, such as a Data Stream post) and Start Date (the beginning of crediting activities). Specifies that retroactive crediting of up to three years prior to the Project Initiation Date. **Section 3.1 & 8.7 — Clarification on Spatial Boundaries and Applicability of the Theory of Change:** Clarifies that the Theory of Change must remain relevant across all project areas. At least one of the same core threats specified in the ToC must be applicable across all areas to ensure strategic coherence, even though specific interventions may vary according to local contexts, practices, and resources. **Section 4 & 5 — Public Database Clarification:** Clarifies that all monitoring data must be anchored on Regen Ledger to ensure transparency, traceability, and permanence. While projects are encouraged to use the Data Stream feature on the Regen Marketplace, they may also use other platforms as long as the data remain anchored and publicly accessible. Sensitive or culturally restricted data may be specified as "available upon request," with ownership and access conditions transparently indicated. This balances transparency with data protection and community rights. **Section 4.1.1.1 — Habitat Area Classification:** Refines habitat classification to prevent overlap; "Ecological Corridors" are no longer treated as a land cover class, but must be indicated if officially recognized. Reporting corridors is important because they play a critical role in species movement and landscape connectivity, yet they are not included in the Habitat Area calculation. **Section 7.2.2 — Fee Application Rules:** Clarifies the percentage rates applicable to each fee and how they are calculated. All mandatory fees (Credit Class Fee, Regen Registry Fee, and Buffer Pool) are fixed as a percentage of the total project cost, while the Profit Margin is variable and applied exclusively to the project implementation cost. This update ensures consistent application of fees across all projects. **Section 7.2.3 — Buffer Pool Mechanism:** Introduces new section detailing the purpose, rules, and conditions of the Buffer Pool to mitigate project risk. **Section 8 — Verification Timeline:**

		Clarifies that verifications must be initiated within two years from the date of the last Verification Report. The final verification may occur up to six months after the project end date to include full monitoring data. **USp Credit Calculator:** Updated to align with the clarified fee structure. All fixed-percentage components are now pre-set and locked for editing, while variable components (Sales Commission and Profit Margin) remain adjustable. The tool also distinguishes between total project cost and implementation cost to support accurate profit margin calculation.