Biodiversity Stewardship Credits Methodology

Protocol for Ideation, Implementation & Monitoring

ERA CARBON SERVIÇOS AMBIENTAIS LTDA.

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This document is intended to be used in combination with:

- Regen Registry Program Guide[1]
- Umbrella Species Guidelines[2]

[1] Accessed at: https://registry.regen.network/v/regen-registry-handbook/regen-registry-overview/program-rules-and-requirements
[2] Accessed at: https://registry.regen.network/v/methodology-library/

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1. METHODOLOGY OVERVIEW

The Biodiversity Stewardship Credits Methodology (henceforth called the "Methodology") provides a holistic assessment of ecological indicators as well as practice-based indicators to incentivize the maintenance of conservation areas, crucial for the persistence and resilience of wildlife and biodiversity.

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

To apply this Methodology 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 Property Area. This is the main requirement of this Methodology. Nevertheless, throughout this document other mandatory parameters and frameworks will be introduced that must be carefully followed.

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 identified and registered. These Monitoring Reports will be verified by external auditors to ensure all guidelines have been followed in accordance with this Methodology.

This Methodology is not applicable to aquatic ecosystems.

This first chapter provides a general overview of the Methodology and its accessory documents, including: **(i)** definitions & acronyms; **(ii)** introduction, scope, and structure of the methodology; **(iii)** definition of an Umbrella Species; and **(iv)** a general guideline for the development and implementation of this Methodology.

1.1 DEFINITIONS

- **<u>Adoption Date</u>** – Date of the first evidence-backed implementation of Project Activities.
- **<u>Baseline Scenario</u>** - Hypothetical description of what would have occurred in the absence of the Project Activities.
- **<u>Biodiversity Claims</u>** – Biodiversity Claims are affirmations by end-use buyers claiming that the acquisition of biodiversity credits: **(i)** finance Project Activities that represent investments of the company or person in SDG 13 or 15, "climate action" or "life on land", respectively; **(ii)** finance Project Activities as investments of the company or person in biodiversity, nature or ecological investments, with this information disclosed before any agency or organization, public or private, ex: B-Corp Impact Assessment or Taskforce on Nature-Related Financial Disclosures; **(iii)** finances Project Activities as investments of the company or person in biodiversity, nature or ecological investments, with this information disclosed on the company´s sustainability report.
- **<u>Buyers</u>** – Buyers of the biodiversity credits. Can be end-users making Biodiversity Claims, or not.
- **<u>Consolidated Area</u>** – Anthropic area, infrastructure area, agricultural or wood plantation, and/or pasture.
- **<u>Environmental Stewardship Indicators (ESI)</u>** – A group of three indicators: **(i)** Property Management; **(ii)** Social Engagement; and **(iii)** Financial Strategy (see Chapter 6). The ESI indicators are evaluated at the USp Guideline level only and chosen based on their possibility of providing a practice-based, systems-thinking, and integrated approach to USp stewardship.
- **<u>Habitat Area</u>** – 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 (see Section 4.1.1.1). Habitat is organism-specific and is more than vegetation or vegetation structure[3].
- **Habitat Quality (HQ)** – The Habitat Quality is defined as the ability of the environment to provide conditions appropriate for individual and population persistence (see Chapter 5). Quality should be based on the demographics of the population and not necessarily numbers alone[1].
- **<u>Host Country</u>** – Country where the Project Activities are implemented.
- **<u>Land Steward</u>** – Person or entity involved in the caretaking and maintenance (stewardship) of a

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[3] Krausman, P.R. and Morrison, M.L. (2016), Another plea for standard terminology. Jour. Wild. Mgmt., 80: 1143-1144. https://doi.org/10.1002/jwmg.21121 6

Property Area. This can ultimately be the Project Developer or the Landowner.

- **Landowner** – The individual or organization that holds title to the Property Area. This can be the Land Steward or a third party that rents the land to the Land Steward.
- **Monitoring Period** – Annual or biannual 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 Methodology.
- **Project Activity** - The applied management or conservation practice that is protecting an USp and/or producing monitoring data for scientific purposes.
- **Project Developer** – Third party involved in the implementation of Project Activities and/or monitoring and reporting.
- **Project Entity** – On-chain digital representation of the Project Developer & Land Steward before the Regen Registry.
- **Project Plan** – Project Design Document with general overview of proposed Project Activities and impact matrix, including the Monitoring Plan.
- **Project Proponent** – The Project Developer or Land Steward that is applying to register a project on the registry.
- **Project Registration Date** – The date the project is registered on-chain.
- **Project Start Date –** The date of the first proof of existence of the USp within the Project Area, which might coincide with Adoption Date.
- **Project Timeframe** – The period during which the Project Proponent will undertake the Proposed Activities.
- **Property Area** – The entire area of the property including Consolidated Area and Habitat Area.
- **Regen Network Scientific Community –** Decentralized scientific community providing feedback to projects and methodologies registered in the Regen Registry.
- **Regen Registry –** Blockchain registry operated by the Regen Network Development, PBC.
- **Stakeholder** – Party of interest involved and/or affected by Project Activities.

- **Biodiversity credits** – On-chain digital unit representing the USp Stewardship Project Activities and ecological conservation.
- **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 Guideline (USG)** – A document tailored for the reality and particularities of each USp, ecosystem, and habitat, including specific ESI.
- **Umbrella Species Health (USH)** – The framework defined in Chapter 4 for USp conservation projects to maintain monitoring practices throughout the Project Timeline, creating continuous production of scientific knowledge, enhancing data about specific USp, and offering important inputs for conservation strategies across diverse bioregions.
- **Validation** – The systematic, independent, and documented process for the evaluation of the Project Plan against the criteria of the Methodology.
- **Verification** - The systematic, independent, and documented process for the evaluation of the Monitoring Report of the Project Activities and the observance of the validated Project Plan and Monitoring Plan against the criteria of the Methodology.
- **Verifier** – Responsible Third-Party auditor that will perform Validation and Verification process. Verifier will validate and verify the Project Plan, Monitoring Plan, Monitoring Reports, 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
- ESI - Environmental Stewardship Indicators
- GBF - Global Biodiversity Framework.
- HQ - Habitat Quality
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- MRV – Monitoring, Reporting, and Verification activities.
- PES – Payments for Environmental Services.
- SDG - The United Nation´s Sustainable Development Goals.
- USp - Umbrella Species
- USG – Umbrella Species Guideline
- 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)[4], 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[5].

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[6]. 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[7].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[8]:

"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

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[4] 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.

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

[6] 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.

[7] 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.

[8] 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

needed over the next 10 years as a steppingstone towards 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)*[9]

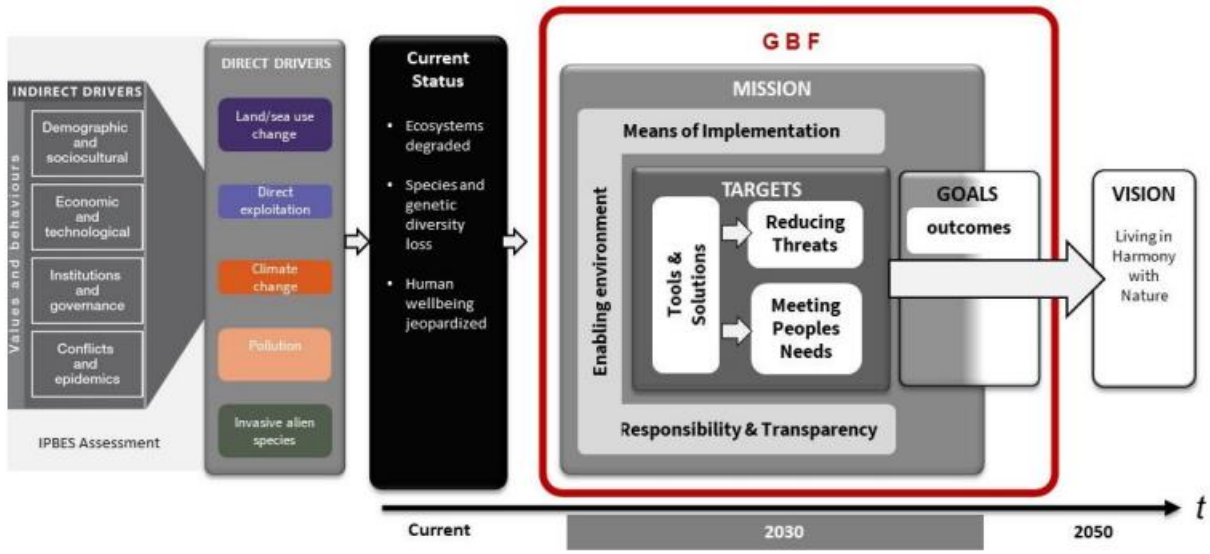

Figure 1 *Extracted Theory of Change figure from the last draft of the Post-2020 Global Biodiversity Framework*[10].

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 methodology 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[10]:

(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,

[9] 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

[10] 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

especially developing 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 Methodology 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 Property Area. USH and HQ monitoring will be coupled with Environmental Stewardship Indicators (ESI) that can provide improvements to 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[11]. 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[12].

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[13]. 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

[11] 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.
[12] Frankel, O.H. & M.E. Soule. (1981). Conservation and evolution. Cambridge University Press, Cambridge, UK.
[13] Roberge, J. M. & Angelstam, P. E. R. (2004). Usefulness of the umbrella species concept as a conservation tool. Conservation biology, 18(1), 76-85.

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.

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 Methodology is intended to be a practice-based methodology (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 methodology 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 Property 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 USp will have a specific Umbrella Species Guideline (USG) document **USp Guideline**, tailored for the reality and particularities of each USp, ecosystem, and habitat. Any Project Proponent can draft a USp Guideline, provided the document is based on best practices, peer-reviewed literature, and/or government or environmental agencies public guidelines, for public policy purposes (for more information, refer to Chapter 6). All USp Guidelines will go through an in-depth scientific review and public comment process.

The USH and HQ indicators are available only in this present methodology general document. The USp Guideline provides a system of continuous improvements to the USH and HQ of the Property Area, besides building and improving interactions between humans and animal communities, especially considering the USp. Three **ESI** are defined: **(i)** Property Management; **(ii)** Social Engagement; and **(iii)** Financial Strategy, chosen based on their possibility of providing a practice-based, systems-thinking, and integrated approach to USp stewardship. The ESI are defined in the USp Guideline only.

Figure 2 illustrates the structure of the methodology, showcasing the two main documents that must be followed: **(i)** this main methodology document herein, with the Umbrella Species Health and Habitat Quality indicators; and **(ii)** in the USp Guideline, with the Environmental Steward Indicators, as described above.

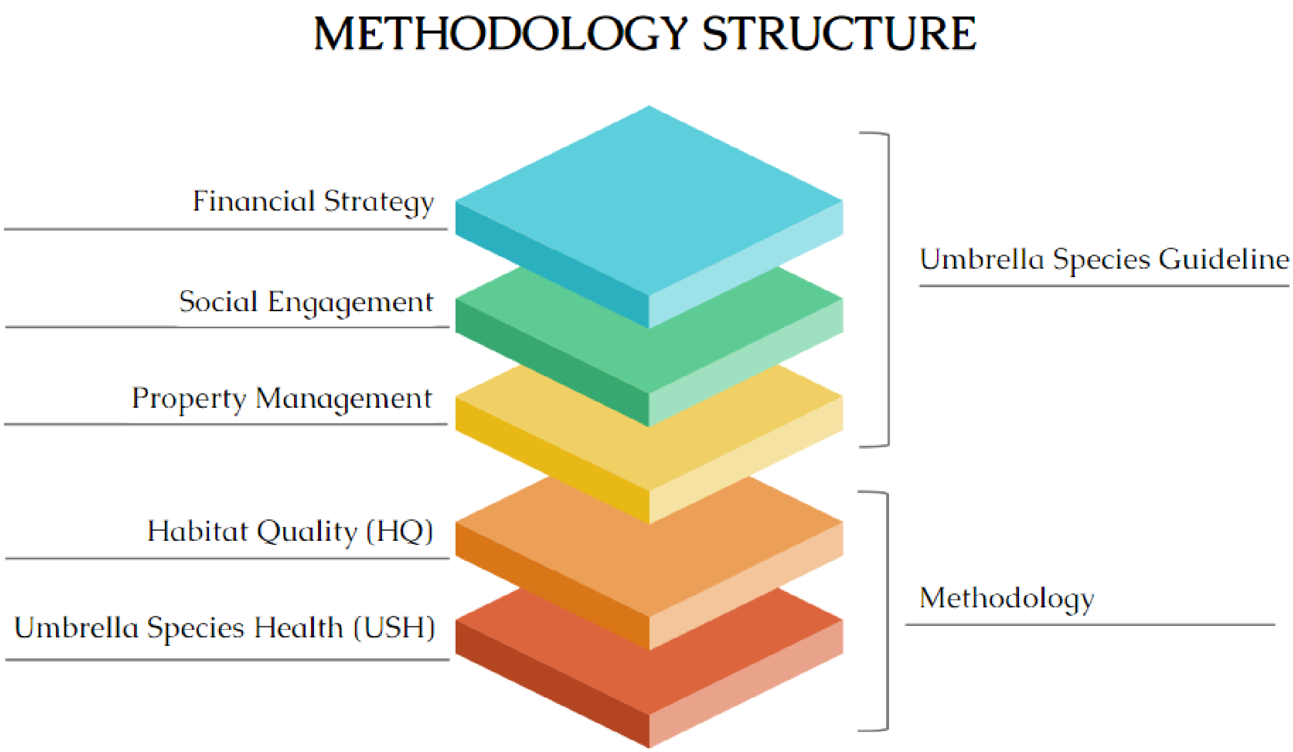

Figure 2 *Illustrative representation of the structure of the Biodiversity Methodology for Umbrella Species Stewardship*.

This general guidance of the Methodology 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 Property 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[12]. 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 methodology 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 methodology 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, 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:

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

Other species may additionally be covered by this methodology, 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 METHODOLOGY STEPS

A general framework for the Methodology 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 Methodology as a radius of no more than 200km 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 photographicevidence with GPS coordinates has been established of a USp within the Project Area, the Start Date can be defined. Project Proponents must then define the specific USp Guideline that will be applied. If a USp Guideline does not exist, the Project Proponent must develop a new guideline by following the steps outlined in Chapter 6.3.

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 must be developed. 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 ESI.

The first monitoring period must implement the minimum requirements of this Methodology, 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, for the Project to undergo verification. If the verification is successful, biodiversity credits will be issued accordingly in the Project Entity's on-chain wallet. The second monitoring period begins, and additional Project Activities must be implemented following the indicators of this Methodology and USp Guideline. Subsequent yearly MRV takes place, with biodiversity credits issuance only following a positive verification statement.

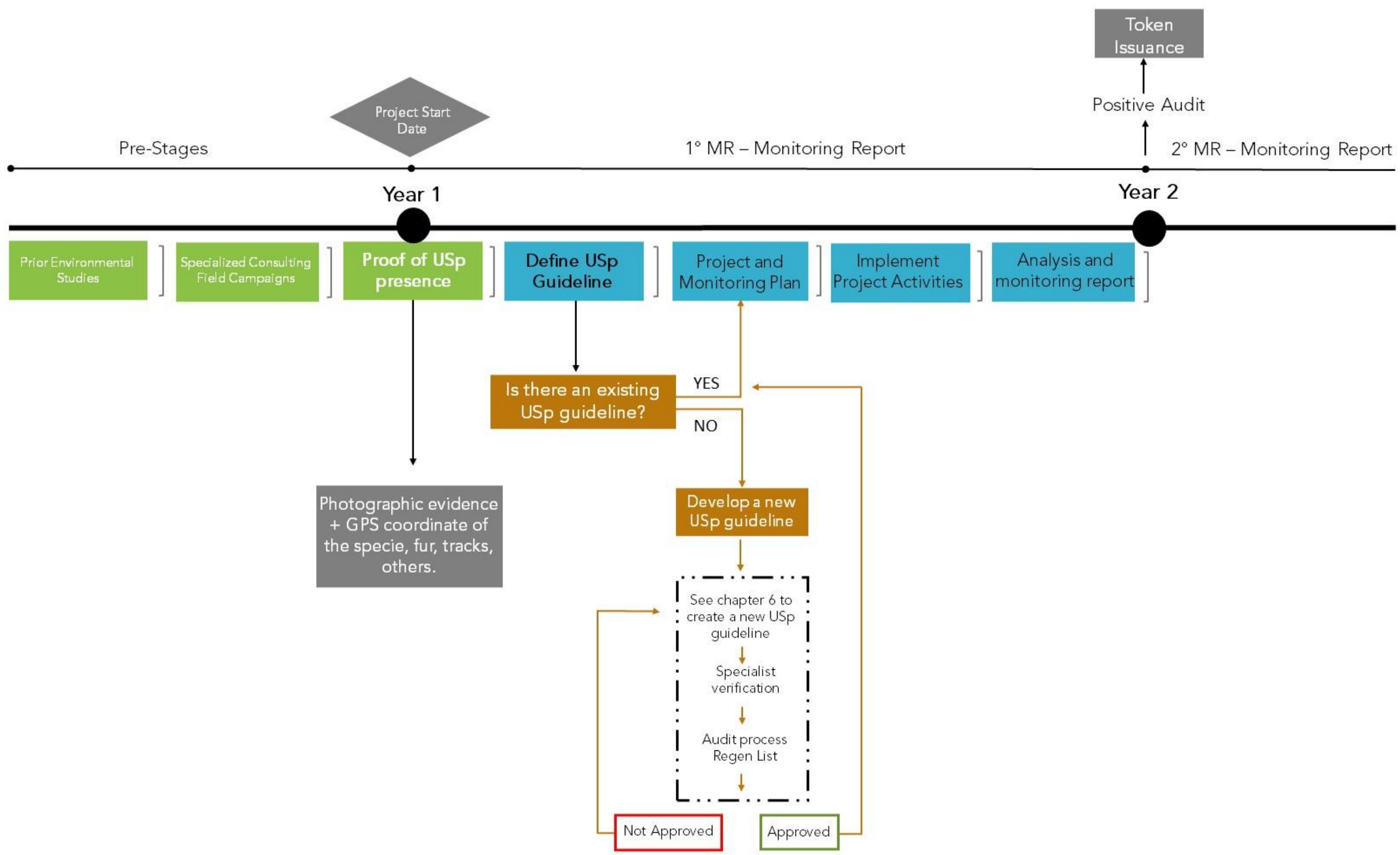

Figure 3 *Illustrative representation of the methodology framework.*

To summarize how to implement the Methodology in the Property Area, the following steps are required:

1. Carry out a prior biodiversity campaign to assess the Property Area (optional pre stages above).
2. Choose USp and prove presence in Property Area.
3. Define the USp Guideline, if available.
4. If a USp Guideline is not readily available, the Project Proponent has the option of drafting one according to Chapter 6.
5. Develop the Project Plan and Monitoring Plan.
6. Implement the Project Plan and Monitoring Plan, by deploying monitoring technology and implementing Project Activities for the Property Area according to Chapter 4 to 6.
7. Data Analysis and Report.
8. Validation and verification of data and evidence of the Monitoring Report 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 Methodology 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[14].

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 Methodology 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 Area will be protected, or any other legal or regulatory remedy,

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

public or private in nature, that entails this specified outcome.

2.7. PROJECT START DATE AND ADOPTION DATE

Project Start Date: The date of the first proof of existence of the USp within the Project Area, may coincide with Adoption Date.

Adoption Date: Date of the first evidence-backed implementation of Project Activities. This Methodology will accept an Adoption Date that goes back up to 3 years prior to the Project Registration Date. To claim an Adoption Date before the Project Start Date and the Project Registration 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 USp Guideline and overall eligibility to this Methodology.

2.8. CREDITING TERM

The Crediting Term for this Methodology for the issuance of biodiversity credits is of 5 years, from the moment of Project Registration 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.

3. PROPERTY AREA BOUNDARY

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

3.1. SPATIAL BOUNDARIES

<u>Property Area</u>: It comprises the entire area of the property bounded by spatial boundaries, including all Consolidated Areas and Habitat Areas.

<u>Consolidated Area</u>: 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.

<u>Habitat Area</u>: 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[15]. **Furthermore, it is the main datapoint for the calculation of the USH indicator, as per Chapter 4.**

Project Proponent can include more than one property in the Project if all ESI strategies are implemented in all areas and are within a 200km range.

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[16], 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[17].

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 biannual) 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.

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[15] 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.
[16] 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.
[17] 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.

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.

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**.

A main pillar of this Methodology is to produce scientific knowledge over the Project Timeframe in order to incentivize the accumulation of data capture as important inputs for scientific research. All the data produced on USp shall be reported annually or every two years in the Monitoring Reports. All data produced should be shared in a public database online.

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 Methodology are based on the Essential Biodiversity Variables (**EBV**), which assess biodiversity change over time in different dimensions and across multiple scales[18]. 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[18]:

- Genetic composition
- Species populations
- Species traits
- Community composition
- Ecosystem structure

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

- Ecosystem function

From these classes, specific EBVs were chosen to provide the Methodology 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 Property Area with the aid of remote sensing. Two general features are evaluated in each Property 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. Habitat is organism-specific and is more than vegetation or vegetation structure[1].

This methodology 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).
- Ecological corridors.

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 Property 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. The date of the satellite images should be as close as possible to the project start date (≤ 6 months) and high resolution (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[19]. The process requires the selection of appropriate variables and the use of refined algorithms to improve classification performance[20].

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	
Ecological Corridors	
Total	

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

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.

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

Consolidated Area	Hectares
Agriculture and/or pasture	
Infrastructure areas	
Total	

[19] 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.
[20] 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.

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 Property 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 Property Area, the presence of a single individual of USp will be valid for access to the Methodology and eventual issuance of biodiversity credits.

It is mandatory to record the presence of the USp in the Property Area in the first Monitoring Report. After this period, it is permitted by the Methodology that the USp is not registered in the Property Area for up to 2 years, still being eligible for the Methodology in this time frame. However, it is mandatory for the Project Proponent to have to implement a system of continuous improvement in the application of the Environmental Stewardship Indicators (ESI) as described further in Chapter 6.

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

The size of population is understood as the total number of individuals of the same species living in a given area. The larger the population, the greater its genetic variation and, therefore, its potential for long-term survival. Genetic diversity of populations can also be maintained through admixing with other populations connected through dispersal. Population connectivity is also important to prevent local extinctions.

This parameter will analyze the size of the USp population in the Property Area. The Project will yield a higher overall score if the Land Steward chooses to engage in the application of this analysis.

For moving individuals, such as mammals and birds, a traditional technique called the "mark and recapture method" is often used to determine the population size of a given species. In the first capture, the individual is marked and released. In the second capture, the individuals captured with marking are not counted as new individuals, and new individuals are marked. The capture and marking can only be performed by a specialized and authorized technical team, with legal permission from environmental authorities.

To calculate the size of the population by the traditional technique "mark and recapture method" it is suggested to use the following equation:

$$N = \frac{nM}{x}$$

Where:
N= population size
n= total number of individuals caught in the second capture
M= number of individuals tagged in the first capture
x= number of new individuals tagged in the second capture

Captured individuals can be fitted with radio collars, for example, and monitored via telemetry to track movement and improved population estimates. Furthermore, other alternative approaches for determining population size that do not require capturing individuals can use drones, camera traps, or other high-frequency detection methods. These approaches can produce robust estimates for species that are difficult to detect, but also involve statistical modeling.

Expert consultants and biologists should be conducting the studies to quantify this parameter and should be filed in a specialized monitoring report.

Each individual of the same USp registered in the area will count as **1 point** in the equation of Section 4.3.

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[21]. Movement is defined by the animal's behavior (foraging, resting, and walking) based on tracking data[22].

Scatter patterns or distribution patterns refer to how individuals in a population are distributed in

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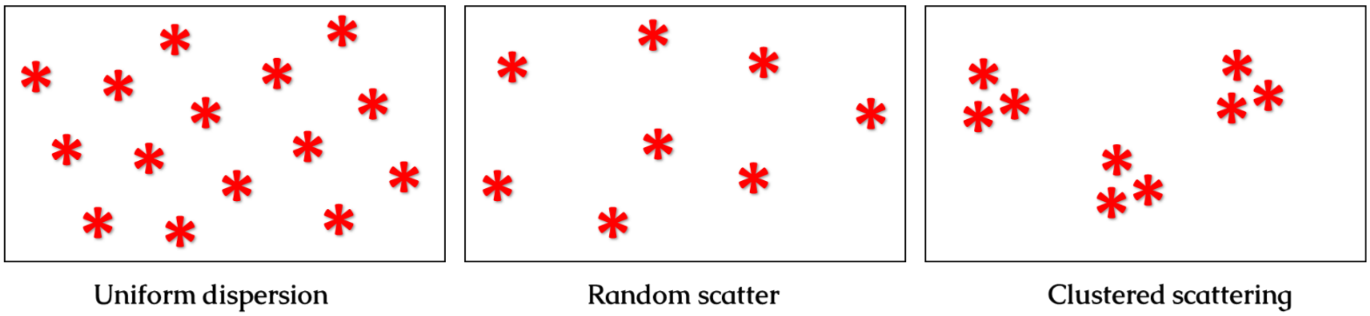
[21] Nathan, R. et al. (2008). A movement ecology paradigm for unifying organismal movement research. Proc. Natl. Acad. Sci. U. S. A. 105, 19052–19059. doi: 10.1073/pnas.0800375105

[22] 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.

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. 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.

Compliance with this parameter is mandatory as of the third year of monitoring.

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 THROUGH 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 Property Area in the first Monitoring Report. Compliance with the Movement and Distribution parameter is mandatory as of the third year of monitoring. The size of the population is a parameter 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 Section 4.1.2. Details about how to apply the traditional methods consolidates in the scientific literature can be found in the technical guides provided byVan Horne et al.(2005)[23] and Gaur et al. (2017)[24]. 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.

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[23] 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

[24] 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

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[25]. 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[26]. 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 Property Area.

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[27].

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)

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[25] Taberlet, P., Waits, L. P., & Luikart, G. (1999). Noninvasive genetic sampling: look before you leap. Trends in ecology & evolution, 14(8), 323-327.
[26] Chame, M. (2003). Terrestrial mammal feces: a morphometric summary and description. Memórias do Instituto Oswaldo Cruz, 98, 71-94.
[27] Jewell, Z. & Alibhai, S. (2013). Identifying endangered species from footprints. International Society for Optics and Photonics (SPIE) Newsroom, 2013, 1-3.

[28]. 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 Property 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[29].

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

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[30].

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)[31]. Each bioacoustic recording sites in the field must have their geographic coordinate registered together with photographic records.

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[28] 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

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

[30] 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.

[31] Obrist, M. K. et al. (2010). Bioacoustics approaches in biodiversity inventories. Abc Taxa, 8, 68-99.

This method can be used to evaluate the presence of the USp in the Property 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[32]:

- 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 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

[32] 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

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[33].

- 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)[34], the random encounter and staying time model (REST)[35], the association model (AM)[36] and time-to-event model (TTE)[37]. 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

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[33] 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.

[34] 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.

[35] 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

[36] 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.

[37] 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.

the comparison of these models can be found in Santini et al.(2022)[38]. 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[39].

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)[40]. 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.

  The distribution of USp can be estimated through the hierarchical modeling approach[41]. This modeling requires that the ecological process that influences occupancy be modeled separately from the observation process[42].. 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 Methodology 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 USp Guidelines.
- 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 USp Guideline.**

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 Methodology. Wildlife tracking technologies have been used to estimate

[38] 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.
[39] 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.
[40] Howe, E. J., Buckland, S. T., Després-Einspenner, M. & Kühl, H. S. (2017). Distance sampling with camera traps. *Methods Ecol. Evol.* 8, 1558–1565.
[41] 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
[42] 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.

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[43].

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[44]. 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 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[45]. 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 methodology[46].

- 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

[43] 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.
[44] 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.
[45] 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.
[46] Duffy, J.P., et al.(2020). *Drone Technologies for Conservation*. WWF Conservation Technology Series 1(5).

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.

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[47]. 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[48]. 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[49]. 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[50].

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[47] 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.
[48] 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.
[49] 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.
[50] 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.

- Movement and distribution: Software has been developed to track the movement, body orientation and approximate visual fields of individuals from drone footage[51]. 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[52,53].

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.

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[54].

4.3. UMBRELLA SPECIES HEALTH SCORING METHOD

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.
Property area	AR	Number of total 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 in the area.

[51] Graving, J. M. et al.(2019). DeepPoseKit, a software toolkit for fast and robust animal pose estimation using deep learning. *ELife*, 8, e47994.
[52] Cliff, O. M., Saunders, D. L. & Fitch, R. (2018). Robotic ecology: Tracking small dynamic animals with an autonomous aerial vehicle. Science Robotics, 3, eaat8409.
[53] Hui, N. T. et al.. (2021). A more precise way to localize animals using drones. *Journal of Field Robotics*, 38, 917–928.
[54] Minamoto T. et al. (2020). An illustrated manual for environmental DNA research: Water sampling guidelines and experimental protocols. *Environmental DNA*, 8-13.

Movement	MO	1 point per individual monitored in the area.

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:

$$USH = (PA + SP + MO) * HA$$

USH = Umbrella Species Health indicator.
HA = Habitat Area.
SP = Size of the population.
PA = Presence or Absence data.
MO = Movement.

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 Methodology.

Size of Population (SP) cannot be more than the capacity of the territorial area specified at the umbrella specie guideline. 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.

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[55].

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 suitable for applications at varied temporal and spatial scales.The EBVs parameters will also be used to assess habitat quality[56].Two classes of EBV will be considered:

- Community composition
- Ecosystem functioning

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

- Community composition, characterized by the
- Taxonomic diversityEcosystem functioning, characterized by the

Ecosystem disturbance
This chapter presents parameters of the HQindicator and scoring method. This Methodology provides the framework for Usp conservation projects to maintain monitoring practices of the HQthroughout the Project Timeline, **creating continuous production of scientific knowledge, enhancing data about HQ, and offering important inputs for conservation strategies across diverse bioregions and landscapes.** All the data produced considering HQshall be reported annually or biannually in the Monitoring Reports. All data produced shall be shared in a public database online.

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 Methodology is to evaluate the community composition through theparameter oftaxonomic diversity. Knowing the taxonomic diversity in the Property Area helps to understand which species are being influenced by the presence of the USp.

[55] 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.
[56] Pereira, H.M. et al.(2013). Essential biodiversity variables. Science, 339, 277–278.

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[57]. Diversity indices assess, in addition to richness, the dominance or rarity of species in the community. The two most used diversity indices are:

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.

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

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.

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

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

[57] Magurran, A. E., & McGill, B. J. (Eds.). (2010). Biological diversity: frontiers in measurement and assessment. OUP Oxford.

the total number of individuals in the community.

Taxonomic diversity in this Methodology 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 Methodology 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[58]. Techniques include direct observations by the sighting and listening 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 Methodology. 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 methodology 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 Methodology considers as a mandatory to determine the taxonomic diversity in the Property Area. Compliance with this parameter scores 1 **point (per seasonal climatic period)** in the equation of the Section 5.3.

[58] 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

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[59].

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[60]. Therefore, the focus of this Methodology is evaluated the ecosystem functioning through an ecosystem disturbance.

5.2.1. ECOSYSTEM DISTURBANCES

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[61].

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[62]. 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[63]. 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.

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[59] Tilman, D., Isbell, F. & Cowles, J. M. (2014). Biodiversity and ecosystem functioning. Annual review of ecology, evolution, and systematics, 45, 471-493.
[60] 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.
[61] Wohlgemuth, T., Jentsch, A. & Seidl, R. (2022). Disturbance Ecology: A Guideline. In Disturbance Ecology (pp. 1-7). Cham: Springer International Publishing.
[62] White, P.S. & Jentsch, A. (2004). Disturbance, succession and community assembly in terrestrial plant communities.
[63] Wohlgemuth, T., Jentsch, A., & Seidl, R. (2022). Disturbance Ecology: A Guideline. In Disturbance Ecology (pp. 1-7). Cham: Springer International Publishing.

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 Methodology considers, as an important factor, the environmental characterization after the occurrence of a disturbance within the property 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[64], must be used to identify occurrences of fire disturbances. Climatic and hydrologic disturbances can be monitored through WorldClim database[65]. This monitoring must be done in each seasonal climatic period.

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

The disturbance report with the corrective mitigation measures of the area after the occurrence of an event will count as 1 **point** in the equation of the Section 5.3.

5.3. HABITAT QUALITY SCORING METHOD

The formula for HQconsiders 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 seasonal climatic period

Ecosystem Functioning Section 5.2	**Acronym**	**Score**

64 https://firms.modaps.eosdis.nasa.gov/
65 https://www.worldclim.org/

Ecosystem disturbance	ED	1 point for each occurence and mitigation of disturbances)

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

$$HQ = HA\,x\,(TD + ED)$$

Being,

HQ = Habitat Quality

TD = Taxonomy diversity – Section 5.1

ED = Ecosystem disturbances – Section 5.2

HA = Habitat Area – Section 4.3

6. UMBRELLA SPECIES GUIDELINES ASSESSMENT AND APPLICATION

For the implementation and development of this Methodology, 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 application of specific guidelines for each USp, addressing the complexity and specificity of the challenges that each USp entails.

This chapter presents:

- Structure of the USp Guidelines, including its indicators.
- Process of drawing up a USp Guideline.
- Scoring method for this chapter.

6.1. 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 Property Area.

This Methodology 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.

These three aforementioned items will always be tackled by prescribed actions or conducts in the chosen USp Guideline, **with context-specific scoring methods based on the USp** and may be included in any of the following items described ahead, as a USH, HQor ESI. The Project Proponent must create an Impact Strategy Outline (ISO), as defined by the template below:

Agent or Cause of Threat to USp	Describe agent or cause of threat (ex: logging or mining companies, agricultural activities, wildfires, man-made fires, poachers for exotic wildlife trade).
Negative Impacts Attributed	Describe system's short, medium, and long-term negative impacts of agents or causes.
Type of Strategies that Address the Negative Impacts	Describe the Project Activities that address the negative impacts.
Impacted Stakeholders	Describe stakeholders impacted by the Project Activities that address the negative impacts (ex: local communities involved in ecotourism).
Benefits Provided	Describe the positive impacts of Project Activities.
Impact Timeframe	Describe if the Project Activities have short, medium, or long-term positive impacts.

Table 1 – *Impact Strategy Outline.*

The ISO above will be duly described and developed in the Project Plan, as per the available template. The ISO will list all necessary Project Activities that address the USp Guideline prescribed actions or conducts for tackling agents and causes of deforestation, degradation, poaching and fires.

Project Activities that are prescribed in the US Guidelines that address the threats to USp described in this chapter will be mandatory as per the 2nd Monitoring Period of the Project.

Below are some exemplifications of strategies that might be addressed in the USp Guidelines, 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 Property 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 [66]

- 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[67]

- Security patrols and surveillance inside the Property 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. UMBRELLA SPECIES GUIDELINE STRUCTURE

[66] 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.

[67] 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 USp Guidelines will be developed based on the ESI strategies, as mentioned: **(i)** Property Management; **(ii)** Social Engagement and **(iii)** Financial Strategy.

Every Project Plan shall describe a specific Impact Strategy Outline for each Project Activity suggested by the USp Guideline and implemented by the Project Proponent, as shown below. These are duly inserted for guidance in the Project Plan template.

USp Guideline Project Activity	Describe the Project Activities.
Impacted Stakeholders	Describe stakeholders impacted by the Project Activities (ex: local communities involved in ecotourism).
Benefits Provided	Describe the positive impacts of Project Activities.
Impact Timeframe	Describe if the Project Activities have short, medium, or long-term positive impacts.

Table 2 – *USp Guideline Impact Strategy Outline*

The following sections describe in general the rationale of the strategies and their importance.

6.2.1. ENVIRONMENTAL STEWARD INDICATORS

6.2.1.1. PROPERTY MANAGEMENT

Property management consists of adopting strategic measures to mitigate the negative impacts and threats described at Section 6.1, not only in the preservation areas determined, but on the entire property.

Each project proponent must determine specific objectives for property management, consistent with the local reality. Landowners and Project Proponents can implement specifically prescribed actions to reduce or control conflicts, using best practices and techniques that ensure harmony between production, conservation, and land stewardship therefore humans, communities, and USp.

Property management is evaluated through a system of continuous improvement of property management that prescribes yearly goals, through general objectives that can be achieved through various practices in the Property Area.

An example of how this strategy could be applied in a project where there is a high incidence of man-made fire outside the biome's standards, is the adoption of satellite fire monitoring systems, along with the creation of fire brigades and firebreaks, and aligned with the creation of strategic objectives. In this example, an evaluation will be made on how the strategies adopted are impacting on fire prevention strategies and reducing the risks to habitats.

6.2.1.2. SOCIAL ENGAGEMENT

Studies in the field of human-wildlife interaction and coexistence have demonstrated that wildlife conservation and management problems are ultimately people related[68,69] The main threats to which wildlife is subject are the degradation of its habitat by humans and risks such as illegal hunting and deforestation. Therefore, social engagement is fundamental to ensure the preservation of wildlife in the short and long term[70].

Stakeholders can be any local actors that directly or indirectly affect the area where this methodology will be applied, whether through direct use for fishing, hunting, livelihoods, well-being, among other activities, or such as through the implementation of regulations or externalities that affect habitat conservation.

Social Engagement is evaluated through a system of continuous improvement of stakeholder engagement that prescribes yearly goals, through general objectives that can be achieved through various practices in the Property Area and surroundings.

One of the main goals for conservation projects must be to influence local productive economic activity, such as mining, infrastructure, agroindustry, cattle ranching, logging, and their financial agents and communities that are involved in such activities, to adopt social and environmental safeguards that include biodiversity conservation requirements. Therefore, developing social engagement activities is essential to raise awareness amongst diverse audiences and ensure the conservation of the species.

Also, involving local community stakeholders (indigenous and traditional communities, as well as smallholder farmers) is key to addressing long term goals of conservation and USp stewardship practices, for these agents act as the best spokespersons and enactors of good and effective local wildlife management.

6.2.1.3. FINANCIAL STRATEGY

The implementation of a consistent Financial Strategy is fundamental to ensure the implementation of the actions planned by the project throughout its lifetime.

Financial Strategy is evaluated through a series of financial indicators that are connected to project objectives. These strategies evaluate whether the project has a reserve of funds for the continuity of actions, and the elaboration and implementation of a communication program that mobilizes new funds for the design, development, and implementation of a business plan focused on biodiversity on the property.

6.3. DEVELOPMENT AND REGISTRATION OF NEW UMBRELLA SPECIES GUIDELINES

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[68] Treves, A., Wallace, R. B., Naughton-Treves, L. & Morales, A. (2006). Co-managing human–wildlife conflicts: a review. Human dimensions of wildlife, 11(6), 383-396.

[69] Fiasco, V.; Massarela, K. (2022). Human-Wildlife Coexistence. Conservation & Society, v. 20, n. 2, p. 167-178.

[70] Dickman, J. A. (2010). Complexities of conflict: the importance of considering social factors for effectively re-solving human–wildlife conflict. Animal Conservation, 13.5: 458–466

The first step in developing a new USp Guideline is to check if there is a preexistent USp Guideline uploaded to the Regen Registry. In case there is no USp guideline developed, the step-by-step below should be followed for the development of a new guideline.

Note: It is important to carefully read Section 1.5 of this document to verify that the chosen species represents a USp, according to the requirements of this Methodology.

All new USp Guidelines should be elaborated in a professional consultation with professionals specialized in USp, ecology, biodiversity and similar academic backgrounds.

For the preparation and development of new USp Guidelines, it is suggested and necessary to:

(i) examine existing US Guidelines uploaded to the Regen Registry, because some ESI strategies and activities are applicable or adaptable for various USp.

(ii) perform extensive research and understanding of the chosen USp, to develop the strategies necessary to ensure the conservation of USp in the Property Area.

(iii) develop an impact matrix for the USp Guideline, including an evaluation of all strategies elaborated in relation to the cost and difficulty of implementation and result in the conservation of the species, thus rewarding strategies that have the greatest impact on each USp specific context. The impact matrix below in Section 6.3.1 is a suggested template for such needs.

For the registration of new USp Guidelines in the Regen Registry, it is necessary to submit the finalized USp Guideline to the standard Methodology Review Process[71], as per the Regen Registry Program Guide.

Afterwards, new accepted USp Guidelines will be featured in this Methodology´s official page[72] of the Regen Registry as supporting documents.

6.3.1. SUGGESTED IMPACT MATRIX TEMPLATE

Every new USp Guideline should contain ESI strategies and adopt the principle of continuous improvement in the development of these strategies over the Project Lifetime. See example below.

It is suggested that the matrix should use at least three parameters for impact assessment, for example cost, difficulty and results that will ground the analyses. These parameters could be scored as 1 to low and 3 to high score.

[71] Accessed at: https://registry.regen.network/v/regen-registry-handbook/methodology-development/methodology-review-process
[72] Accessed at: https://registry.regen.network/v/methodology-library/methodologies-and-credit-classes-in-review/call-for-public-comment/methodologies-coming-soon/era-brazil-methodology-for-biodiversity-stewardship-tokens

			Impact Assessment				
Indicator	**Criteria**	**Metric**	**Cost**	**Difficulty**	**Result**	**Aver.**	**Final Score**
1. Property Management Indicator	1.1 Improving property management techniques to reduce conflict.						
	1.2. Fire management: prevention and combat.						
2. Social Engagement Indicator	2.1 Develop and implement an education and communication program.						
	2.2 Implement a stakeholder relations program with rural assistance and extension agencies.						
	2.3. Establish a partnership with inspection agencies.						
3. Financial Strategy Indicator	3.1 Develop an adaptive management plan.						
	3.2 Demonstrate funding for the project budget.						
	3.3. Implement a communication program to mobilize and increase financial resources.						
	3.4. Implement an Ecotourism Program at the project area.						
						Total	**50**

Table 3 – *USp Impact Matrix Template*

The score of the USp Guideline should adhere to the following steps:

• The guideline should count strategies for the ESI defined in this Methodology (Property management, Social Engagement and Financial Strategy).
• The parameters for impact assessment should be chosen. In the example above (Table 3) the parameters chosen were the cost of the strategy implementation, the difficult of implementing the strategy, and the results that the strategy will add to the conservation of the USp.• Each parameter should be scored from 1 to 3 (being 1 the lowest score and 3 the highest score). For example, if a strategy is low cost should be scored as 1, if it is high score should be 3.
• An average should be calculated and rounded up.
• The final score can be the calculated average or the specialist can adapt and decrease or increase the final score of a strategy considering the project specifics. The specialist

shall demonstrate the reason for increasing or decreasing a final score. Each final score can achieve a maximum of 5 points.

- The sum of points must have a minimum score of 50 points and a maximum of 100 points.

6.4. USp GUIDELINE SCORING METHOD

The scoring method will be obtained through the sum of points obtained with the implementation of USp Guideline strategies.

$$\mathrm{USG} = [\left(\frac{\mathrm{PO}}{\mathrm{TO}}\right) + 1]\ \mathrm{x}\ \mathrm{AR}$$

Where:
PO= Points obtained from the Umbrella Specie Guideline calculated according to the strategies implemented by the project
TO = Total fixed pointsfrom the Umbrella Specie Guideline
AR = Property Area – Section 4.3

At the first monitoring report, project developers should score at minimum 20 (twenty) percent of the activities below, where three of these activities are mandatory: Make firebreaks across the boundary of the property; Security patrols and surveillance inside the Project Area; and Use of remote sensing tools to identify deforestation and forest degradation.

It is expected forthe project to have procedures to establish continued improvement strategies, therefore it is mandatory that the final score in subsequent monitoring periods be **10% higher** than the period before.

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7. BIODIVERSITY CREDITS ISSUANCE

7.1. OVERALL SCORING METHOD

The biodiversity credits emission will be calculated using the formula below:

Final Number of Biodiversity Credits Issued = USH Score + HQ Score + USp Guideline Score

It is important to remember that:

- USH Score was calculated at Section 4.4.
- HQ Score was calculated at Section 5.3.
- USp Guideline was calculated at Section 6.3.

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 Biodiversity Credit Simulation Template. Project proponents can include or exclude items from 1-10 lines based on project specifics (please see the cost template tab). Lines between 25 to 28 must be maintained in the calculation of project costs.

The final value of the credit to be sold shall be equal to the total price per credit calculated at the spreadsheet.

7.2. BIODIVERSITY CREDIT ISSUANCE NAME TAGGING

Each biodiversity credits batch, as issued annually or biannually, will be tagged with the specific

USp name, and registered on the Regen Registry[73]. Project Proponents may choose any regional or commonly used name for the specific species, for example: jaguar credit (in English), or *onça-pintada* credit (in Portuguese).

[73] Accessed at: https://registry.regen.network/v/methodology-library/

8. VALIDATION AND VERIFICATION

This chapter presents the general guidelines for the validation and verification process for the Biodiversity Stewardship Credits Methodology. 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[74].

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

• Validation is understood as the systematic, independent, and documented process for the evaluation of the Project Plan against the criteria of the Methodology, 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 of the Project Activities and the observance of the validated Project Plan and Monitoring Plan against the criteria of the Methodology.

Verification must be performed at least every two years.

Both validation and verification may be jointly assessed in the first annual or biannual 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.

A validation/verification entity should not perform verifications for more than three consecutive years in the generation of biodiversity credits for a project.

8.2. VERIFIER CREDENTIALS

Verifiers shall be any impartial, lawful, and competent entity with a proven background on socioenvironmental audit. Verifier application will be revised and approved by the Regen Registry and shall be featured and listed in this Methodology´s official page of the Regen Registry[75].

8.3. VERIFIER RESPONSIBILITIES

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

[75] Accessed at: https://registry.regen.network/v/methodology-library/

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 Methodology are being achieved. Therefore, the Verifier must perform the follow activities:

a) Documental Audit: Analyze the Project Plan, Monitoring Plan, and the Monitoring Report and all its attached accessory evidence, evaluating whether the requirements of this Methodology are being achieved.

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 Methodology. 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 Methodology 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 Methodology 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, or directly via autonomous Internet of Things ("IoT") devices.
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 as per the submission to the Regen Registry[76].

8.6. VERIFICATION OF MONITORING REPORT

After each Monitoring Period, a Monitoring Report must be submitted to the Verifier through the Regen Registry[77]. The reported results for each section of this Methodology 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.

[76] Accessed at: https://registry.regen.network/v/methodology-library/
[77] Accessed at: https://registry.regen.network/v/methodology-library/

Monitoring reports 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:

8.6.1.1. UMBRELLA SPECIES HEALTH

Refer to this Methodology **and** the USp Guideline to assess USH as per the Monitoring Report.

8.6.1.2. HABITAT QUALITY

Refer to this Methodology and the USp Guideline to assess HQas per the Monitoring Report.

8.6.1.3. ENVIRONMENTAL STEWARDSHIP INDICATORS

- Property Management

  Review property management scores in the USp Guideline and analyze evidence provided to ensure the requirements were met.

- Social Engagement

  Review social engagement scores in the USp Guideline and analyze evidence to ensure the requirements were met.

- Financial Strategy

  Review financial strategy score in the USp Guideline and analyze evidence provided to ensure requirements were met.

8.7. EXPANDING THE PROPERTY AREA OF A PREVIOUSLY VALIDATED PROJECT

New property areas can be added to a previously validated project in accordance with the concepts outlined in section 4.1.1. 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 or in a separate validation report.

For new property 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.

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

Biodiversity credits, as per the guidelines of this Methodology, cannot be used as "compensation" or "offsetting" for environmental impacts, for legal/regulatory purposes or not. They do not, in any form, represent a biodiversity net gain in the Property Area or any kind of surplus.

The biodiversity credits herein described are representative of 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. BIODIVERSITY CREDIT RETIREMENT RULES

Despite some of the aforementioned points regarding the nature of the biodiversity credits, they are still subjectable to retirement. Biodiversity credits might be held by end-users or not. A party might choose to hold the biodiversity credits in the Regen Registry in order to sell them at a later period.

Nevertheless, any end-user buyer that is making a Biodiversity Claim, with regards to the acquisition of the biodiversity credits, will need to necessarily retire them and Project Proponent or Seller shall retire them on the Regen Registry[78].

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

- 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.

The Project Proponent, when selling the Project´s biodiversity credits, shall mandatorily inquire buyers if a Biodiversity Claim is being made or shall be in a predictable future. If the biodiversity credits are not to be immediately retired by Project Proponent upon an event of a sale, Project Proponent shall execute a legally enforceable instrument with the buyer in which the entity declares they are just a trader or intermediary and retirement shall be done in the future on behalf of a third

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

party. This responsibility shall be deemed in force and applicable to the new holder of the biodiversity credits the moment the credit´s ownership is changed in the Regen Registry.