TERRASCAPE

TOWARDS NATURE POSITIVE

Protocol for Nature Credits

Version 1.3

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1. Objective of the protocol

Biodiversity encompasses the rich variety of life on Earth, comprising plants, animals, and microorganisms. It is the very foundation of life itself.

The Terrascape protocol aims to unlock financing for biodiversity conservation by striking a balance between businesses' needs to become nature-positive and the social and ecological aspects of effective biodiversity conservation practices. While the primary objective of this document is to present a Protocol for Nature Credits, it is crucial also to address the roles and responsibilities of businesses, as well as the interplay between Terrascape Nature Credits, nature-positive, and science-based targets for nature (SBTN).

The protocol assumes that the reader has the necessary background knowledge on Science Based Targets for Nature (SBTN) and Taskforce for Nature-related Financial Disclosure (TNFD).

2. Guiding principles

Terrascape protocol is built on three guiding principles.

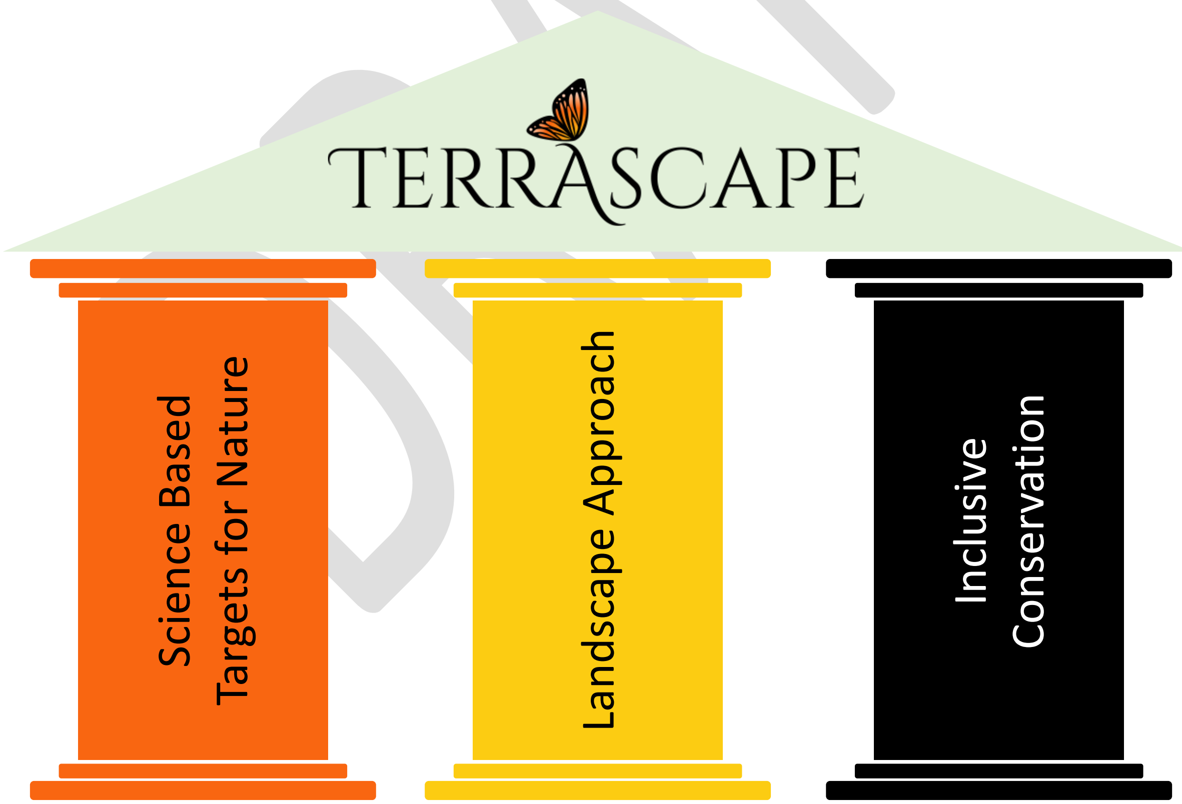

Figure 1. Three guiding principles of Terrascape protocol

2.1. Science-based Targets for Nature

Businesses receive numerous benefits from nature. These benefits or ecosystem services include goods such as food, water, and timber, as well as services such as pollination, carbon storage, and climate regulation. Biodiversity plays a crucial role in maintaining the health and functioning of ecosystems and enhancing the resilience of the ecosystems against the impact of climate change. The presence of a diverse array of species allows for a wide range of ecological functions to be performed, including nutrient and water cycling, pollination, pest control, and soil formation.

Over half the world's total GDP is moderately or highly dependent on nature and its services and, as a result, exposed to risks from nature loss. Construction ($4 trillion), agriculture ($2.5 trillion) and food and beverages ($1.4 trillion) are the three largest industries that depend the most on nature[1]. Global biodiversity has declined by over 70% since 1970[2], and it is estimated that over 50% of terrestrial and freshwater ecosystems on the planet are moderately or highly degraded[3]. This has caused a significant decline in the ability of nature to provide ecosystem services to businesses.

Therefore, businesses must measure, reduce, and manage the risks associated with the degradation of nature. The Science Based Targets for Nature (SBTN) provides a framework for businesses to do so. The SBTN for the land sector, which is most relevant for this protocol, recommends three sets of targets – two at the value chain level and one at the landscape level. It is crucial that businesses set targets and take action across all three, as addressing only one without considering others will not appropriately address nature-related risks.

Within the context of setting and working across all three sets of targets, Terrascape Nature Credits will directly help businesses achieve landscape engagement targets. Landscape-engagement targets, as per the SBTN guidance[4], are based on the Ecosystem Integrity Index (EII). The Terrascape Nature Credits are also based on measured, additional, and verified increases in the EII across a landscape, which is defined based on ecological science and stakeholder consultation. Therefore, the purchase of these credits from appropriate landscapes will directly contribute to businesses' SBTN targets. It is important to note that the Terrascape protocol and corresponding Nature Credits do not receive any official validation from SBTN; however, it has been confirmed through informal discussions that by following the Terrascape protocol, a corporate can claim SBTN contribution, if credits are purchased from the appropriate landscapes i.e. the landscapes identified as high-risk concerning that business's supply chains.

The Terrascape Nature Credits are not a means for businesses to buy their way out of value chain inaction, nor do they represent a license for degrading biodiversity elsewhere. It is important to acknowledge and understand that value chain and beyond value chain actions at the landscape level, in the context of biodiversity conservation, are not independent. For instance, ensuring zero deforestation and conversion requires the identification and sustainable management of areas of high conservation

[1] https://www.weforum.org/press/2020/01/half-of-world-s-gdp-moderately-or-highly-dependent-on-nature-says-new-report/
[2] https://livingplanet.panda.org/
[3] https://onlinelibrary.wiley.com/doi/10.1111/gcb.14549
[4] This is based on the draft guidance. Since then, the guidance has been updated to include other (mostly less robust) indicators but EII still remains the most recommended and most appropriate indicator for nature.

value. The assessment of areas of high conservation value is done in the context of a wider landscape, not just the boundaries of the concession where a particular business is sourcing from. Therefore, although the businesses should prioritize value chain actions (target 1 and target 2 of the Land SBTN), taking an integrated approach is the only ecologically justified path and requires companies to work towards all three targets, including Target 3 (landscape engagement) instead of taking a piecemeal approach.

2.2. Landscape Approach

A landscape approach is a holistic and integrated way of managing land and natural resources that considers multiple interactions, interdependencies and priorities - such as agriculture, livestock, and mining – that compete with environmental and biodiversity goals. Therefore, inclusive governance, wherein priorities of different stakeholders are incorporated in design and implementation, is central to the landscape approach. A landscape approach has several attributes.

- Integrated management: The landscape approach involves considering the multitude of objectives and balancing the interests of various stakeholders and sectors within a landscape, such as agriculture, forestry, water management, biodiversity conservation, and local communities.
- Spatial planning: The landscape approach emphasizes spatial planning to identify and designate different zones within a landscape for specific purposes, such as areas designated for agriculture, protection, urban development, or ecosystem restoration. Spatial planning helps to optimize land use, minimize conflicts, and promote sustainable development.
- Inclusive governance: The involvement of local communities, indigenous peoples, and other stakeholders is central to the landscape approach. Participatory processes ensure that decisions are made collectively, incorporating local knowledge, cultural values, and the needs and aspirations of different groups.
- Ecological connectivity and resilience: The landscape approach recognizes the importance of maintaining and enhancing ecological connectivity within a landscape, simultaneously strengthening climate resilience and reducing human-wildlife conflict.
- Adaptive management: The landscape approach requires adaptive management strategies. Monitoring, evaluation, and learning from implemented interventions are essential to adjust management actions based on feedback and new information.

2.3. Inclusive conservation

Terrascape protocol aims to integrate the knowledge, perspectives, and priorities of local communities and indigenous peoples into conservation strategies of the landscape projects. It recognizes that communities' traditional knowledge and practices contribute to sustainable resource management and biodiversity conservation. The protocol also ensures that indigenous peoples and local communities benefit from conservation efforts. This can include providing economic opportunities, such as ecotourism or sustainable livelihoods, and supporting community-led initiatives that promote sustainable resource use and development.

Terrascape protocol recognizes that several countries haven't yet integrated policy frameworks, institutional capacity and processes that enable and accelerate the inclusive conservation approach. The protocol thus has a specific provision to promote and strengthen the ownership, governance, and sustainable management of natural resources by indigenous peoples, even in situations where such ownership and management are not yet fully recognized.

3. Voluntary Nature Credits

3.1. Defining the size and boundaries of the landscape

A landscape is a mosaic of different land uses that ecologically interact with each other. Therefore, rather than focusing on a single land use, an ideal landscape should consider biodiversity, eco-geographical features, homogeneity and cultural considerations, and ecological connectivity and processes in defining the boundaries of the landscape. The protocol doesn't mandate a minimum size of the landscape; however, there must be strong justifications for proposing landscapes smaller than 20,000 ha. The boundary of a landscape could also be defined based on the identity and culture of the indigenous people within, irrespective of its size.

Please see supplementary guidance on defining the boundaries of the landscape. The boundaries of the landscape as well as the process used to define the boundaries will be validated by a third party (see section on Validation and Verification).

3.2. Definition of a Nature Credit

One Nature Credit represents a 1% increase in the Ecosystem Integrity Index (EII) per hectare within the defined landscape.

Ecosystem Integrity Index (EII) = Arithmetic average (Human Modification Index, Terrascape Biodiversity Intactness Index, Net Primary Productivity Ratio[5])

The three primary attributes of ecosystem integrity are its structure, composition, and function. The three variables in the equation above - Human Modification Index, Terrascape Biodiversity Intactness Index, and Net Primary Productivity Ratio - are the indicators of these three attributes.

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[5] Incorporation of NPP into the formula for calculating Nature Credits will have implications, in terms of additionality and double counting, if carbon credits are stacked on top of Nature Credits. Thus, Terrascape may further adapt the equation as market and consumer demand for Nature Credit evolves.

3.2.1. Human Modification Index (HMI)

The first attribute of ecosystem integrity is the ecosystem structure. To measure structure, a Human Modification Index (HMI) layer is constructed using the techniques outlined in Kennedy et al. (2019). This involves incorporating various pressure layers such as human settlement (population density and built-up areas), agriculture (cropland and livestock), transportation (major roads, minor roads, two tracks, and railroads), mining, energy production (oil wells and wind turbines), and electrical infrastructure (powerlines and nighttime lights). The identical pressure intensities detailed in Kennedy et al. (2019) are applied. Subsequently, the human modification layer undergoes inversion to convert it into an equivalent of the habitat quality and extent layer described in Beyer et al. (2019). Lastly, their methodology is employed to introduce landscape pressure and fragmentation influences, resulting in the ultimate structure layer. These procedures involve the use of a moving window that compares the quality of a grid cell with that of neighbouring cells, defined as cells within a 27 km distance. All spatial processing was conducted in Google Earth Engine with a resolution of 30 arcsec.

Terrascape protocol considers it critical to incorporate HMI in the methodology because it incentivizes maintenance and improvement of the structural integrity of the landscape.

The Terrascape credit engine maintains an up-to-date layer of HMI at 1 km resolution. The project developer will be required to provide the coordinates of the landscape through a shape file and the Terrascape credit engine will automatically calculate the HMI of that landscape.

3.2.2. Terrascape Biodiversity Intactness Index (TBII)

The second attribute of ecosystem integrity is composition, which is measured through Biodiversity Intactness.

Biodiversity Intactness is usually measured using the Biodiversity Intactness Index (Scholes and Biggs, 2005). It is a measure of the abundance of a set of species at a project site, relative to the reference abundance. Several challenges exist in estimating the reference abundance. These challenges include (a) lack of historical data on what species abundance was before human interventions across the whole planet, (b) differences in reference abundance of the same species across different eco-regions, and (c) different viewpoints on the reference date – should it be pre-Anthropocene, pre-industrial era, or about 1950 when more recent declines in biodiversity started.

Moreover, in this context, directly using available layers of modelled BII (Newbold, 2016) to measure changes in biodiversity intactness is not of much use because certain kinds of interventions that are important for reducing biodiversity loss, such as reducing poaching and hunting, removing invasive species, are unlikely to increase the modelled BII, irrespective of the efforts deployed on the ground. Another key shortcoming in the modelled BII is that it may show zero to minimal impact – at least in the short term – for the disappearance of a small set of species, even if they are keystone species – such as megaherbivores like elephants - which are critical for maintaining ecological functions and processes.

Therefore, the globally available layers of modelled BII and consequently EII are of limited use in calculating site scale or landscape scale changes in these indexes.

To address these challenges, Terrascape protocol has developed a proprietary Terrascape Biodiversity Intactness Index (TBII), which deploys a mix of remote sensing and on the ground surveys. The proposed approach is chosen for several reasons.

1. Greater collaboration with local communities and stakeholders in biodiversity surveys: Collecting biodiversity data through surveys often requires collaboration with indigenous peoples and local communities in setting up camera traps and acoustic devices, collecting eDNA samples, and conducting sign surveys. Experience demonstrates that engaging local stakeholders enables a positive behavioural change towards biodiversity conservation.
2. Alignment with Global Biodiversity Framework: As mentioned earlier, the Terrascape BII (TBII) goes beyond modelling and brings the measurements as close to the "original" BII ((Scholes and Briggs, 2003) as possible. The modelled BII, however, double counts the land use change attributes.
3. It maintains a balance between having enough species to indicate an improvement in the overall biodiversity and keeping the requirements of biodiversity data collection and associated costs at a manageable level. Therefore, when the population of keystone species, such as elephants, dwindles or recovers in the landscape, the TBII reduces or increases.

The details of how to estimate the biodiversity intactness index are detailed in Annex 1.

3.2.3. Net Primary Productivity Ratio (NPP)

The third attribute of ecosystem integrity is ecosystem function. Efforts to map ecosystem function have concentrated on diverse aspects of functional integrity. Some approaches have explored alterations in specific variables related to ecosystem function, yet no singular metric has been developed to comprehensively represent all dimensions of ecosystem function. In the absence of an alternative, more encompassing methodologies, the Terrascape protocol directs its focus toward a key ecosystem function, namely Net Primary Productivity (NPP), due to its well-established links with ecosystem functioning (Malhi et al., 2011; Mayer et al., 2021), as well as its advantages in terms of spatial resolution (layers available in raster format at 1 km² resolution or higher) and update frequency (e.g., MODIS releases a global new NPP layer annually).

Initially, a global layer of potential NPP is created to serve as a 'natural' reference. This layer is then juxtaposed with a current-day NPP layer derived from remote sensing to assess proportional losses in NPP. Natural NPP levels are modelled per grid cell using environmental variables trained on mean NPP levels (Running and Zhao, 2015) measured within strictly managed protected areas (IUCN categories I and II) between 2015 and 2020 (UNEP-WCMC and IUCN, 2017).

A generalized linear model framework is employed, using a Gamma distribution for the response variable and a log link. Model selection follows a backwards stepwise approach based on AIC values (Zuur, 2009). Variables are chosen for testing through a literature review of potential predictors of NPP, including latitude, bioclimatic variables (Fick and Hijmans, 2017), mean, minimum, and maximum solar radiation (Fick and Hijmans, 2017); aridity (Global Aridity Index, Zomer and Trabucco, 2022); total nitrogen, cation exchange capacity, predicted sand concentration, pH of water in soil (Poggio et al., 2021); continuous heat insulation load index (CHILI, Theobald et al., 2015); roughness of terrain, slope, topographic position index, terrain ruggedness index (Amatulli et al., 2018); and landforms (Sayre et al., 2020). The final model structure incorporates latitude as an interaction with total annual precipitation, mean annual temperature, and the mean temperature of the coldest quarter.

For each grid cell, the ratio of retained functioning is computed by dividing the current-day NPP value by the natural (model-estimated) NPP value.

The Terrascape credit engine maintains a global up-to-date layer of NPP ratio. Based on the geographical coordinates of the landscape, the Terrascape credit engine will calculate the NPP ratio.

3.3. Terrascape Nature Credits

Terrascape protocol divides Nature Credits into three categories.

3.3.1. Biodiversity Enhancement

Biodiversity enhancement is the improvements in ecosystem integrity obtained through restoration, reintroduction, or regenerative activities within the landscape of the project. Let $t = T$ be the number of years since the project initiation at $t = 0$. Nature Credits can be generated at interim periods during the project duration at varying times t. The relative incremental ecosystem integrity index at time $t = T$ is,

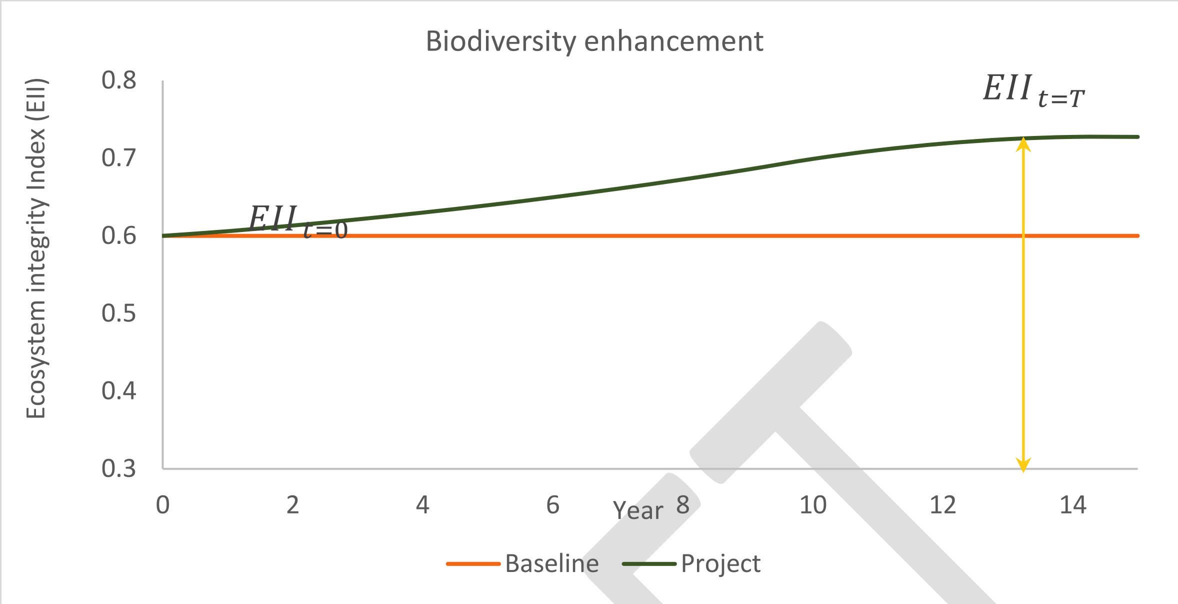
$$\Delta EII_{t=T} = \frac{EII_{t=T} - EII_{t=0}}{EII_{t=0}}$$

Nature Credits per hectare of project landscape area are calculated as,

$$\frac{NC_{t=T}}{ha} = \Delta EII_{t=T} * 100$$

Thus, the total Nature Credits generated by a project at $t = T$, with total hectare area $ha = HA$ are,

$$NC_{t=T} = \Delta EII_{t=T} * 100 * HA$$



To calculate $EII_{t=T}$ and $EII_{t=0}$ under this typology, the following four parameters are required:

$$\{HMI_{t=T}, TBII_{t=T}, NPP_{t=T}, EII_{t=0}\}$$

Out of these four, three parameters $\{HMI_{t=T}, NPP_{t=T}, EII_{t=0}\}$ are directly calculated by the Terrascape crediting engine based on the landscape's coordinates and biodiversity surveys at the start of the project. The process to calculate $\{TBII_{t=T}\}$ is detailed in Annex 1.

3.3.2. Avoided loss

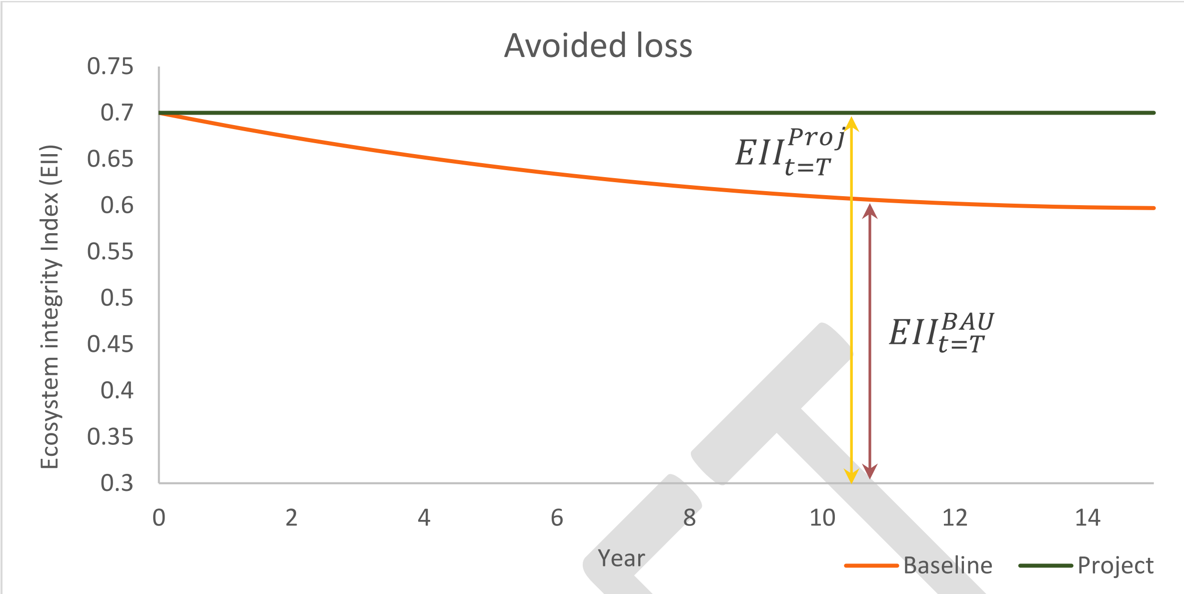
The reduced loss in ecosystem integrity obtained from protecting the landscape that contains natural or near-natural ecosystems or species, or ecosystems of local or global importance.

Let $t = T$ be the number of years since project initiation at $t = 0$. Nature Credits can be issued during interim periods during the implementation of the project, at varying times t. The relative incremental ecosystem integrity index at time $t = T$ is,

$$\Delta EII_{t=T} = \frac{EII_{t=T}^{Proj} - EII_{t=T}^{BAU}}{EII_{t=T}^{BAU}}$$

Where $EII_{t=T}^{Proj}$ is the ecosystem integrity index at time $t = T$ under the project scenario, and $EII_{t=T}^{BAU}$ is the ecosystem integrity index at time $t = T$ under the business-as-usual scenario. The total Nature Credits generated by a project at $t = T$ and with total hectare area $ha = HA$ is,

$$NC_{t=T} = \Delta EII_{t=T} * 100 * HA$$



To calculate $EII_{t=T}^{Proj}$ and $EII_{t=T}^{BAU}$ under this typology, the following four parameters are required:

$$\{HMI_{t=T}^{Proj}, TBII_{t=T}^{Proj}, NPP_{t=T}^{Proj}, EII_{t=T}^{BAU}\}$$

Out of these four, three parameters $\{HMI_{t=T}^{Proj}, NPP_{t=T}^{Proj}, EII_{t=T}^{BAU}\}$ are directly calculated by the Terrascape crediting engine based on the landscape's coordinates. The process to calculate $\{TBII_{t=T}^{Proj}\}$ is detailed in Annex 1.

The $\{EII_{t=T}^{BAU}\}$ is estimated by the crediting engine based on historical trends, biodiversity data at t = 0, and threats and policy outlook. Please see Annex 2 for further information on how the outlook needs to be estimated[6]. As mentioned, Terrascape protocol takes a conservative approach to estimating the BAU scenario to reduce the risk of inflated baselines.

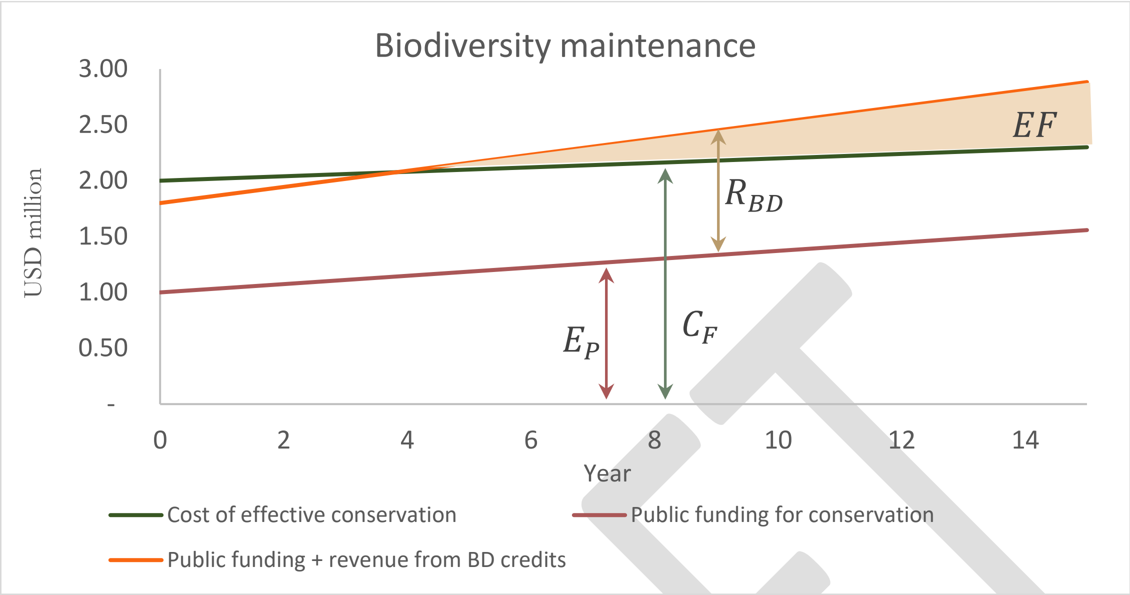
It is important to note that most projects will be a combination of both enhancement and avoided loss. In such cases, using avoided loss typology will incorporate enhancement.

3.3.3. Maintenance

This typology is only applicable for low- and middle-income countries[7] or for the landscapes that are primarily managed by the indigenous peoples, and appropriate in situations where the landscape remains largely intact and rate of loss of ecosystem integrity is negligible. The maintenance typology does not imply the absence of threats but rather offers opportunities to ensure the long-term conservation of landscapes that are under chronic threats. Chronic threats are those threats that are not imminent, but because of lack of legal or effective protection, may arise in future.

[6] The modeling approach used for estimating the BAU scenario may be revised after pilots on the ground.
[7] https://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/daclist.htm

It is important to clarify one of the critical additionality requirement under this typology.



The Nature Credits are considered additional if, $N_F \geq 150\% * A_p$, where N_F is the first ten years of cumulative costs of achieving effective biodiversity conservation outcomes at the landscape scale, A_P is the available finances for the same period, including public funding, in the absence of the project[8].

If $R_{BD} + E_P \geq C_F$ then the amount over and above C_F will go into an endowment fund (EF). Here R_{BD} is the revenue from the sale of Nature Credits, C_F is the cost of legally and effectively conserving the landscape, and E_P is the available financing from other sources, including public funding. To calculate Nature Credits under this typology, first estimate:

$$\Delta EII_{t=T} = EII_{t=T} - EII_{t=0}$$

After this step, use the following process to calculate the Nature Credits.

IF $-\Delta EII_{t=T} * \frac{100}{T} \geq 0.10$

Maintenance typology is no longer appropriate[9]. Change to typology two.

ELSE

$$NC_{t=T} = EII_{t=T} * 100 * HA * 0.02$$

Maintenance typology within a landscape cannot be combined with the other two typologies. In such a situation, a project will need to be divided into two, one focusing on maintenance, and the other focusing on enhancement and avoided loss.

[8] If the difference is less than 150%, then perhaps strengthening public financing and effective use of public resources for conservation may be more cost-effective than financing the gap through Nature Credits.
[9] This condition is based on a tolerance of 1000 years. If ecosystem integrity is lost faster than this rate, it can't be considered a landscape without imminent threats.

4. Ensuring high integrity

4.1. Additionality

The Nature Credit will only be awarded to project interventions where biodiversity gains are additional to those that otherwise would occur. Although there have been several debates around additionality, it remains an essential consideration to ensure that resources are deployed for activities that result in measured and verified improvements in biodiversity.

The additionality requirements under the protocol vary depending on the typology of the Nature Credits.

4.1.1. Additionality under enhancement

A biodiversity enhancement project or the biodiversity enhancement components of a project do not have to model a business as usual (BAU) scenario. The following requirements should be met.

a) Demonstrate that the barriers preventing natural regeneration are likely to be present in the BAU scenario. Such a demonstration could include, for example, an analysis of existing land management practices and why such practices are likely to continue in the absence of any incentives, thus prohibiting or suppressing the natural recovery of biodiversity.
b) Demonstrate that other sources of finance, both public and private finance, including financing through any ongoing carbon credit projects, are insufficient to achieve the desired biodiversity outcomes.

4.1.2. Additionality under avoided loss

The BAU scenario is modelled by the Terrascape crediting engine based on three variables, namely - the historical trends in EII, biodiversity surveys at the start of the project, and threats and policy outlook. Annexe 2 provides the detailed algorithm that the Terrascape crediting engine uses. Out of the three variables, historical trends in EII and biodiversity surveys at the start of the project would be based on facts and do not require any judgement or interpretation. The project developer will be required to classify threats and policy outlooks into one of the five scenarios – no change, an increase in threats, a significant increase in threats, a reduction in threats, and a significant reduction in threats. To avoid the risk of an inflated baseline, the engine uses conservative estimates for each of the five scenarios. The algorithm that the Terrascape crediting engine uses is further explained in Annex 2. The following additionality requirements should be met.

a) Demonstrate necessary and sufficient evidence to substantiate the threats and policy outlook scenario chosen. The sufficiency of evidence will be assessed by the third-party validator and by Terrascape.

b) Demonstrate that other sources of finance, both public and private finance, including financing through any ongoing carbon credit projects, are unavailable or insufficient to achieve the desired biodiversity outcomes.

4.1.3. Additionality under maintenance

The additionality under this typology is defined not from the perspective of counterfactual but how Nature Credits should strengthen the governance and legal and effective management of the landscape that would not have happened in the absence of the project. To meet additionality requirements under this typology, several criteria must be met. Otherwise, the project is not eligible to generate credits.

The following criteria must be met at the beginning of the project.

- Demonstrate that current financing is insufficient, for instance, based on historical trends, and cannot be sustained to manage the project site effectively and that the biodiversity conservation effort requires a new source of finance. It must be demonstrated that revenue from the sale of Nature Credits would not undermine the government's obligation to finance biodiversity conservation.
- The country is listed in the ODA list of OECD countries (This conditionality is not applicable for landscapes governed by indigenous peoples).

The following criteria must be met before the **issuance** of Nature Credits under maintenance.

- Designation of the project site for conservation, for example, through the incorporation of the project site into the national protected and conserved area system. Protected and conserved areas[10] that have been de-gazetted from legal protection within the last five years are not eligible under this typology
  OR
  Effective recognition and protection of indigenous rights and customary uses aligned to conservation objectives through recognized modalities such as ICCAs[11] registered in the global registry.

- Proven improvements in governance and management effectiveness of the project landscape demonstrated through recognized tools and standards, such as IUCN Greenlist[12], CATS[13], METT[14], or ICCA peer reviews[15].

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[10] Include protected areas (PAs), Other effective area-based conservation measures (OECMs), and ICCAs.
[11] Terrascape will recognize indigenous conserved areas that have been registered in the global ICCA registry and have been positively peer-reviewed, to issue Nature Credits contingent on an assurance that the national government is also likely to recognize these indigenous conserved areas in the coming years.
[12] https://www.iucn.org/resources/conservation-tool/iucn-green-list-protected-and-conserved-areas
[13] https://conservationassured.org/
[14] https://www.iucn.org/news/protected-areas/202112/management-effectiveness-tracking-tool-mett-new-edition-mett-handbook-launched
[15] https://ssprocess.iccaconsortium.org/act-with-others/see-how-others-do-it-2/

4.2. Crediting cycle, crediting period and duration

The BAU scenario needs to be updated every few years to ensure that the baseline is not exaggerated. The crediting cycle under the Terrascape protocol is nine years, after which the BAU scenario needs to be re-calculated and the project re-validated.

The crediting period is the period for which the Nature Credits can be issued as a result of positive biodiversity outcomes. This also means that the project developer will continue to do biodiversity surveys in the landscape and feed high-resolution biodiversity data into the Terrascape crediting engine to be able to calculate the Ecosystem Integrity Index. The protocol doesn't prescribe a minimum crediting period; however, it is important to recognize that addressing threats and underlying drivers of biodiversity loss requires a long-term vision and commitment. The project design document (PDD) must justify how the project aims to achieve its objectives within the proposed project implementation and crediting period. The implementation period refers to the period for which biodiversity conservation activities will continue to be implemented in the landscape. It is recommended that the crediting period of the project be in the multiple of nine years, to align with the crediting cycles.

The duration of the project will be 54 years. Terrascape will continue to track the changes in the EII after the crediting period. Any reversals in the ecosystem integrity will be deducted from the buffer.

4.3. Eligibility

The project should meet several eligibility requirements.

4.3.1. Realm

In the first phase, the Terrascape protocol is limited to the terrestrial realm. Within the terrestrial realm, the protocol applies to all biomes and ecosystems.

4.3.2. No transfer of Nature Credits

The ownership of Nature Credits under Terrascape protocol will not be transferred internationally and countries will be able to report the improvements in ecological integrity and increase in protected and conserved areas against their commitment to the Convention on Biological Diversity (CBD).

4.3.3. Land ownership and proof of ownership

The target landscape of a project under the Terrascape protocol is likely to have a mosaic of different land uses and ownerships, including ownership by the state, businesses, individuals and communities. In several countries, however, the legal framework on land is complex. To promote inclusive conservation, the Terrascape protocol considers specific measures that incorporate those complexities.

a. The ownership and rights to Nature Credits, as well as the benefit sharing, will be based on the national legal framework. Terrascape protocol's requirements on benefit sharing will also need to be applied. In case no national legal framework exists on benefit sharing, an explicit benefit-sharing agreement must be reached among all key stakeholders. Regardless, FPIC needs to be obtained from the local communities and indigenous peoples.
b. Terrascape has zero tolerance for the displacement of indigenous peoples. In indigenous peoples' territories, whether recognized nationally or otherwise, the design of the interventions and the implementation of activities must be driven by the indigenous peoples.
c. In several countries, by law, all land and its natural resources are owned by the state. Land is leased to businesses, individuals, and communities for specific purposes and a specific period. In such situations, an endorsement letter needs to be obtained from the state. Moreover, sufficient evidence must be provided that the land lease provided to businesses, individuals, and communities will be renewed.
d. Businesses and individuals participating in the project in the landscape must have undisputable rights (ownership or use rights) to land. If such land overlaps with the customary land rights of indigenous people, an agreement must be reached between indigenous peoples and businesses/individuals.
e. Indigenous peoples can participate in the project without requiring prior and nationally recognized land rights, provided that there are no land disputes with other communities or businesses[16]. Recognizing that several countries don't have the legal or effective legal framework to recognize indigenous territories, in such cases the Terrascape protocol has a provision for two pathways for indigenous territories to participate.
    a. [redacted]
    b. [redacted].

Landowner (or leaseholder)	Scenario	Documents required
Business or individual	No overlapping claims or disputes over land	• Land ownership (or use rights) documents
	Overlapping claims of indigenous peoples or local communities	• Free, Prior and Informed Consent (of the entity that asserts overlapping claims) • Benefit sharing agreement (with the entity

[16] If any dispute with other communities or businesses exists, an agreement needs to be reached before the full project is registered in the registry.

		that asserts overlapping claims) • Land ownership (or use rights) documents.
Local communities (communal land ownership)	No overlapping claims or disputes over land	• Land ownership (or use rights) documents
	Overlapping claims (with other communities, indigenous peoples or businesses)	• Free, Prior and Informed Consent (of the entity that asserts overlapping claims) • Benefit sharing agreement with (with the entity that asserts overlapping claims) • Land ownership (or use rights) documents.
Indigenous peoples	Nationally recognised land ownership (or rights)	• Land ownership (or use rights) documents
	[redacted]	• [redacted]
	[redacted]	• [redacted]

Table 1. Requirements to demonstrate legal rights or ownership of land

Note that the FPIC and benefit-sharing agreements mentioned in the table above are only in the context of disputes over the legal rights to land. In the process of project development and implementation, additional FPIC and benefit-sharing agreements will be required. Those requirements are detailed in the Terrascape protocol project development guidance and templates and the environmental and social safeguards framework (ESSF).

4.3.4. Benefit-sharing

Terrascape protocol requires that a minimum of 75% of the revenue from the sale of Nature Credits must go to the landscapes. The protocol prescribes a waterfall model of benefit sharing as illustrated in the figure below.

17 [redacted]

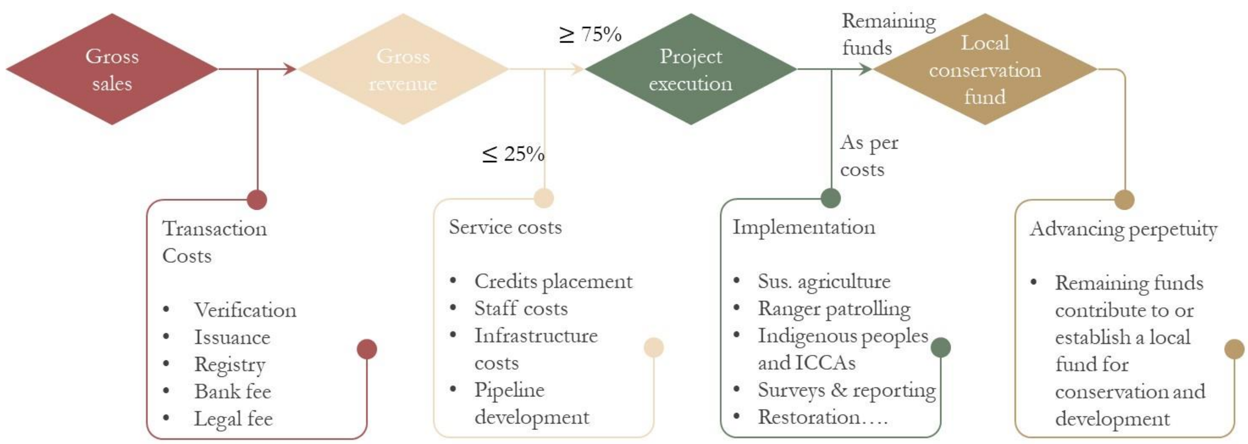

Figure 2. Benefit sharing mechanism

If a national/jurisdictional framework on benefit sharing exists, stricter of the two - i.e., jurisdictional framework or Terrascape protocol's benefit sharing – should be followed. Free, Prior and Informed Consent (FPIC), including that on benefit sharing, should be obtained from the landowners and users, including those who have customary rights, which haven't yet been legally recognized. Further details on FPIC are detailed in the Environmental and Social Safeguards Framework (ESSF).

4.3.5. Process

The following table summarizes the high-level process.

Process Step	Description
1	The concept note for the project is prepared and submitted. *[Template and guidance available]*
2	Stage gate: Approval of the concept note by Terrascape *[Checklist criteria available]*
3	The project design document (PDD) is prepared and submitted, including the baseline assessment, and ESSF. *[Template and guidance documents available]*
4	Validation of the project is done by a third party.
5	Stage gate: Approval of PDD by Terrascape *[Checklist criteria available].* The project is registered in the registry.
6	Implementation of the project starts on the ground.
7	Verification of the project by a third party, at least once every three years. Once successfully verified, Nature Credits are added to the registry and available for buyers who meet the protocol's requirements.
8	Re-validation of the project and re-estimation of baseline done by a third party (every nine years).

9	Stage gate: Approval of updated PDD.
10	Steps 6, 7, 8, and 9 continue until the project is completed. In the last cycle, i.e., just before the completion of the project, steps 8 and 9 are not required.

Table 2. Step-by-step process of starting and implementing a project using Terrascape protocol

4.3.6. Environmental and Social Safeguards Framework (ESSF)

Every project must deploy an effective Environmental and Social Safeguards Framework (ESSF). The mitigation measures must be commensurate with the environmental and social risks identified in the landscape. Both the risks and the measures will be reviewed and validated by both the validation body and Terrascape.

Please see the separate guidance documents and templates on ESSF, which are based on the safeguards used by the UN and WWF.

4.3.7. Buffer

Terrascape will maintain a buffer pool that will range from 10% to 30% of the credit generated. The amount of buffer kept will depend on the risks, which will be determined by the standard deviation of the year-on-year change in the ecosystem integrity index.

5. Validation and verification

All the projects will be required to go through a validation process *before the start of the crediting period*. In this process, an independent third party will confirm that the project meets the specific criteria and requirements of the Terrascape protocol. The validation will be based on:

a. Project Documentation Review: The validation body examines the project documentation, including the project design document (PDD), landscape boundaries and the process of defining boundaries, representative species and their selection process, survey methodology, assessment of threats and underlying drivers, preparation of theory of change, and roles and responsibilities of different stakeholders. The documentation review also includes an assessment of the social and environmental risks, and relevant mitigation measures proposed to address those risks.
b. On-site visit and interview with stakeholders: The validation body conducts an on-site visit to assess the project's design. They may interview project stakeholders and inspect relevant facilities to verify the accuracy of the reported data and assess the project's compliance with the protocol.
c. Spatial analysis and data analysis: The validation body reviews the project's variables required to calculate the Ecosystem Integrity Index (EII). The validation body will not be required to carry

out the biodiversity surveys itself but will ensure the accuracy and soundness of the surveys being done to calculate the baseline. Note that all approved third-party agencies will have access to the Terrascape crediting engine source code.

d. Compliance Check: The validation body assesses the project's compliance with the specific requirements in terms of additionality and permanence criteria.

Based on their assessment, the validation body will prepare a validation report that outlines their findings, conclusions, and recommendations. The report serves as a basis for determining whether the project is eligible for Nature Credits or requires further improvements before proceeding to the implementation stage.

The list of certified third-party validation bodies and the format and template for the validation, along with the criteria and requirements will be made available.

The Terrascape protocol requires that verification be done at least once every three years. Verification will ensure that the project is successfully implementing activities according to the plan and that the biodiversity gains are valid and meet the requirements of the Terrascape protocol. Key aspects of the verification process include:

a. Independent Assessment: Verification will be conducted by an independent third-party verification body. This ensures objectivity and credibility in assessing the project's claim in terms of biodiversity gains achieved.
b. Data and Documentation Review: Verifiers review the project's monitoring data, documentation, and evidence to evaluate the accuracy and integrity of the reported biodiversity surveys and biodiversity gains.
c. Compliance Check: The verification body verifies that the project has complied with Terrascape protocol's methodology, rules, and requirements. This includes confirming the project's adherence to additionality criteria, inclusive conservation aspects, and landscape approach.
d. On-Site Inspection: Verifiers may conduct on-site visits to assess the project's infrastructure, operations, and monitoring systems. They may interview project stakeholders and use remote sensing to ensure the project's compliance with the protocol.

Verification Report: Following the assessment, the verifier prepares a verification report that provides findings, conclusions, and recommendations. The report outlines whether the project has achieved the claimed biodiversity improvements and provides insights into the project's adherence to the protocol.

The list of certified third-party verification bodies and the format and template for the verification, along with the criteria and requirements, will be made available.

All validation and verification reports will be made available on the Terrascape registry.

6. Alignment with the Global Biodiversity Framework

Ecosystem integrity is a central component of the Global Biodiversity Framework (GBF), playing a pivotal role in achieving the framework's overarching goals and targets. The GBF recognizes the importance of maintaining or enhancing the integrity of ecosystems to ensure the long-term health and functioning of biodiversity.

Goal A of the GBF, which focuses on the conservation of biodiversity by 2050, explicitly emphasizes ecosystem integrity. The goal, which is also the very first line of the framework, states “**The integrity,** connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050;”.

Several targets within Goal A are specifically focused on ecosystem integrity. In addition to Goal A, other parts of the GBF also address ecosystem integrity. For example, Goal B focuses on sustainable use and management of biodiversity and that ecosystem functions are valued, maintained and enhanced.

7. Communications and claims

The claims must be made appropriately in accordance with the protocol to avoid the risks of greenwashing and to protect the integrity, credibility and reputation of the market in general. Inaccurate claims also risk derailing biodiversity conservation efforts, negatively impacting the natural world and the indigenous people.

The claims that a buyer can make depend on the objective and buyer’s nature strategy, if any, within the scope of which the credits are claimed.

Buyer	Objective	What claim can be made
Individuals	Philanthropic	Only general statements about how the project is supporting the biodiversity conservation efforts and indigenous peoples could be made. Statements, stories and case studies about the project benefitting specific species or communities could also be made and published. Moreover, general statements about the contribution to a nature-positive world and the Global Biodiversity Framework (with no reference to SBTN or TNFD could be made) could be made.
Business, foundation or government	Philanthropic [The landscape from which credits are sourced is not considered a material risk to the buyer]	
Business	Contribution to SBTN [redacted]	In addition to what can be claimed by the [redacted]

		[redacted].
Government	[redacted]	[redacted].

Under no circumstances can Terrascape Nature Credits be used for offsetting environmental impact.

Annexe

1. Terrascape biodiversity intactness index (TBII)

The Terrascape biodiversity intactness index (TBII) uses a combination of abundance surveys[18] and modelled biodiversity intactness index (N-BII) (Newbold, 2016) to estimate the changes in biodiversity intactness. To calculate TBII, take the following steps.

a. Identify the representative species: select 2-4 representative species across the five taxonomic groups – mammals, birds, reptiles, amphibians, and plants[19]. The selection should be based on the following criteria.
   i. Importance of the species to the Indigenous Peoples and Local Communities (This includes both use and non-use importance such as historical and spiritual connections.)
   ii. Keystone, threatened, endangered and endemic species
   iii. Species for which necessary and sufficient data could be gathered.

b. Let S_{jk} represent a species k in taxonomic group j, where $1 \leq j \leq 5, 1 \leq k \leq K_j, and\ 2 \leq K_j \leq 4.$ K_j is the number of identified representative species in taxonomic group *j*. Let w_{jk}represent the relative importance of species k in the taxonomic group j.

   Note that for each taxonomic group j, $\sum_{k=1}^{K_j} w_{jk} = 1$. Please see reference guidance on identifying representative species.

c. Prepare the survey design: For each of the 10 - 20 species identified, prepare the survey design. The design should be scientifically robust[20]. Note that the frequency of surveys at a particular site should not be lower than once every three years.

d. Identify different zones in the landscape: Terrascape protocol prescribes that the landscape be divided into the following zones. The typology of this segmentation is based on the same approach that (Newbold, 2016) used to model the biodiversity intactness index (N-BII).
   i. (Z_1) Primary vegetation
   ii. (Z_2) Secondary vegetation (includes young, intermediate, and mature)
   iii. (Z_3) Plantation forests (include only those management types that require low chemical inputs and low level of active management. Mixed agroforests may also be classified under plantation forests depending on the management. The project developer will be

[18] Estimating true abundance is an arduous task. Terrascape methodology doesn't require the calculation of true abundance but only to use proxy indicators based on survey efforts. In order to minimize efforts, it is important that the survey efforts are consistent across time and are based on stratified random sampling.

[19] The selection of five taxonomic group as representative groups is based on and aligned with the original paper that proposed BII (Scholes and Briggs, 2003)

[20] Please refer to section on third party verification.

required to classify a particular agroforest management either under Z_3 or Z_5, based on the management deployed.)

iv. (Z_4) Pasture

v. (Z_5) Cropland (perennial that isn't classified under plantation forests will be cropland.)

vi. (Z_6) Urban

Note that the area under a particular zone may increase or decrease during the implementation of the project.

e. Conduct the surveys: Carry out the biodiversity surveys in Z_1, Z_2, Z_3 and Z_4 as well as, if required, in Z_5. Let $A_{ijk\ t=0}$ be the abundance in the zone Z_i of species S_{jk} based on the biodiversity surveys at $t = 0$ i.e., at the beginning of the project.

f. [redacted]

g. [redacted]

[redacted]

[redacted]

h. [redacted]

[redacted]

[21] https://livingplanet.panda.org/

[redacted]

2. Modelling of the BAU scenario in the avoided loss typology

Modelling the BAU scenario is challenging and can only be done with certain assumptions, which should be as realistic as possible. At the same time, to ensure high integrity, the modelling should be done based on conservative estimates.

Terrascape uses the same calculation process as that of the Black-Scholes-Merton option pricing model. Almost all the financial models currently use Black-Scholes-Merton, one way or the other, as the basis to calculate the anticipated future price of financial security. The model is modified and adapted to calculate the BAU Ecosystems Integrity index. Another benefit of the model is that the more uncertainty there is in anticipating the BAU EII, the more conservative estimate it takes. Such an approach provides a more accurate estimation compared to linear projections.

The model assumes that the [redacted].

[redacted]

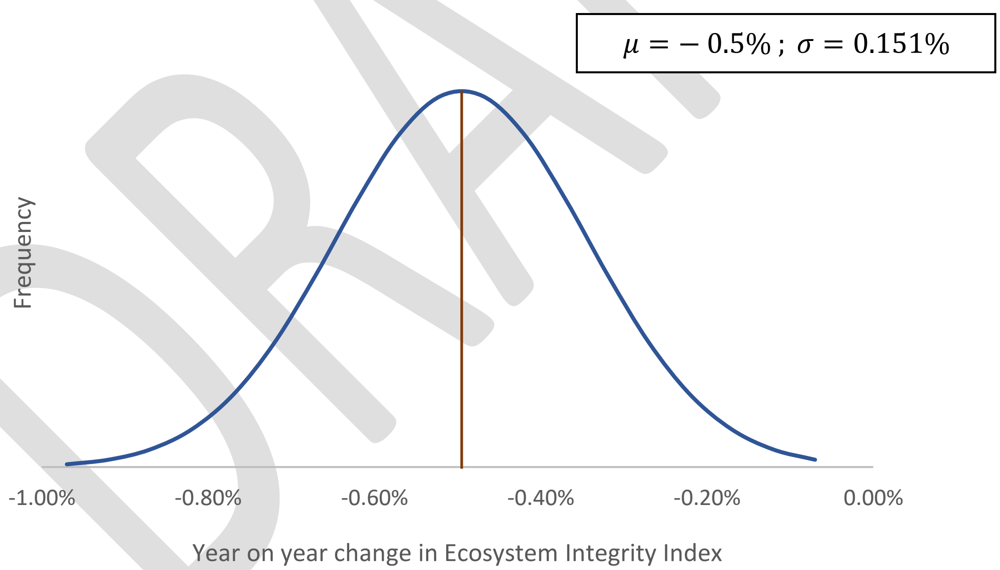

Figure 3. Example: Probably distribution of year-on-year change in the Ecosystem Integrity Index

[redacted]

[22] https://www.statlect.com/probability-distributions/log-normal-distribution

[redacted]

To estimate a realistic BAU scenario, it is important to consider the following cases.

a. *No change in the land use and conservation policy and practice*: This case is appropriate in situations where there have been no recent changes in land use policy and practice and no changes are anticipated in the coming years. The crediting engine will take conservative estimates.
b. *(Significant) increase in threats to biodiversity loss*: This case is most appropriate for situations wherein the government has recently changed its land use policy and practice in ways that will accelerate ecosystem degradation compared to historical trends. Examples include new and unprecedented economic land concessions (ELCs) for commercial agriculture, and oil and minerals extractions in areas of high biodiversity value.

   Note that this scenario is applicable only if the impact of the policy shift is recent (i.e., less than two years). A timeframe of less than two years is chosen because the impact of policy change on the ground is unlikely to be reflected in the estimated mean and standard deviation of year-on-year change in the Ecosystem Integrity Index.

c. *(Significant) decrease in threats to biodiversity loss*: If the policy and practice on land use change are anticipated to promote sustainable use of land, the historical loss in ecosystem integrity will exaggerate the BAU scenario and thus need to be adjusted.

#	Scenario	Value of $EII_{t=T}^{BAU}$	Confidence estimate
1	*No change in the land use and conservation policy*	[redacted]	~65%
2	***Increase** in threats to biodiversity loss*	[redacted]	> 57% (likely between 57%-82%)
3	***Significant increase** in threats to biodiversity loss*	[redacted]	> 50% (Likely between 50% - 90%)
4	*Decrease in threats to biodiversity loss*	[redacted]	~73%
5	***Significant decrease** in threats to biodiversity loss*	[redacted]	~79%

Table 3. Scenario selection

Note that the project developers will not need to estimate BAU themselves. They will need to select the appropriate case based on stakeholder consultation and policy outlook that is backed by evidence. The Terrascape crediting engine will calculate the BAU scenario based on the equations mentioned above. All the source code used to estimate the BAU scenario will be made publicly available to ensure full transparency.