

The Global Biodiversity Standard: Manual for assessment and best practices



PROTECT ENHANCE RESTORE

The Global Biodiversity Standard

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

PLAN VIVO For nature, climate and communities

TRAFFIC

The Global Biodiversity Standard: Manual for assessment and best practices

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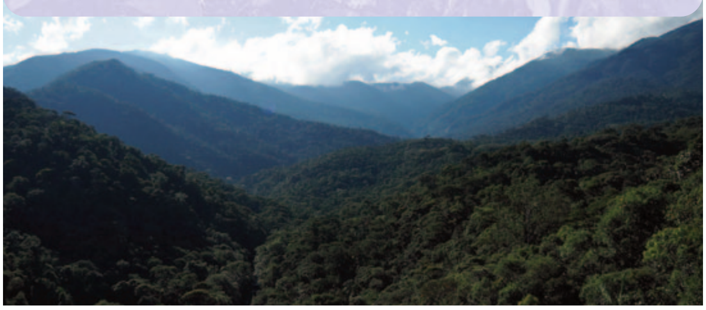
Contents



Section 5: Field Survey

Section 6: Assessment, Verification and Certification

Section 7: TGBS Mentoring

Section 8: Becoming a GBS Assessor or Trainer

Section 9: Conclusion

Appendices

Foreword

Dr Éliane Ubalijoro, *Chief Executive Officer, Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF) and Director General, ICRAF*

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Dr David Cooper, *Executive Secretary, United Nations Convention on Biological Diversity (CBD)*

We are delighted to write this foreword for the Global Biodiversity Standard (TGBS) Manual.

The TGBS has been conceived, developed and implemented to help address the major environmental challenges of our time – biodiversity loss, ecosystem degradation, climate change and viable livelihoods. Integrated approaches to solving these challenges are desperately needed, not least to ensure that our pursuit of one goal doesn't undermine another.

The TGBS is a site-based global standard for nature-based solutions aimed at driving positive outcomes for biodiversity, ecosystems and the communities that rely on them. Developed by a coalition of global biodiversity experts, the TGBS seeks to recognise and promote best practices in projects that aim to protect, restore and manage biodiversity sustainably.

CIFOR-ICRAF is honoured to be a founding member of the TGBS, contributing expertise on productive landscapes that balance human needs with nature conservation. Forests, trees and agroforestry hold immense potential to address global challenges. CIFOR-ICRAF has invested decades of research in tree genetic diversity and offers evidence-based guidance on the selection of the right trees for diverse landscapes and needs, including large-scale forest landscape restoration (FLR) initiatives worldwide. We endorse the '10 golden rules of reforestation', emphasising the dual objectives of carbon sequestration and positive impacts on community livelihoods and native biodiversity. Collaboration on the TGBS inspired the development of the 'Global Useful Native Trees' and 'Tree Globally Observed Environmental Ranges' databases. These resources guide tree planting projects globally, considering diverse species mixes that are suited to both community needs and changing climate conditions. The TGBS mentoring component ensures continual improvement in nature-based solutions, enhancing outcomes for biodiversity, ecosystems and communities. CIFOR-ICRAF is committed to sharing knowledge that empowers smallholder farmers to plant trees for optimal results. As an enthusiastic supporter of the TGBS, CIFOR-ICRAF is proud to have contributed to the methodologies outlined in the manual. Together, we are shaping a future where trees drive positive transformation, embodying our shared commitment to a sustainable, resilient and just world.

IUCN welcomes the TGBS as a tool to assess the impacts of tree planting and other nature-based initiatives on biodiversity and ecosystem integrity, providing assurance to financiers and policymakers, as well as assistance to practitioners. IUCN hosts the Bonn Challenge Secretariat, which records and tracks progress against a target of 350 million hectares of land pledged for FLR by 2030. To date, 210 million hectares of degraded and deforested land have been earmarked for restoration in more than 60 countries worldwide. FLR is a landscape-based approach that combines productive land uses such as agroforestry and tree plantations with ecosystem restoration and biodiversity-positive interventions. The TGBS methodology takes into account the land-use mosaics that characterise FLR, and assesses the impacts on biodiversity across these mosaics.

The TGBS measures changes to biodiversity and ecosystems caused by management interventions, recognising that biodiversity-positive trajectories are possible no matter the land use. More importantly, the TGBS also detects negative impacts on biodiversity and ecosystem integrity that may be caused inadvertently or in cases where biodiversity is subordinate to market forces or human needs.

A regional TGBS hub in Malaysia. (Tropical Rainforest Conservation & Research Centre)

A standardised site-based assessment process is core to the TGBS and is carried out by regional biodiversity hubs, with rigorous certification criteria that require certified projects to present evidence of positive outcomes for biodiversity. The capacity to carry out such objective measures, particularly by third-party in-country experts, is in desperately short supply. Thus, in addition to the novel methodology presented by the TGBS, the site-based assessment is implemented by local biodiversity centres and experts – people who know their own biodiversity, socio-economic context and culture best. It builds on existing, bona fide scientific centres of expertise and strengthens them through training and access to the best available data, with the goal to create a paradigm shift for tree planting, land management and other carbon credit and livelihood projects around the world.

The TGBS is one of several tools that are compatible with the Convention on Biological Diversity's Global Biodiversity Framework (GBF). Target 1 of the GBF calls for participatory effective management of biodiversity and ecological integrity, and Targets 2 and 11 call for restoration to repair damage already caused. Target 4 calls for urgent management action to halt human-induced extinction, and Targets 5 and 9 seek to ensure that the use, harvesting and trade of wild species is sustainable. The Global Biodiversity Standard will help to deliver on all of these targets.

The bottom-up approach of this methodology is also consistent with the CBD's central tenet of equitable sharing of benefits. This element of knowledge sharing and cooperation helps to meet Targets 17, 20 and 21 of the GBF, and empowers local biodiversity experts to influence land-use decision-making in their own countries and regions.

The methodology presented in these pages has been conceived and developed by an impressive array of organisations and individuals, including biodiversity experts, ecologists, sociologists, tree planting organisations and certification agencies in consultation with local communities. It has also been rigorously tested across more than 100 projects and land uses in multiple countries and cultures.

We would like to congratulate the TGBS partners on their achievements, and we look forward to working with them as the TGBS develops further.

Executive Summary

Atlantic Forest, Itatiaia National Park, Brazil. (David Bartholomew)

This manual describes in detail the Global Biodiversity Standard (TGBS) methodology required for TGBS certification, including the application form, remote sensing and field survey, as well as the assessment process and scoring system.

The goal of this manual is to make all elements of the methodology clear to applicants, assessors and reviewers of the TGBS. However, some sections are designed specifically to support applicants to the TGBS (sections 2 and 3) and to help assessors to conduct TGBS assessments of sites that will be certified under the TGBS (sections 2, and 4-6). Reviewers should use this manual to verify whether assessors have appropriately implemented the TGBS assessment methodology and assessed and scored projects appropriately. This manual also provides an outline of mentoring resources available to applicants under the TGBS (section 7), and a guide on how to become an assessor or trainer of the TGBS methodology (section 8).

Whilst some sections have been written specifically to guide assessors, applicants may also use these sections to understand and find resources on best practice for restoration implementation, to develop and enhance monitoring and evaluation activities, and to improve their understanding of the TGBS assessment process.

This manual is divided into nine sections, each of which addresses a different aspect of the TGBS and its implementation.

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 1
Introduction

Parana pine, Araucaria angustifolia, a critically endangered species, in Atlantic Forest, Brazil. (David Bartholomew)

The Global Biodiversity Standard

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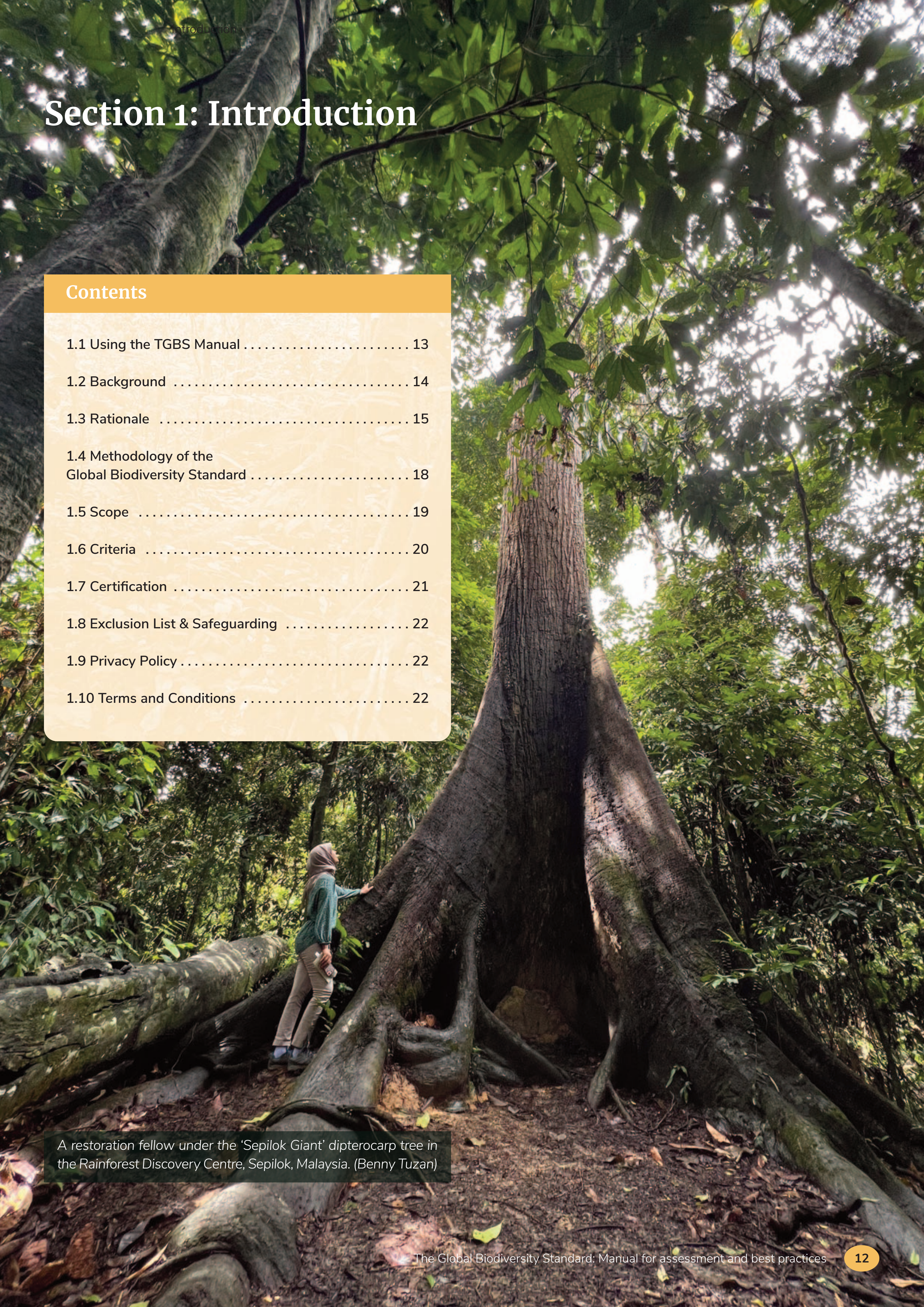
Section 1: Introduction

Contents



A restoration fellow under the 'Sepilok Giant' dipterocarp tree in the Rainforest Discovery Centre, Sepilok, Malaysia. (Benny Tuzan)

1.1 Using the TGBS Manual

This manual is divided into nine sections, each of which addresses a different aspect of the TGBS and its implementation.

1

Section 1: Introduction:

This section introduces the manual and explains the TGBS, including its rationale, scope and the criteria on which it is based. The different certification tiers are also explained, and the terms and conditions of the standard are described including the exclusion list and privacy policy.

2

Section 2: Getting Started:

This section discusses the roles and responsibilities of the assessor, applicant and other parties. The section concludes with instructions on how to define the baseline condition and identify the native reference ecosystem, an important part of the TGBS assessment.

3

Section 3: Application Form:

This section covers the essential details of the application form, including contact details, project description and project area. This section describes the prerequisite information that must be provided prior to a TGBS assessment.

4

Section 4: Remote Sensing Survey:

This section describes how to conduct the remote sensing survey component of a TGBS assessment. It describes the steps involved in preparing for remote sensing assessments, as well as the interpretation and analysis of remote sensing data. It also covers how to use remote sensing to support the field survey and the reassessment process every five years after the award of TGBS certification.

5

Section 5: Field Survey:

This section describes how to conduct the field survey component of a TGBS assessment. It describes the steps involved in conducting a field survey assessment. The field survey evaluates the impact on biodiversity, the level of protection, stakeholder engagement, and baseline and monitoring data, as well as the reporting and dissemination of field survey results.

6

Section 6: Assessment, Verification and Certification:

This section describes the TGBS assessment, verification and certification process. The system for scoring sites against the TGBS criteria is also described in detail.

7

Section 7: Restoration Mentoring:

This section outlines a series of modules that the assessors may provide to applicants and a range of mentoring resources that can support sites to become certified by the TGBS. The modules cover support related to the application and assessment processes, implementation of best practices and long-term sustainability of projects.

8

Section 8: Becoming a Global Biodiversity Standard Assessor and Trainer:

This section outlines how to become a TGBS assessor or trainer. Here, the requirements and training needed to become an assessor and trainer are described, in addition to the TGBS assessor certification process.

9

Section 9: Conclusion:

This section provides a summary of the key points covered in the manual. It emphasises the importance of TGBS certification and calls for continued improvements.

A

Appendix A - The Global Biodiversity Standard Application Form

Appendix B - Assessment Form: This appendix outlines the field assessment form that is to be completed by assessors for applicant projects.

Appendix C - Using the Ecosystem Integrity Five-star System: This appendix provides an overview of ecosystem integrity, the principles of the Five-star System, and examples of measurement and analysis. It addresses assessment strategies, tool selection, data collection and assessment tools, quality assurance and control, analysis and interpretation of ecological data, and data analysis techniques.

Appendix D - Remote Sensing Methodologies: This appendix provides an outline of available remote sensing methodologies that can be used to evaluate sites under the Five-star System.

Appendix E - Stakeholder Engagement and Social Benefits Assessment Methodologies: This appendix outlines the assessment tools to collect data for the assessment of criterion 3 of the TGBS.

Appendix F - Ecosystem Integrity Five-star System: This appendix outlines the details of the five-star ratings for six attributes and 21 sub-attributes of ecosystem integrity and biodiversity used in the TGBS assessment.

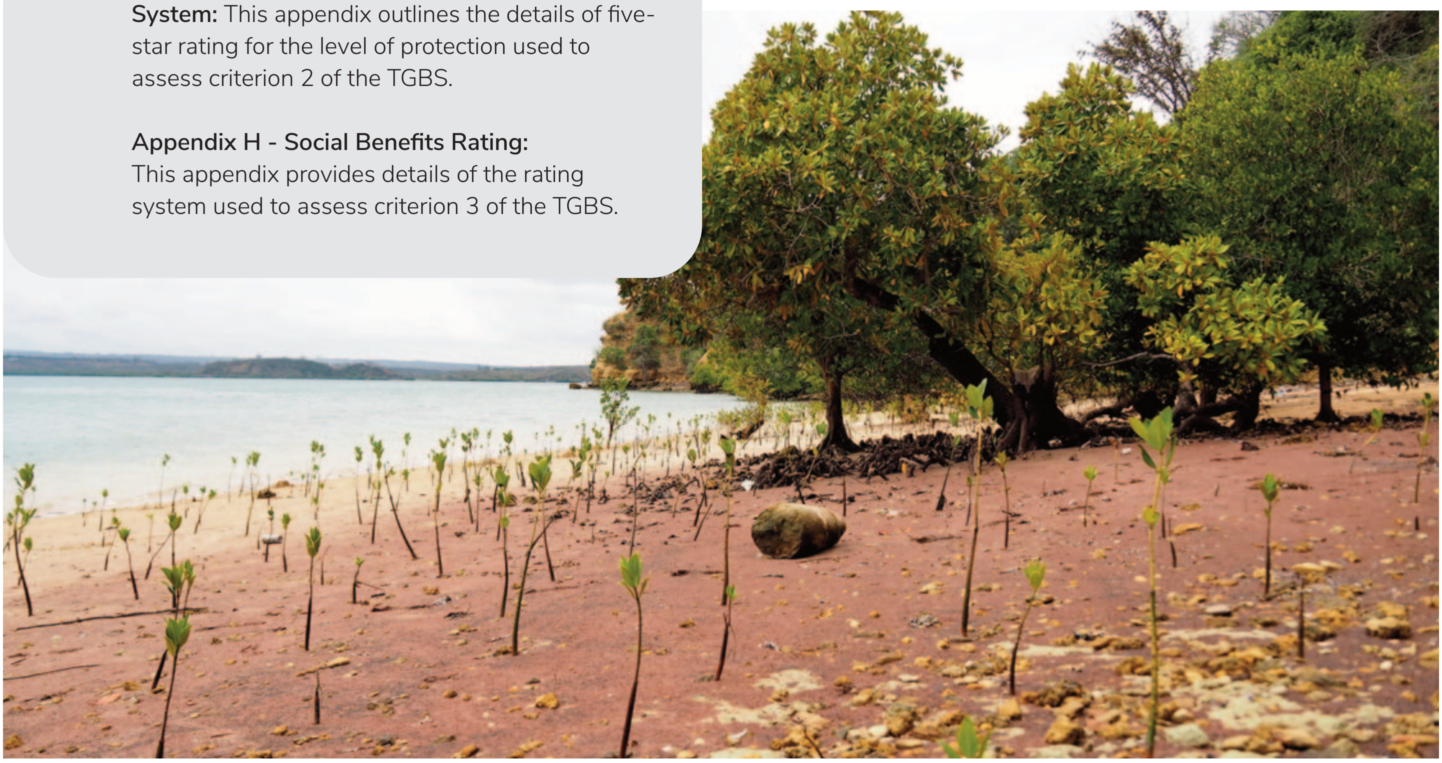
Appendix G - Level of Protection Five-star System: This appendix outlines the details of five-star rating for the level of protection used to assess criterion 2 of the TGBS.

Appendix H - Social Benefits Rating: This appendix provides details of the rating system used to assess criterion 3 of the TGBS.

1.2 Background

The TGBS is a site-based certification scheme that aims to improve biodiversity outcomes throughout the full range of the restoration continuum, including restorative agricultural practices such as agroforestry, rehabilitation and ecological restoration (Figure 1.1). The TGBS has been developed to provide a mechanism to support the 10 golden rules for reforestation (Di Sacco et al. 2021), the Kew Declaration (Kew Declaration 2022) and the implementation of the standards of practice of ecological restoration (Gann et al. 2019). The TGBS has the major goals of helping to address biodiversity loss by assessing the impacts on biodiversity by site management practices and promoting a wide variety of restoration approaches from assisted natural regeneration to biodiverse tree plantings and other forms of intensively assisted recovery in forests and other natural ecosystems (Gann et al. 2019, Chazdon et al. 2021). The TGBS promotes the restoration of degraded landscapes and supports sustainable development by conserving and restoring the biodiversity that underpins the delivery of ecosystem services.

The TGBS has been developed by Botanic Gardens Conservation International (BGCI), the Society for Ecological Restoration (SER), the Plan Vivo Foundation, TRAFFIC, the Center for International Forestry Research and World Agroforestry Centre (CIFOR-ICRAF) and Ecosia. The development of the assessment methodology has also been supported by Rabobank, Reforest'Action, the Royal Botanic Gardens, Kew, Bioflore, Space Intelligence and 1t.org. The assessment methodology has been tested in six countries by Auroville Botanical Gardens (India), the Centre for Ecosystem Restoration – Kenya, Huarango Nature (Peru), Jardim Botânico Araribá (Brazil), Missouri Botanical Garden's Madagascar Program and Tooro Botanical Gardens (Uganda). The development of the Global Biodiversity Standard was supported by funding from the Defra, UK Darwin Initiative Extra project DAREX001 and Etihad Airways.



Mangrove restoration in Kilifi Creek, Kenya. (David Bartholomew)

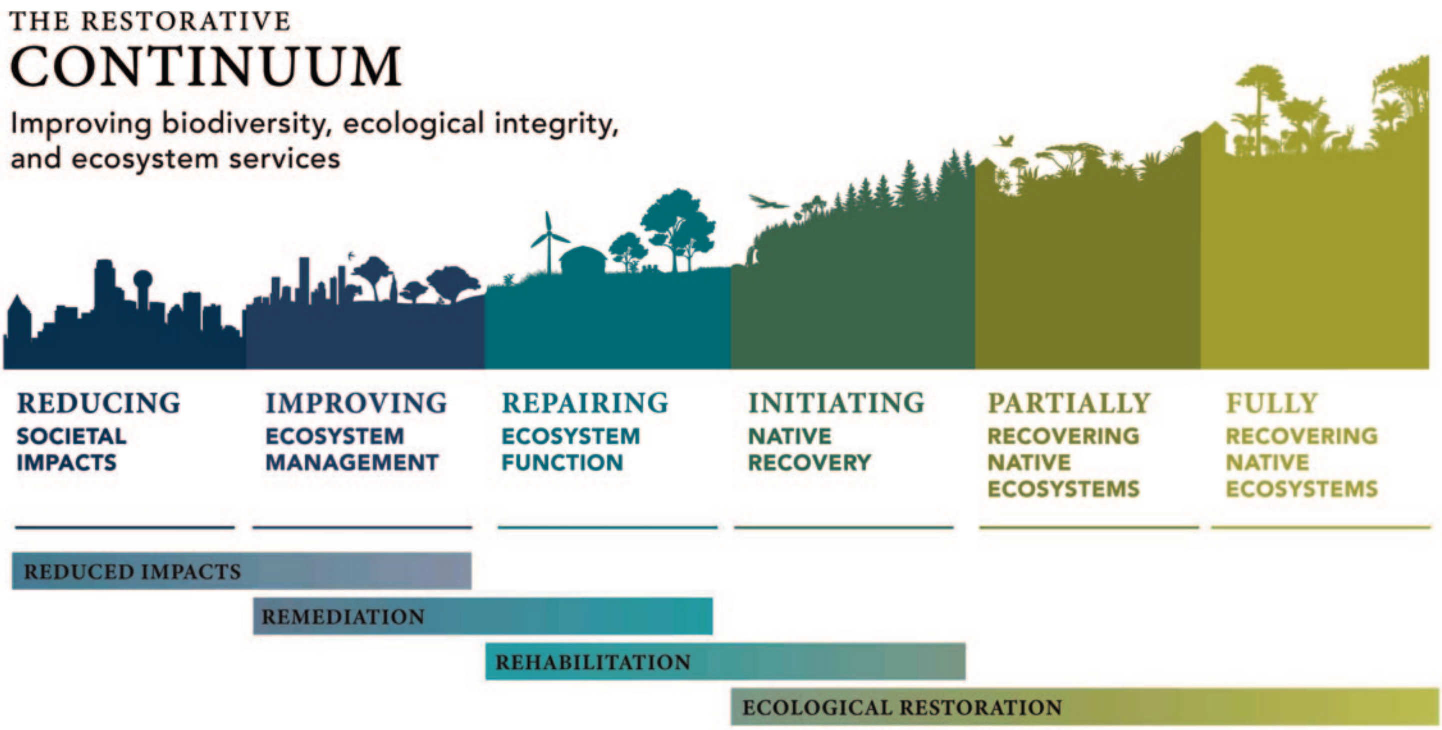


***Figure 1.1** – The restoration continuum. Copied with permission from Gann et al. (2019).*

1.3 Rationale

The TGBS is an international, site-based standard that recognises and promotes the protection, restoration and enhancement of biodiversity across multiple land uses and sectors. Its principal justification is to replace the 'any tree, anywhere at minimal cost' solution to climate change with long-term, best practice nature-based solutions that combine the considerations of biodiversity, local communities and carbon capture. The TGBS contributes to the Kunming-Montreal Global Biodiversity Framework (GBF), the United Nations 2030 Sustainable Development Goals (SDGs) and global climate change mitigation targets, including the Paris Agreement. The TGBS helps to support the United Nations Decade on Ecosystem Restoration by promoting best ecosystem restoration practices. The TGBS assessment methodology provides a mechanism to measure contributions and share data for Targets 1-11 of the GBF and also helps support Targets 15 and 20-23 of the GBF. If applied as conceived, the TGBS will contribute to 12 of the SDGs (Figure 1.2).

***Figure 1.2** – The Global Biodiversity Standard contributes to 12 of the United Nations Sustainable Development Goals.*

Target			Contribution
Reducing threats to biodiversity	1	All areas are planned or managed to bring loss of areas of high biodiversity importance close to zero	Assessment under criterion 2.
	2	30% of degraded areas are under effective restoration	Assessment under criteria 1-8.
	3	30% of areas are effectively conserved	Assessment under criterion 2.
	4	Threatened species are recovering, genetic diversity is being maintained and human-wildlife conflict is being managed	Assessment under criteria 1, 3 & 6-7.
	5	Use, harvesting and trade of wild species is sustainable, safe and legal	Assessment under criterion 1.
	6	Reduce rates of introduction and establishment of invasive alien species by 50%	Assessment under criteria 1 & 5.
	7	Pollution reduced, halving nutrient loss and pesticide risk	Assessment under criterion 1.
	8	Minimise impacts of climate change and ocean acidification including through nature-based solutions and/or ecosystem-based approaches	Assessment under criteria 1-8.
Meeting people's needs through sustainable use and benefit-sharing	9	Management of wild species is sustainable and benefits people	Assessment under criteria 1 & 3.
	10	Areas under agriculture, aquaculture, fisheries and forestry are managed sustainably	Assessment of agriculture and forestry areas.
	11	Nature's contributions to people are restored, maintained and enhanced	Assessment under criteria 1-8.
Tools and solutions for implementation and mainstreaming	15	Businesses assess and disclose biodiversity dependencies, impacts and risks, and reduce negative impacts	The TGBS provides a mechanism for assessment and disclosure of biodiversity impacts.
	20	Capacity building and development, technology transfer, and technical and scientific cooperation for implementation is strengthened	The TGBS promotes capacity building and technical and scientific cooperation across its network.
	21	Data, information and knowledge for decision-making is available	The TGBS mobilises data, information and knowledge for decision-making; Assessment under criterion 3.
	22	Ensure participation, justice and rights for indigenous peoples and local communities, women, youth, persons with disabilities and environmental defenders	Assessment under criterion 3.
	23	Implementation follows a gender-responsive approach	The TGBS supports gender equality throughout; Assessment under criterion 3.

Table 1.1 – The Global Biodiversity Standard contributes to 16 of the Global Biodiversity Framework Targets.

Kishan Bagh Sand Dunes Park, Jaipur, India – a pioneer project restoring the native dune ecology. (Auroville Botanical Gardens)

The Global Biodiversity Standard aims to provide:

- **Recognition:** The TGBS will help provide recognition for projects that have a positive impact on biodiversity that protect, enhance and restore natural ecosystems and incorporate native biodiversity into regenerative agricultural practices.

- **Incentives:** By publicly recognising best practice, we will provide incentives for organisations to incorporate a diversity of native species into planting and land management programmes. At the same time, projects will avoid planting and introduction of potentially invasive species.

- **Assurance:** The TGBS will provide assurance to governments, financiers of large-scale tree planting, and the public that initiatives are promoting and protecting biodiversity, not causing damage or loss.

- **Knowledge:** The TGBS will provide knowledge, data and mentoring delivered by local TGBS hubs for policymakers, financiers, brokers and tree planting groups that apply to the TGBS to develop land management practices that protect, restore and enhance a biodiverse world.

The core values of the Global Biodiversity Standard are:

- **Protect and restore biodiversity:** The Standard will promote projects that help to halt and reverse declines in biodiversity. Land-use change, over-harvesting and extraction, pests and disease, climate change and the introduction of invasive species are leading to the destruction of the world's biodiversity.

- **Use the knowledge of local and international experts:** The Standard will deploy the world's largest plant conservation network, BGCI, with over 875 member institutions and 60,000 experts in 155 countries, the global network and Certified Ecological Restoration Practitioner (CERP) programme of SER, and the expertise of TRAFFIC, CIFOR-ICRAF and other partners. The hubs conducting TGBS assessments will connect with experts and resources local to project sites. This will ensure that the best knowledge of local ecology is used in assessing and mentoring of project activities and practices.

- **Be objective and scientifically rigorous:** Our methodology is based on the most up-to-date scientific data and best practice paradigms for ecosystem and ecological restoration.

- **Be accessible and equitable:** The Standard will be designed, as far as realistically possible, to be easy to apply for, affordable, relatively rapid, and applicable to projects at all scales and stages of development.

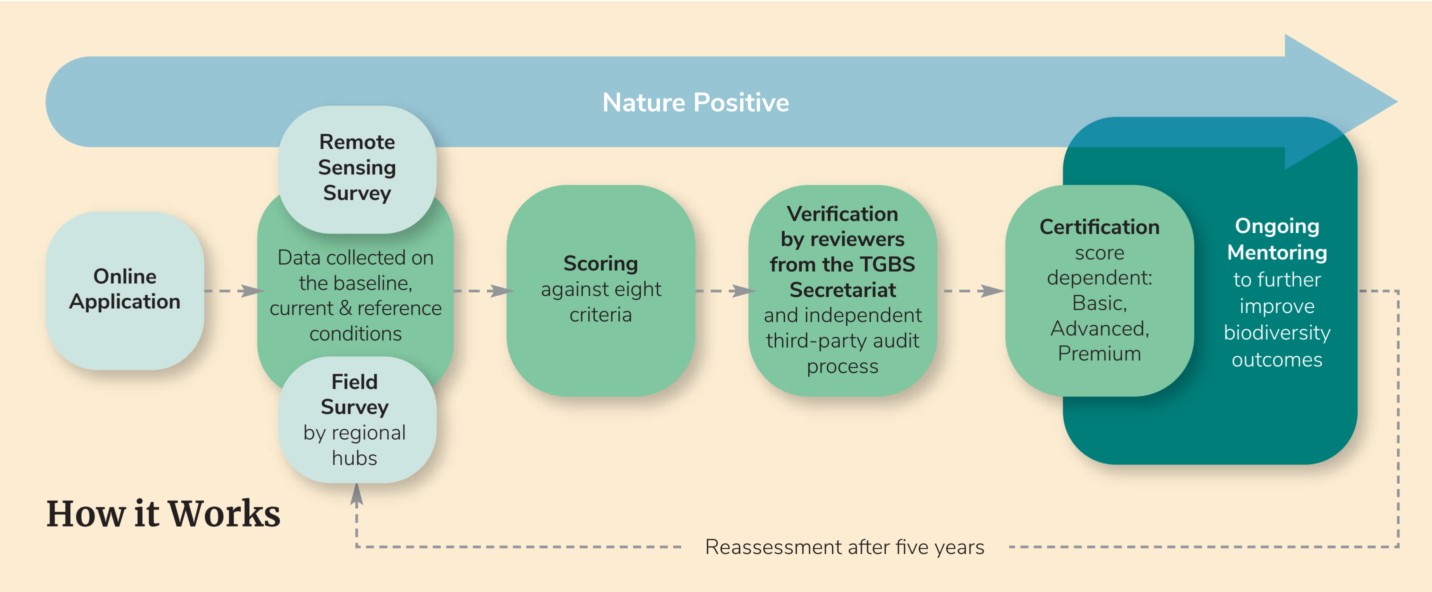


Figure 1.3 – Outline of the Global Biodiversity Standard process that contributes to nature-positive outcomes.

1.4 Methodology of the Global Biodiversity Standard

The Global Biodiversity Standard assesses projects across eight criteria. Projects are assessed according to improvements in ecosystem integrity, the level of protection provided to biodiversity, stakeholder engagement, and monitoring, evaluation and adaptive management activities. Each criterion is scored out of 10 points, with a total score calculated for projects assessed under the TGBS (section 6.2). Projects that score higher than the threshold for certification (section 1.7) are awarded the TGBS, with the tier of certification dependent on the total score of the site.

To assess a project applying for certification under the TGBS, information about the project is obtained using three methods:

- **An online application form:** Applicants to the TGBS must complete the online application form. This form gathers contact information; general information about the project; project area; partnerships and stakeholder engagement; monitoring, evaluation and management plans and reports; protective measures; and biodiversity. Before submission of the application form, applicants must agree to the exclusion list (section 1.8), privacy policy (section 1.9), and terms and conditions (section 1.10) of the TGBS. More details about the online application form are outlined in section 3: Application Form.

- **A remote sensing survey:** Assessors will evaluate trends in biodiversity, land use and landscape impacts of the project using remote sensing data. The remote sensing survey will use a range of satellite-derived remote sensing products to understand changes caused by the project applying for the TGBS. More details about the remote sensing survey are outlined in section 4: Remote Sensing Survey.

- **A field survey:** Assessors of the TGBS will record the current conditions and impact of the project via a field survey of the project site. The field survey will include an assessment of ecosystem integrity, including biodiversity, as well as stakeholder engagement, the level of protection, and the monitoring, evaluation and adaptive management activities. Ecosystem integrity will be assessed via rapid biodiversity assessment techniques and will include native biodiversity, use of native, rare and threatened species, and the exclusion or control of invasive species. The level of stakeholder engagement will be evaluated via semi-structured interviews and focus group discussions. To assess the level of protection, both the legal framework of the site and the protective measures in place will be recorded. More details about the field survey are outlined in section 5: Field Survey.

Following the collation of data and evidence, assessors will evaluate the project based on the scoring system for each of the eight criteria (section 1.6). All TGBS assessors are trained to ensure standardised application of the methods and criteria across different sites and countries. A provisional score, alongside evidence, will be submitted by the assessors to the Secretariat for review. A review team will audit the evidence and score submitted. The applicant will then receive a final decision from the Secretariat about certification of the project.

Installation of a bioacoustic sensor as part of a field survey. (Gabriela Orihuela)

1.5 Scope

The Global Biodiversity Standard is designed to be accessible and equitable to a wide range of initiatives. All land management initiatives, including tree planting, rehabilitation and ecological restoration, agriculture initiatives and protected areas are eligible for certification, conditional to obtaining the minimum score necessary for certification (Figure 1.4). This includes rehabilitative agricultural practices, such as agroforestry, that enhance the presence of native biodiversity on a site. Full certification under the TGBS is reserved for projects that have already achieved positive biodiversity outcomes. The TGBS offers a pre-certification for projects that can clearly demonstrate the intent for positive biodiversity outcomes but have yet to achieve these outcomes because of recent implementation (Figure 1.4). Certification as a TGBS-certified plan is also available for projects in the planning stage with the aim of TGBS certification once a change in biodiversity is measurable.

The Global Biodiversity Standard certifies terrestrial, freshwater and coastal project sites for their positive biodiversity outcomes. Certification of organisations is outside of the scope of the TGBS because each site where an organisation works will have been subject to a different starting point and different management. A separate application must hence be submitted for each project site.

Assessors meandering through a protected mangrove forest with a mix of Rhizhopora mucronata regenerants and Bruguiera gymnorhiza in Makongeni area, Gazi, Kenya. (CER-K)

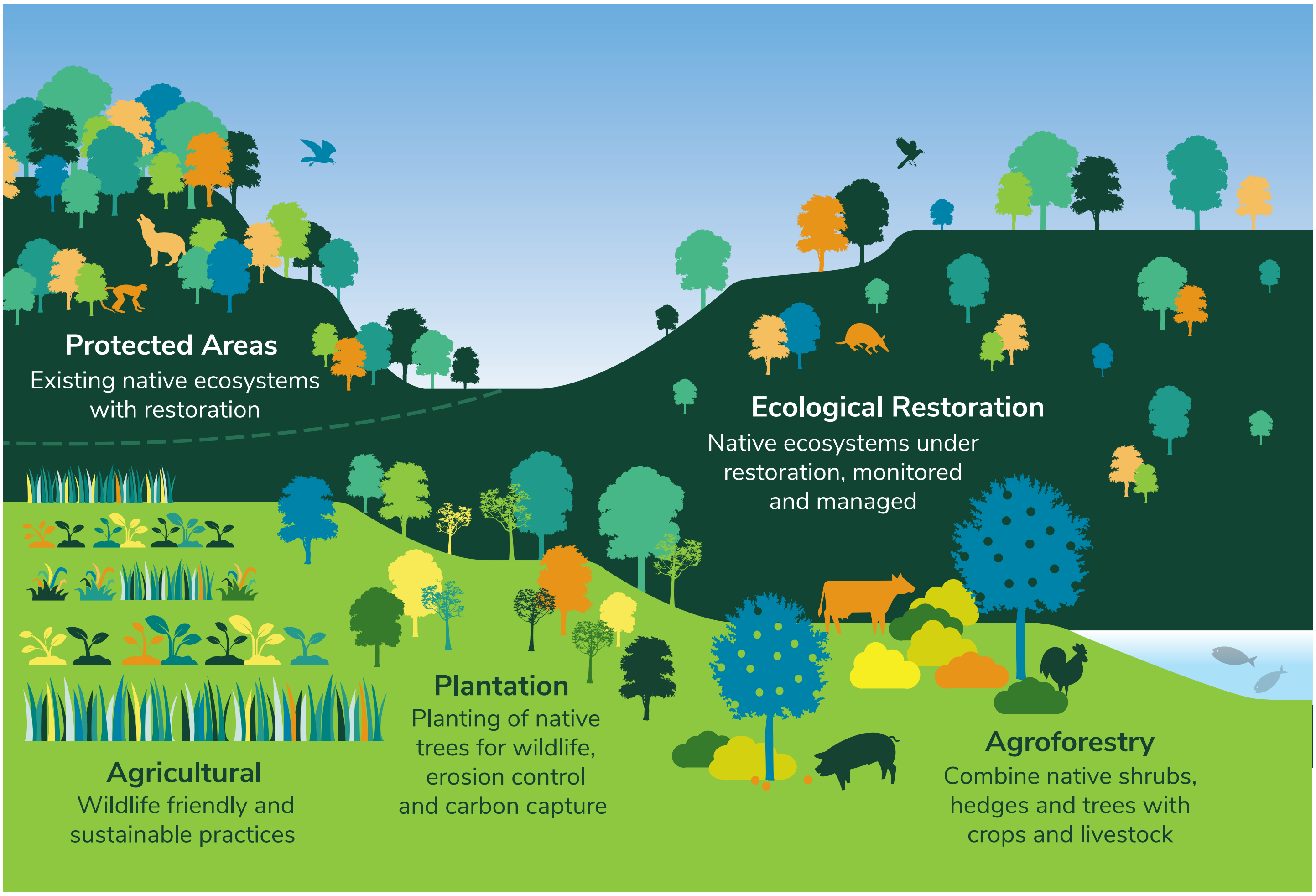


Figure 1.4 *– Tree planting, rehabilitation and ecological restoration, agriculture initiatives and protected areas are eligible for Global Biodiversity Standard certification.*

Figure 1.5 – Sites that meet the eight criteria of the Global Biodiversity Standard help to ensure diverse and resilient ecosystems.

1.6 Criteria

The eight criteria of the Global Biodiversity Standard verify that projects implement activities that improve and secure the long-term management of biodiversity at project sites. The criteria of the TGBS are based on the 10 golden rules for reforestation to optimise carbon sequestration, biodiversity recovery and livelihood benefits (Di Sacco et al. 2021) and align with the International Principles and Standards for the Practice of Ecological Restoration (SER Standards; Gann et al. 2019). The eight criteria of the TGBS are:

1. Select appropriate sites to enhance native biodiversity.
Sites are selected to enhance or protect native biodiversity by reducing threats and improving physical conditions, species composition, structural diversity, ecosystem function and beneficial external exchanges such as habitat links and gene flows. Pre-existing native biodiversity is not displaced and ecosystem integrity should not be degraded by project interventions.

2. Enhance protection of existing habitats and biodiversity.
The level of protection of the site is enhanced to protect existing habitats and biodiversity. Protection is enhanced through management activities and not just achieved through legal status.

3. Protect, restore and manage biodiversity in consultation and partnership with local communities and other stakeholders.
Stakeholders are consulted and benefit from the protection, restoration and management of biodiversity. Particular stakeholders that should be consulted and benefit include indigenous peoples and local communities (IPLCs), youth groups, women, other minority groups, governmental organisations, non-governmental organisations, and scientific and conservation networks. Monitoring, evaluation and adaptive management of stakeholder consultation and partnerships are implemented to maximise the benefits they receive.

4. Aim to maximise biodiversity recovery through ecosystem restoration.
Appropriate native biodiversity is maximised through restoration and rehabilitation interventions, including natural regeneration, assisted natural regeneration, planting and reintroduction of native species.

5. Avoid and reduce invasive or potentially invasive species.
Invasive and potentially invasive species to natural ecosystems are avoided during planting and reintroduction, and where already present, populations are reduced or eradicated. Invasive and potentially invasive species can be non-native or native species.

6. Prioritise the use of native, threatened and rare species.

The presence of native, threatened and rare species is enhanced (although not to the extent of exceeding the range of natural abundances) through restoration and rehabilitation interventions, including the reintroduction of locally extinct species. Boundaries of ecosystems and vegetation types may shift because of climate change, and thus native species may change over time. Species can be threatened and/or rare at the local, national and/or global level.

7. Promote biodiversity and adaptive capacity.

Diversity at all levels is facilitated including genetic, species and ecosystem-level diversity to enhance adaptive capacity to changing environmental conditions, such as those caused by anthropogenic climate change. This may be achieved through appropriate provenance of planting material, assisted gene flow or by enhancing the connectivity of landscapes.

***Figure 1.6** – The eight criteria of the Global Biodiversity Standard.*

8. Implement robust monitoring, evaluation, and adaptive management of biodiversity.

Monitoring and evaluation of biodiversity is based on clear objectives and indicators to ensure the long-term viability and sustainability of the restorative and rehabilitative interventions. Monitoring activities are conducted with appropriate resources, frequency and timing. A plan for adaptive management is in place and being implemented to enhance biodiversity according to the results of monitoring and evaluation activities.

1.7 Certification

The TGBS is awarded to projects that attain the minimum required score for certification. The TGBS has five tiers in total, including three tiers of full certification:

- **The Global Biodiversity Standard:** Awarded to projects that attain a minimum overall score of 5 out of 10 and do not score negative points under any criteria.
- **The Global Biodiversity Standard Advanced:** Awarded to projects that attain a minimum overall score of 7 out of 10, do not score negative points under any criteria and score a minimum of 5 out of 10 across at least six criteria.
- **The Global Biodiversity Standard Premium:** Awarded to projects that attain a minimum overall score of 9 out of 10 and score a minimum of 5 out of 10 across all criteria.

Projects will be granted certification under the TGBS for a period of five years, after which projects will have to renew their application.

Projects that have started within the last 10 years and are yet to achieve positive biodiversity outcomes are able to apply for a pre-certification:

- **The Global Biodiversity Standard Pre-certification:** Awarded to projects that do not score negatively under criterion 2, attain a minimum score of 2 out of 10 under criteria 1 and 4-7, attain a minimum score of 5 out of 10 under criteria 3 and 8.

Projects will be granted pre-certification under the TGBS for a period of five years, after which projects will have to renew their application. Projects that are older than 10 years are not eligible for pre-certification.

Projects that are in the planning stage are able to apply for certification of their plans as a TGBS certified plan:

- **The Global Biodiversity Standard Certified Plan**: Awarded to projects with plans that show how they will reach the threshold for full TGBS certification. The plans shall be assessed based on the predicted outcomes if activities are fully implemented as outlined.

Projects will be granted a certified plan status under the TGBS for a period of five years, after which projects will have to apply for pre-certification or full certification. The plans must have an implementation timeline that must be followed, with annual reviews of implementation activities. Mentoring will be available for applicants to improve their plans to ensure they meet the threshold of a certified plan (section 7). Certification may be withdrawn from projects that do not implement the plan without appropriate justification.

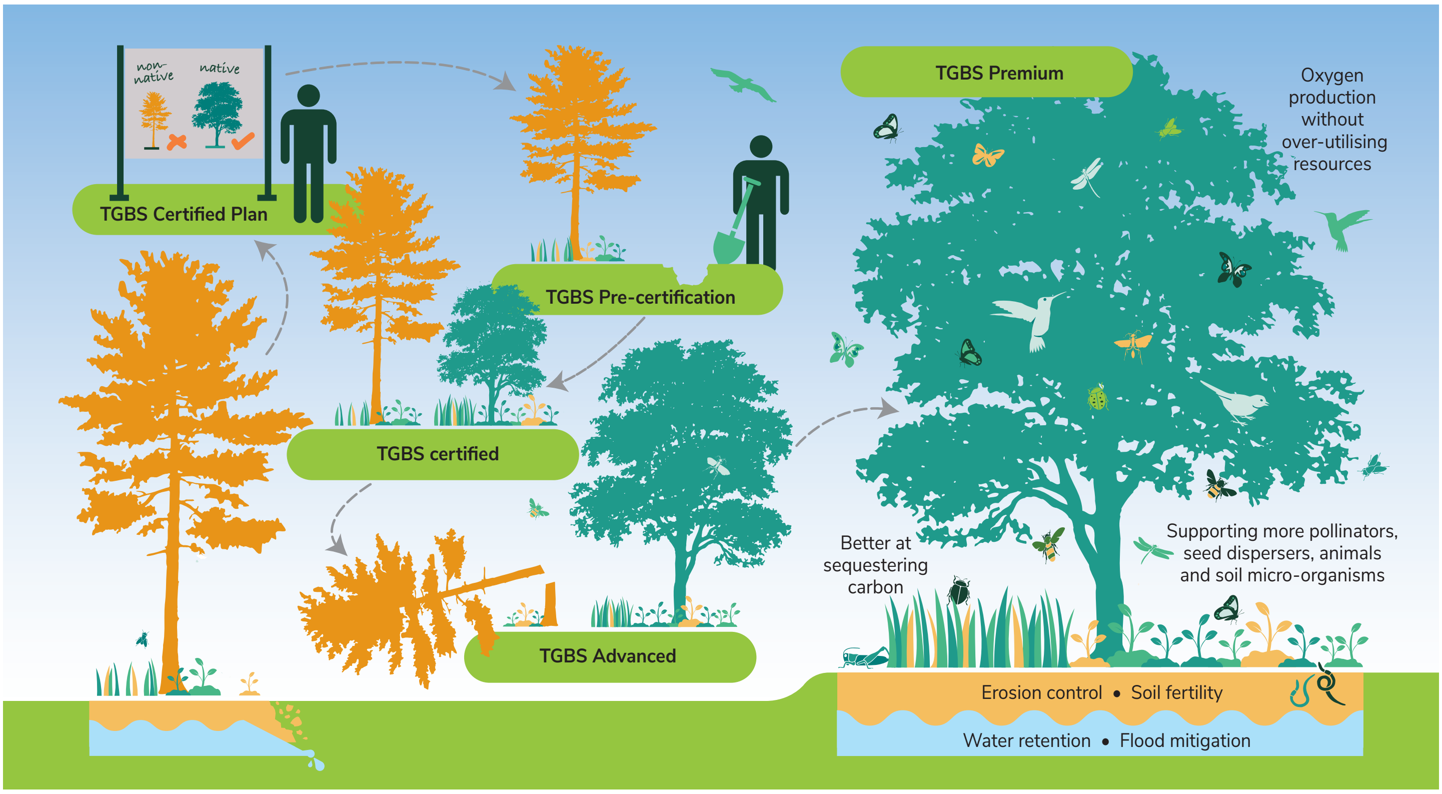


Figure 1.7 – The types of projects eligible for the different certification tiers of the Global Biodiversity Standard.

Certificates of the TGBS will be issued together with a certification logo that recipients can use on their website, letterhead, etc. Products from the site can be labelled with the TGBS logo and in product marketing. A list of certified and pre-certified projects will be highlighted on the TGBS website.

1.8 Exclusion List & Safeguarding

The TGBS maintains an exclusion list to safeguard vulnerable and minority parties and ensure participation is restricted to applicants committed to ethical and responsible business conduct.

The exclusion list has been developed to provide social and environmental safeguards across a range of topics and is applicable to activities of the applicant at both the project site and corporate levels. It excludes applicants with a history of human rights violations, implementation or financing of illegal activities, and other types of social or environmental abuse.

The exclusion list is adapted from the Plan Vivo Standards' exclusion list (reputable standards in the Voluntary Carbon and Biodiversity Markets supporting smallholders and climate-sensitive communities through sustainable land-use projects).

The full exclusion list is available as part of the application form and must be complied with by all applicants. The TGBS reserves the right to turn down an application and/or remove certification from any applicant that is found to violate these terms and conditions. Applicants that are considered to violate these terms and conditions will be contacted in writing. Applicants then have a maximum of 30 days to respond before a final decision will be made on whether to turn down an application or remove certification.

In addition to the exclusion list, the TGBS also incorporates a process to manage environmental and social risks that could be caused by projects. This may include applicants screening projects for environmental and social risks and carrying out a more thorough risk assessment for medium and high-risk projects. Any significant risks should be addressed by the project and monitored throughout the project's implementation. Very high-risk projects may be excluded from TGBS certification.

1.9 Privacy Policy

The TGBS employs a privacy policy that outlines how the data collected from applicants and the assessment process will be used. The TGBS retains the right to share information related to projects that achieve certification or pre-certification but will keep private the details of projects that fail to attain certification. The TGBS retains the right to publish summary information related to the number of projects that fail to attain certification and the reason why projects fail. This information may be disaggregated by region or country, but the names of the applicant organisations or specific project details will not be shared. Personal data will be stored securely by the Secretariat and will comply with the UK Data Protection Act 2018. The full privacy policy is available as part of the application form, and all applicants must agree with this privacy policy.

1.10 Terms and Conditions

The TGBS is awarded to successful applicants under a set of terms and conditions. These include conditions related to how certification can be used, the terms for resolution of disputes, and intellectual property rights related to the TGBS. The full terms and conditions are available as part of the application form, and all applicants must agree with these terms and conditions.

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 2
Getting Started

A TRCRC restoration site in a riparian ecosystem, Elmina, Malaysia. (Amarizni Mosyaftiani)

The Global Biodiversity Standard

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

Section 2: Getting Started

Contents

2.1 Governance Structure

2.1.1 The Secretariat

The Global Biodiversity Standard (TGBS) is managed and governed by its Secretariat. The Secretariat shall initially be hosted by Botanic Gardens Conservation International (BGCI). The staff of the Secretariat play a pivotal role in managing and operating the TGBS including:

- Provision of technical expertise in biodiversity, agroforestry and ecological restoration
- Commissioning and coordination of assessments
- Monitoring and evaluation of assessments, including identification of reviewers
- Management of databases and resources, including a database of reference models (section 2.5)
- Maintaining a register of certified hubs and sites
- Assignment of applications to regional steering committees
- Leading training of trainers in the assessment methodology
- Coordinating certification of trainers and assessors
- Advocacy, communications and global branding
- Developing partnerships to enhance the performance and scale up the use of the TGBS
- Development and implementation of a sustainable business model
- Management of finances

2.1.2 Hubs

Hubs are organisations that are legally independent from the Secretariat. Hubs assess sites applying for the TGBS. Hubs are hosted by organisations identified by the Secretariat as having the necessary expertise in biodiversity, native ecosystems and ecosystem restoration, and capacity to assess sites. Staff at identified hubs are trained and certified in the TGBS assessment process. Hubs play a pivotal role in Global Biodiversity Standard assessments, including:

- Coordinating and implementing remote sensing surveys within the geographic region
- Coordinating and implementing field surveys within the geographic region
- Collating resources such as national, regional and global databases, vegetation maps and species distribution records
- Assessing sites within the geographic region
- Reporting to the Secretariat on performance of sites against the criteria
- Training assessors in the assessment methodology
- Ongoing mentoring to assessed sites to improve biodiversity outcomes
- Developing partnerships in the region for the TGBS
- Developing, compiling and maintaining resources needed to implement assessments of the TGBS and provide mentoring on best practices for ecosystem restoration

A module has been developed to help hubs effectively manage their TGBS activities (Table 2.1). The module covers topics that explain strategic planning, organisational structure and resource mobilisation strategies. This module also discusses recruitment and capacity-building initiatives that can be used to develop skilled hub committee members, trainers, assessors and restoration practitioners.

The module can be taught by the TGBS Secretariat or appointed trainers. Topics covered by the module are outlined in Table 2.1.

Training assessors on how to use the Five-star System to assess ecosystem integrity. (Amarizni Mosyaftiani)

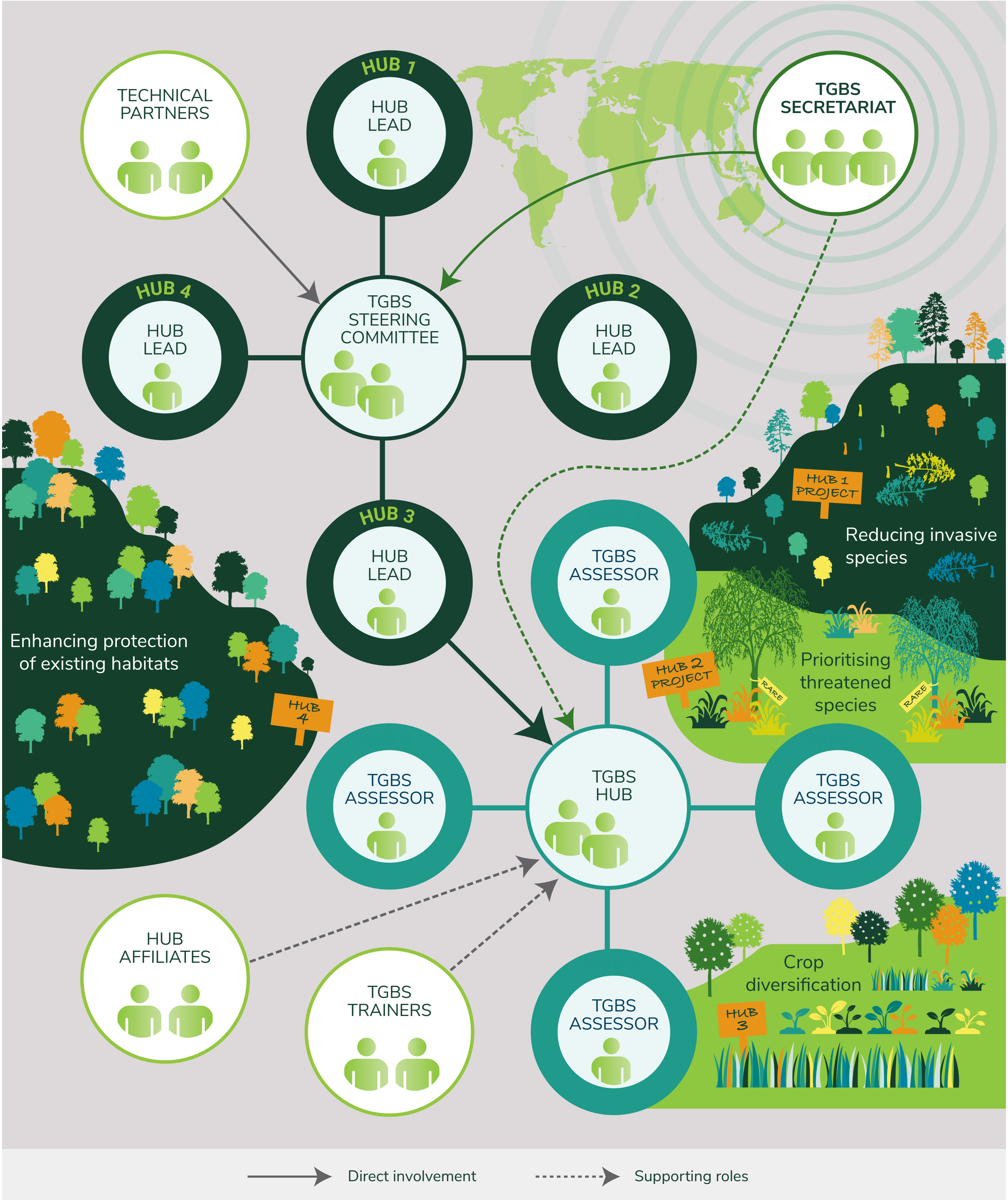


***Figure 2.1** – The governance structure of the Global Biodiversity Standard.*

Lesson	Topics	Description	Approaches	Duration
1.	Establishment and strategic planning	How to establish a TGBS hub and develop a TGBS strategy	Workshops, group discussion	4-6 hours
2.	Organisational structure	Designing a hub's organisational structure	Workshop, brainstorming	2-4 hours
3.	Code of ethics and safeguarding	Ethical considerations and safeguards	Presentations, discussions	2-3 hours
4.	Resource mobilisation strategies	Strategies for funding, support and budget management	Lectures, group discussion and case studies	3-5 hours
5	Recruitment and capacity building	Building capacity of various stakeholders	Workshop, skill-based training	2-4 hours
6.	TGBS trainer and assessor certificate procedures	Mechanisms and standards for issuance of trainer and assessor certificates, including completion of certificate modules and knowledge requirements	Workshop	4-6 hours
7.	Stakeholder engagement and collaboration	Engaging with stakeholders to promote and support the TGBS	Discussion, interactive activities	2-3 hours
8.	TGBS verification and certification process	Process of project verification and certification	Lectures, case studies	3-5 hours

***Table 2.1** – Contents of the TGBS Hub Training Module. This module is developed to support the capacity building of TGBS hubs.*

Knowledge exchange between assessors from two different hubs. (Gabriela Orihuela)

Using the fruit and leaves to identify tree species. (Gabriela Orihuela)

2.1.3 Global Steering Committee

The Secretariat, hub leads and additional partners of the TGBS comprise a global steering committee, which helps provide a wider oversight of the TGBS. The global steering committee is responsible for:

- Standardising the methodology across regions
- Developing global partnerships for the TGBS
- Collating global resources to support the TGBS
- Resolving issues arising at the regional steering committee level
- Periodic reviews of the operation, assessment methodology and certification of the Global Biodiversity Standard
- Tracking performance of the TGBS
- Overseeing the reputation of the TGBS
- Guaranteeing the integrity and credibility of the TGBS
- Identifying, managing and monitoring conflicts of interest
- Resolving disputes and appeals

2.2 TGBS Stakeholders

2.2.1 Applicants

The Global Biodiversity Standard welcomes applicants from a wide range of individuals, organisations, agencies and institutions (the ‘Applicant’). Applicants may apply for project sites for which they are responsible to be certified under the TGBS. The responsibility of the applicant in relation to the site can be (a) accountable, (b) extending, (c) implementing, (d) funding or (e) monitoring and evaluation, but all parties must agree to the assessment. The applicant must have a focal individual who is responsible for overseeing the application process. To apply for certification under the TGBS, applicants must complete the online application form and ensure that assessors are provided with unrestricted access to all documents and facilities that are relevant for certification.

2.2.2 Assessors

Sites applying for certification under the Global Biodiversity Standard will be assessed by individuals trained and certified in the TGBS assessment process (the ‘Assessor’). Assessors are hosted at or contracted by a TGBS hub. Assessors are experts in biodiversity, native ecosystems and ecosystem restoration. Assessors are responsible for reviewing applications, implementing the assessment process and providing mentoring on ecosystem restoration to applicants. Hub leads and leads of regional steering committees shall be certified assessors.

2.2.3 Trainers

Assessors will be trained in the Global Biodiversity Standard assessment process by individuals trained and certified to deliver training on the process (the ‘Trainer’). Trainers will be trained by the Secretariat and technical partners of the Global Biodiversity Standard in the method, skills and techniques that are needed to assess sites and to train assessors. Trainers may also act as assessors.

2.2.4 Reviewers

Assessments of sites applying for the Global Biodiversity Standard will be reviewed by ‘Reviewers’. Reviewers are answerable to the Secretariat of the Global Biodiversity Standard. Reviewers help to provide oversight of assessments across the Global Biodiversity Standard, ensuring standardisation in the assessment process. Reviewers play an important role in providing third-party verification of assessments, the absence of conflicts of interest and the absence of malpractice during the assessment process. Reviewers require the same level of training as assessors (section 8.1).

2.3 Assessment Area

The full area of the site under ecosystem restoration covered by the management of the applicant shall be covered by the TGBS assessment process wherever possible. However, in cases where stratified sampling of a site or series of sites is necessary, the TGBS assessment will only pertain to those sites assessed. In such situations, applicants will clearly define and communicate the sampling size used. The assessment area may include a wide range of land management types, including protected areas under restoration, other areas under ecological restoration, areas under rehabilitation (e.g., agroforestry), plantation and agricultural areas. The assessment area must include ecological restoration or rehabilitation activities, such as the facilitation of natural recovery, assisted natural recovery, either with or without planting, seeding or faunal introductions, or reconstruction or heavily assisted recovery. There is no minimum required area to be eligible for certification under the TGBS.

2.4 Defining the Baseline

Defining the baseline for projects applying for TGBS certification is essential. In the TGBS, the ***baseline*** represents the conditions of the assessment area immediately prior to the beginning of a project.[1] The beginning of the project is usually defined as the time when the applicant’s involvement at the site began (or organisation responsible for site management, if not the same party). The baseline conditions include the level of ecosystem integrity, including biodiversity, and the level of protection provided to biodiversity. Some sites may have baseline data that was collected prior to interventions commencing, while others may not. However, information on baseline conditions can be obtained through a variety of methods, including historical information and remote sensing, or can be inferred from data collected during the field survey either on site or at nearby ***reference sites***. Defining the baseline condition is essential to determine prior degradation or loss, set restoration goals, and track progress over time (Appendix C).

2.5 Native Reference Ecosystem

Establishing the ***native reference ecosystem***[2] for ecosystem restoration projects applying for TGBS certification is essential. Native reference ecosystems are ecosystems that are the targets of conservation and restoration activities (e.g., boreal forest, freshwater marsh, tropical savanna). They are generally the ecosystems that would be present at or near the project site had degradation or conversion not occurred, adjusted as necessary to accommodate changed or predicted change in biotic or environmental conditions (e.g., from climate change). Native reference ecosystems inform the development of ***reference models***, which are used to measure progress in restoring biodiversity and other ecosystem attributes from the baseline condition. For agroforestry and other agricultural projects, the target is not the native reference ecosystem itself, but rather the goal is to incorporate components of the reference model into the site as appropriate. These components could include native trees and shrubs incorporated into agroforestry projects, or hedgerows in agricultural landscapes, restored wetlands along drainage ways, or the restoration of native habitat patches for wildlife.

Reference models are developed using multiple sources of information (Appendix C). Best practice is to build models based on multiple reference sites. Information on past and current conditions at the project site, as well as consultation with stakeholders, can assist in developing reference models, especially where non-degraded local reference sites are unavailable. Sources of data used to create reference models include historical information such as natural archives and cultural records (e.g., photographs, paintings, diaries, maps), seed banks, pollen deposits, specimen labels in herbaria, floristic and faunal lists, vegetation and ecosystem classification systems (e.g., Keith et al. 2020 as amended), indigenous and local ecological knowledge, and local to global databases (e.g., the Global Biodiversity Information Facility [GBIF.org 2023], Plants of the World Online [POWO 2023], World Flora Online [WFO 2023]) and tools that characterise ecosystem properties (e.g., [bio]climate or soil descriptions, rare species distributions). Specific for native tree species, information at the national level is available from GlobalTreeSearch (Beech et al. 2017) and the GlobalTree Portal (BGCI 2023), and at national and subnational levels from the GlobalUsefulNativeTrees database (Kindt et al. 2023), which should always be vetted and augmented with local data. Global databases on invasive species (e.g., CABI Invasive Species Compendium [CABI 2023], Global Register of Introduced and Invasive Species [Pagad et al. 2018]) will also provide insights to species that should be avoided. Spatially, reference models should reflect the biodiversity that would be expected in a similar-sized patch within a non-degraded ecosystem, not the entire possible spectrum of species that could be present in the reference ecosystem.

Construction of reference models ideally incorporates a broad set of ecosystem attributes, including absence of threats, species composition, community structure, physical conditions, ecosystem function and external exchanges. Indicators and metrics appropriate to project sites are then used.

Notes

[1] See also Box 4 in the SER Standards for more information on the various ways the concept of baseline conditions is used in restoration.

[2] See the SER Standards for more information on native reference ecosystems, reference models and reference sites. In this context the term 'native' is equivalent to that of 'natural' as used by the Convention on Biological Diversity and other United Nations programmes. Native reference ecosystems may include traditional cultural ecosystems or semi-natural areas that protect and maintain high levels of native biodiversity.

Preparing plant voucher specimens to deposit in the herbarium. (TBG)

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 3
Application Form


An epiphytic bromeliad in Andean montane cloud forest, Peru. (David Bartholomew)

The Global Biodiversity Standard

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SER SOCIETY FOR ECOLOGICAL RESTORATION

Section 3: Application Form

Section 3: Application Form

A critically endangered Parana Pine, Araucaria angustifolia, in the Atlantic Forest, Brazil. (David Bartholomew)

Applicants who wish to apply for certification of a site under the Global Biodiversity Standard must submit an application form online. The application form is available at www.biodiversitystandard.org alongside detailed guidelines and sample applications. The aim of the application form is to collect information about the applicant and the site applying for certification to support the assessment process. The form is structured to obtain data that are relevant for assessing projects against specific criteria of the Global Biodiversity Standard. Data collected are consistent with the Restoration Project Information Sharing Framework (Gann et al. 2022), which is designed to improve data interoperability in support of global restoration monitoring.

3.1 Sections of the Application Form

The application form for the Global Biodiversity Standard consists of five sections:

1. Contact Information
2. General Project Information
3. Project Area
4. Partnerships
5. Monitoring and Evaluation

3.1.1 Contact Information

This section collects contact information about the applicant. Questions in this section of the form collect the following data from the applicant:

- Name
- Email
- Organisation, agency or institution name
- Organisation role in the project
- Organisation category
- Organisation address
- Project sponsor

These data are collected to allow assessors to contact the applicant to prepare for the assessment process and to understand the type of project applying for the Global Biodiversity Standard.

3.1.2 General Project Information

This section collects general information about the project. Questions in this section of the form collect the following data from the applicant:

- Project name
- Organisation responsible for site management (where different from the applicant)
- Project objectives
- Project start and end dates
- Project biome
- Project land tenure
- Legal frameworks, compliance requirements and constraints of the project
- Project activities, including biodiversity offsetting and other certification schemes

Conducting a Rapid Assessment Survey in Aravali Biodiversity Park, Gurgaon, India. (Auroville Botanical Gardens)

These data are collected to understand the motivation, legal requirements and key activities of the project. These data provide important context for the assessment process and help contribute to monitoring of ecosystem restoration activities. Data is collected on the time frame of the project to allow for baseline conditions to be identified.

3.1.3 Project Area

This section collects information on the location of the project and the species present at the project site. In this section, applicants are requested to upload or draw the geospatial extent of the project site and to upload a list of key species found or being planted at the project site using the standardised template. Within this species list, data on the following should be provided where possible:

- Species name
- The abundance of the species
- The presence or absence of regeneration
- Whether the species has been planted
- Whether the species pre-existed at the site
- Whether the species is native or non-native
- Whether the species is invasive or not
- Whether the species is rare and/or threatened

Geospatial data is required to understand the area and wider context of the area around the site that is being assessed for certification and to calculate the size of the project. The information on the area of the project is necessary because the assessment requirements vary with project size and the complexity of the terrain. Data on the key species found and planted at the project site help provide an initial list that can subsequently be verified and enhanced through the field survey. The information regarding the wider context of the area is also necessary to understand whether or not the interventions at the site might result in 'leakage' or displacement of negative impacts outside the treatment area as a result of the actions being implemented inside the treatment area.

Mangrove nursery, Kilifi Creek, Kenya. (David Bartholomew)

This section also collects information on the different land management types found at the project site and the activities being implemented across these different areas. The types of land management that can be assessed include:

- Protected areas under restoration
- Other ecological restoration areas
- Rehabilitation areas, including:
  - Agroforestry areas
  - Plantation areas
  - Agricultural areas

All projects that apply for certification under the TGBS must include at least one area under ecological restoration or rehabilitation. These include areas with facilitated natural recovery, assisted natural recovery, either with or without planting, seeding or faunal introductions, or reconstruction or heavily assisted recovery. Applicants are requested to describe and provide evidence of protective measures in place. This information is used to assess the project against criterion 2.

Applicants are requested to answer questions that collect data about:

- Restoration activities for:
  - Soil and water management
  - Restoration of vegetation cover and ecosystem structure
  - Control of invasive species
- The biodiversity of the area at baseline, currently, and the target
- The source of seeds and/or seedlings
- The climate resilience of planting material
- The spatial extent of the site
- The key species and planted species at the site

These data are collected to help understand the impact of restoration and rehabilitation activities on the biodiversity of the site. The questions in this section help to provide evidence to allow the project to be assessed under criteria 1 and 4-7 of the Global Biodiversity Standard.

3.1.4 Partnerships

This section collects information on the stakeholders and partnerships that are involved in the project. Questions in this section of the form collect the following data:

- Types of primary and secondary stakeholders
- Stakeholder engagement activities
- Social benefits derived from the project
- Capacity building
- The use of local knowledge
- The presence of economically useful and/or culturally useful species

These data are collected to help understand how the project involves stakeholders and local communities. The questions in this section help provide evidence to allow the project to be assessed under criterion 3.

3.1.5 Monitoring and Evaluation

This section collects information on the monitoring and evaluation of the project outside of the field survey conducted by the TGBS assessors. Questions in this section of the form collect information on:

- Baseline data collected
- Monitoring and evaluation protocols and activities
- Adaptive management activities

These data are collected to help understand the monitoring, evaluation and adaptive management activities of the project. The questions in this section help provide evidence to allow the project to be assessed under criterion 8.

3.1.6 Terms and Conditions

This section of the form describes the terms and conditions, exclusion list and privacy policy of the TGBS. An appropriately designated person from the applicant organisation must agree to all of these policies before they can submit an application.

3.2 Reviewing the Application Form

Applications for certification under the TGBS are submitted to the Secretariat, which carries out an initial review of the application. If the application form is completed correctly, the application is assigned to a regional steering committee which undertakes a comprehensive review of the application. If the application is not completed properly, the application shall be returned for modification. Based on the information provided in the application form, the regional steering committee will decide on whether to proceed with a full assessment of the project or reject the application because there are no clear biodiversity improvements. Any rejections that are recommended by the regional steering committee will be independently reviewed by the Secretariat before a final decision is made.

If a project is approved for a full audit, the regional steering committee will assign, based on pre-established guidelines, a hub and one or more assessors who will proceed with a full assessment of the project, including a remote sensing survey and a field survey of the site.

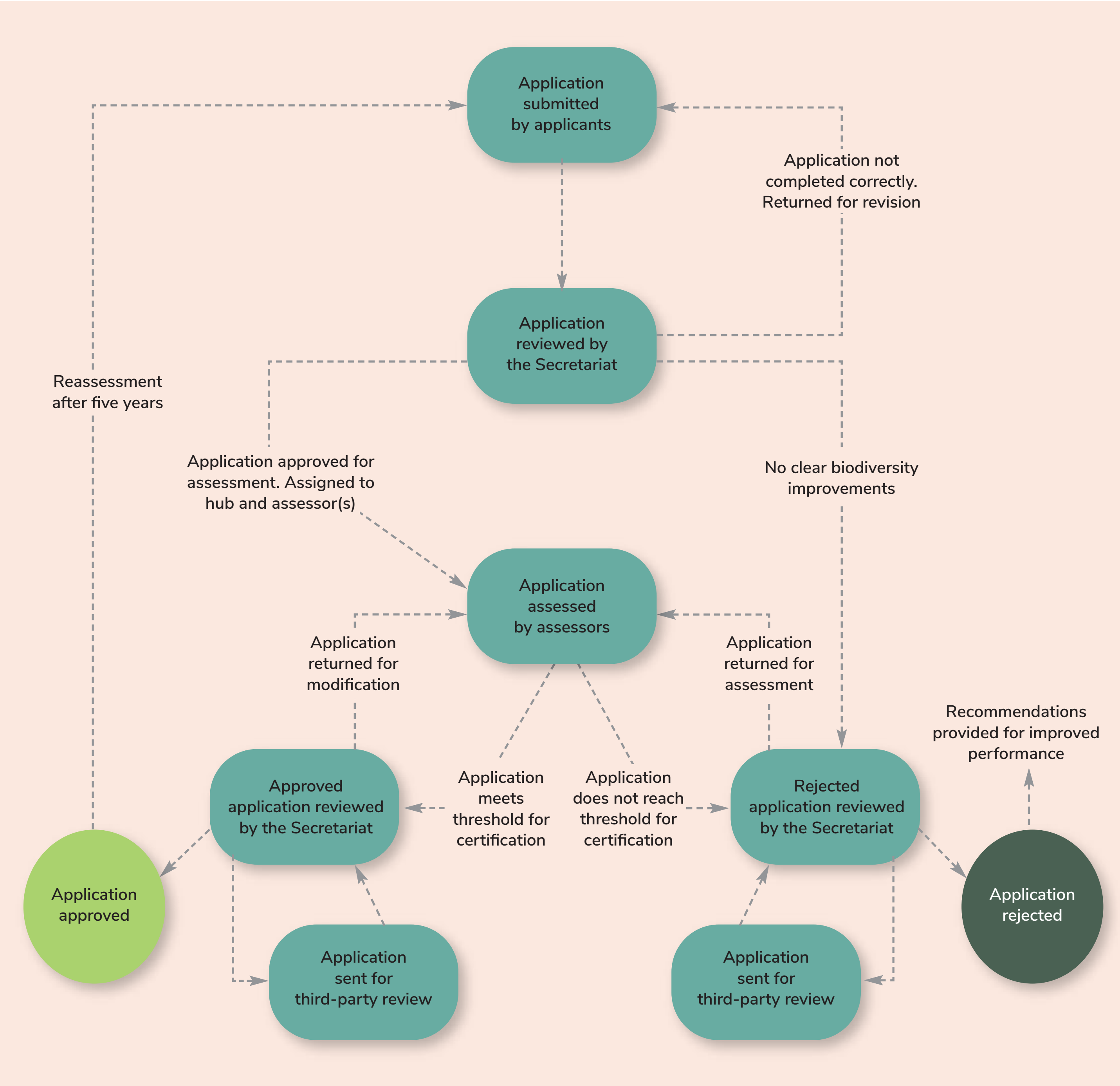


Figure 3.1 – *Flow of the assessment and review process for applications to the Global Biodiversity Standard.*

On assignment of a hub, a contract shall be signed by the hub, the applicant and the site manager (if a different organisation), which shall be shared with the Secretariat and all signatories. All signatories of the contract and the Secretariat shall receive a copy of the assessment report once a final decision on TGBS certification has been made.

For projects that do not have the capacity to complete the application, e.g., insufficient technological expertise or a language barrier, help shall be provided by the Secretariat, regional steering committee or a hub via email exchanges, virtual meetings, phone calls or in-person meetings.

3.3 Application for Reassessment

TGBS certifications are valid for a maximum of five years. To maintain certification, applicants will be required to reapply to the TGBS for reassessment. During the application for reassessment, applicants shall have access to the most recent form submitted for the project. Applicants shall be able to amend any details as necessary. Applicants shall additionally be required to complete any questions that have been added to the application form since the previous application. Applications for reassessment shall pass through the same process as first-time applications as outlined in section 3.2.

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 4

Remote Sensing Survey

A logged lowland dipterocarp forest under assisted natural regeneration in Sabah, Malaysia. (David Bartholomew)

The Global Biodiversity Standard

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

Section 4: Remote Sensing Survey

Contents

The Global Biodiversity Standard (TGBS) uses both remote sensing and field survey data to understand performance of a site against the criteria of the standard. Remote sensing technology employs sensors mounted on drones, aircraft and satellites to remotely collect data about the characteristics of vegetation, enabling the analysis of ecological properties without direct contact. For the TGBS, the remote sensing survey supports the assessment process by monitoring over time the sub-attributes of the SER Five-star System to assess ecosystem integrity (Appendix C).

The TGBS uses remotely sensed data to:

- Complement field surveys to support assessments
- Increase spatial and temporal coverage of site assessments
- Monitor historical trends in ecosystem integrity sub-attributes and provide baseline data
- Provide comparisons between baseline conditions, current conditions, degraded sites and reference sites
- Improve accuracy for ecosystem integrity sub-attributes that are difficult to monitor during field surveys
- Verify field survey data

The TGBS assesses sites based on alterations in ecosystem integrity. This assessment relies on analysing time series data to establish a comprehensive understanding of both historical baselines and current ecological conditions. Remote sensing data acquired by airborne and spaceborne sensors offer varying temporal resolutions; spaceborne sensors can systematically gather data at regular intervals, allowing for consistent monitoring over time. In contrast, drone and airborne sensor deployment typically requires specific surveys and is often event-driven or mission-specific, leading to less regular data acquisition (Figure 4.1). Consequently, the TGBS primarily uses spaceborne sensors, leveraging their ability to readily produce recurrent time series that facilitate the tracking of historical trends.

In addition to the analysis of spaceborne image time series, the use of unoccupied aerial vehicles (UAVs) to acquire high-resolution remote sensing data is recommended to support field surveys. Details on the use of UAVs are provided in section 4.4.

The remote sensing survey shall be implemented by a specialist with experience of remote sensing data and analysis. The specialist may be located at one of the TGBS hubs or be an independent third party, depending on the capacity of the hubs. Such third-party organisations can work with multiple hubs.

The remote sensing survey shall typically precede the field survey. This allows for interesting signatures detected by the remote sensing survey to be investigated and verified during the field survey. In some cases, additional remote sensing surveys may follow field surveys if additional data is sought by the assessor.

Atlantic Forest, Itamonte, Brazil. (David Bartholomew)

Using drones to assess a plantation site in Taucamarca, Peru. (Huarango Nature)

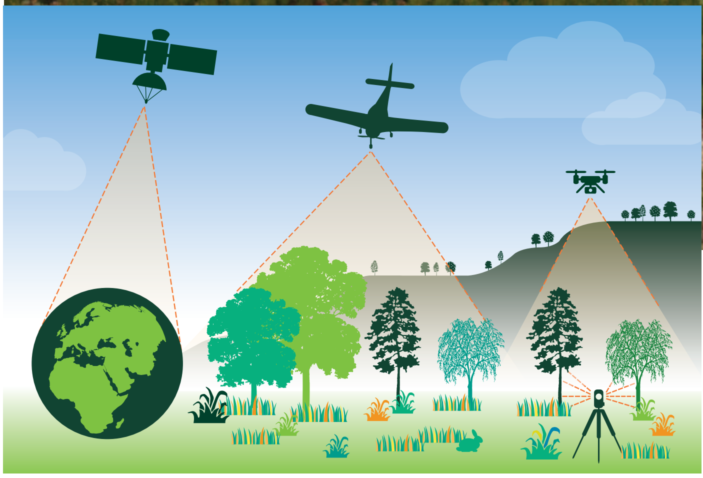


Figure 4.1 – Remote sensing data can be collected across a range of scales, including from sensors attached to spaceborne, airborne (planes and UAVs) and terrestrial devices. The Global Biodiversity Standard uses a range of remote sensing data to understand the ecosystem integrity of a site.

4.1 Preparing for the Remote Sensing Survey

Under criteria 1 and 4-7 of the TGBS, the evaluation of sites hinges on their restoration progress compared to a reference model. Remote sensing surveys are instrumental in this comparison, allowing for the assessment conditions to be juxtaposed with multiple reference sites that shape the reference model. In scenarios where pristine reference sites are unavailable, the most ecologically intact sites accessible shall be pinpointed as substitutes. Furthermore, it is essential to compare the project site not only with high-integrity reference sites but also with a highly degraded site that registers as zero stars within the Five-star System. Should a zero-star site be unattainable, the site with the lowest star rating shall be earmarked.

The identification of both highly intact and severely degraded sites is pivotal, and their selection must resonate with the specific degradation experienced by the project site to ensure accurate monitoring of the relevant degradation signature. This approach to using contrasting reference points is crucial to facilitate a balanced and informed assessment of the site in question. To ensure comparability and consistency in the assessment across different sites, it is vital to use a single sensor for remote sensing surveys. This is because different sensors may have disparate spectral and spatial resolutions, which can introduce variability that complicates direct comparisons. The consistent use of one sensor type across all sites in an assessment (reference sites, degraded sites and the site under assessment) enables a standardised evaluation framework that accounts for the varying conditions of degraded and non-degraded sites alike. Assessors are advised to designate these reference and degraded sites with careful consideration before initiating the remote sensing survey to guarantee that the assessment is accurately benchmarked.

In addition, prior to conducting the remote sensing survey, the assessor shall evaluate the options available and how they can be used to support the assessment of a site. In particular, the assessor shall consider:

- Limitations with respect to spatial, temporal and sensor resolution of data
- Use a single remote sensing mission to assess reference and degraded trends
- The length of available time series
- The potential to increase spatial coverage of assessments (larger sites require more extensive remote sensing surveys to ensure sufficient coverage of the site)

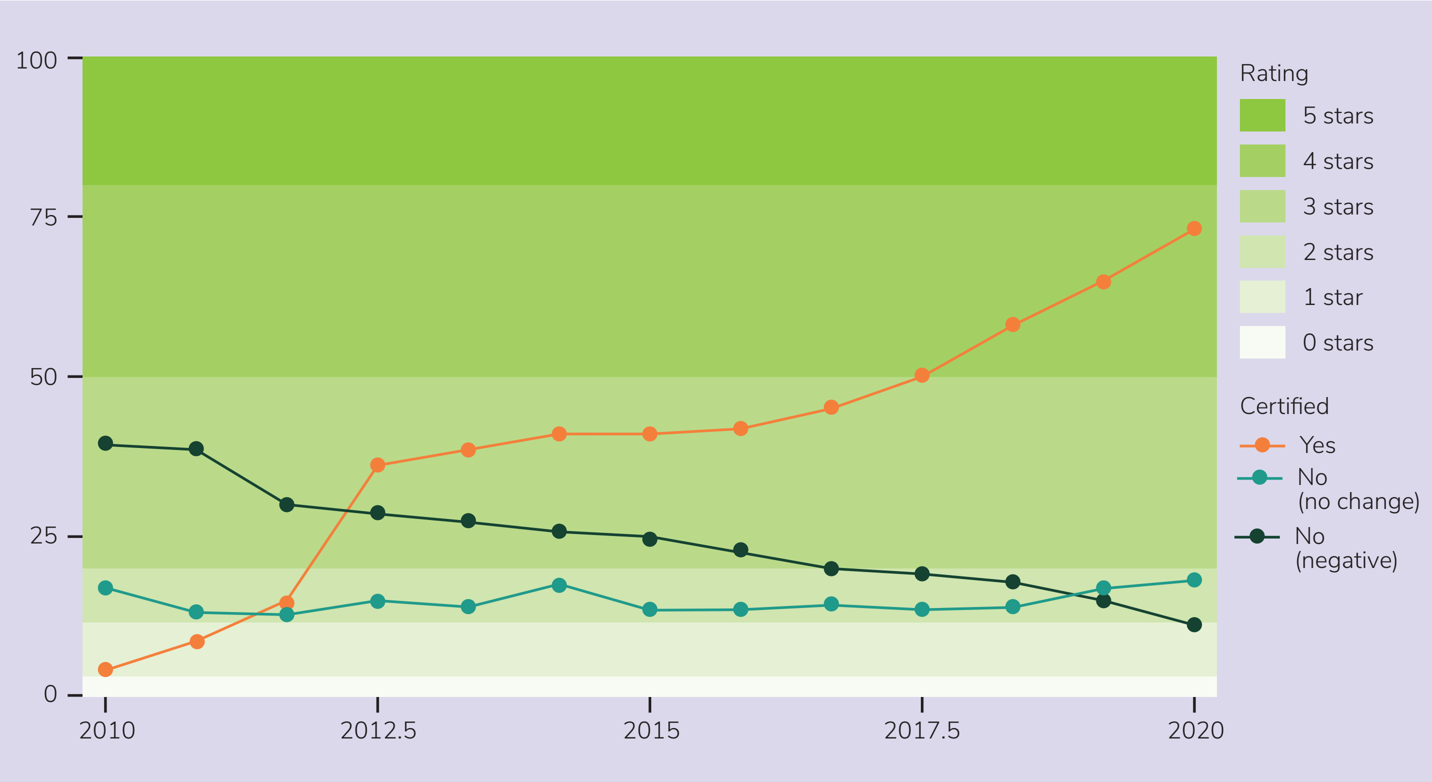


Figure 4.2 – *A simulated example of a time series generated to quantify changes in productivity & cycling using the Normalised Difference Vegetation Index (NDVI). Data is standardised as a percentage relative to the reference (100%) and highly degraded (0%) sites using the analysis and compared with quantitative thresholds for the Five-star ratings for the sub-attribute. In this example, the site shows positive changes (orange) towards the reference model, and will score highly and attain TGBS certification. Projects that show no change (green) or decline relative to the reference model (black) will be awarded a low score that is insufficient to attain TGBS certification.*

- The cost of data for remotely sensed products that are not open-source
- The appropriateness of methodologies to the assessment site
- The time and expertise required for data analysis
- The need to fill knowledge gaps from field surveys
- The potential to improve the accuracy of assessments
- The TGBS assessment requirements, such as the sub-attributes of ecosystem integrity that are more challenging to assess from field data alone
- The difficulty of field surveys because of challenging site conditions, e.g., inaccessibility to certain areas, remoteness, dangerous terrain, habitats of dangerous animals

Assessors shall discuss the options with the remote sensing specialist (if external to the hub) prior to the remote sensing survey. This consultation should be used to identify the highest priority, most reliable and cost-effective remote sensing options to be deployed.

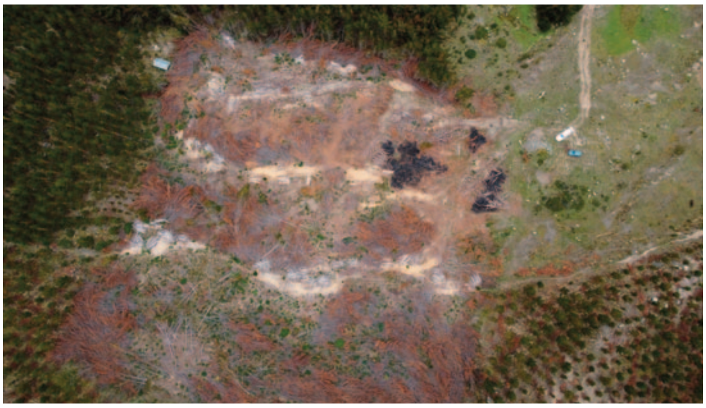
4.2 Conducting the Remote Sensing Survey

The remote sensing survey for the TGBS includes comparing historical trends at the site under assessment against the reference model and highly degraded sites. The process of extracting historical trends involves using multitemporal satellite imagery to develop a comprehensive time series of biophysical characteristics of the assessment site, reference sites and highly degraded sites (Appendix D).

After generating time series for the three types of sites, the initial step involves identifying patterns of change in the remote sensing signal over time. In the case of reference sites, it is anticipated that variations in the remote sensing signal are predominantly due to natural seasonal fluctuations in vegetation properties, such as changes across growing seasons. These patterns observed in the reference sites serve as a baseline to evaluate the relative recovery of highly degraded sites. It is vital to ensure that both the reference and the highly degraded sites share similar edaphic and climatic conditions and encompass identical vegetation formations for accurate comparison and analysis. Sites under assessment that are near to each other and have the same edaphic and climatic conditions may share the same reference sites.

Upon generating the time series data, the subsequent step entails assessing the extent and direction of change in sub-attributes from the project inception to the present conditions. This analysis shall be conducted directly using the time series data of the project area. The outcomes of this analysis shall then be compared against the quantitative thresholds of the Five-star System, allowing for the determination of the site's star rating under both baseline and current conditions (Figure 4.2).

A spatial analysis of the data shall also be undertaken to identify areas with the biggest changes in sub-attribute values. Heat maps showing the magnitude of change can be useful ways to display the results and to identify areas with exceptional values.



Identification of over-utilisation using a drone in Taucamarca, Peru. (Huarango Nature)

A report with the results from the remote sensing survey shall be generated and provided to the assessors. The assessors shall use this report to compare results derived from the field and remote sensing surveys to assess the site (section 6).

4.3 Interpretation of Remote Sensing Data for Assessments

On completion of the remote sensing survey, the assessor shall discuss the results with the remote sensing specialist. This consultation shall be used to explain the analysis and results from the remote sensing survey. Whilst it may be useful to understand the technical details of the survey, the consultation should focus on facilitating an accurate interpretation of the results by the assessor. The remote sensing specialist shall explain any metrics used, including whether they are direct or indirect indicators of biodiversity. The remote sensing specialist shall also explain any limitations with the data that should be considered when making assessments.

The remote sensing survey can give strong indicators of the baseline conditions of the site because of its capacity to use data to directly measure the ecosystem attributes through time series. The remote sensing survey can be used to verify indirect indicators of baseline conditions that are identified through the field survey or to verify baseline monitoring data that may be provided by the applicant.

Remote sensing can provide novel insights to both baseline and current conditions that may not be discovered through the field survey because of methodological limitations. Some sub-attributes may be difficult to measure reliably during the field survey because methods are complex, expensive, require specific expertise or are time intensive. In instances when some field survey data may be unreliable, the remote sensing survey may represent a more reliable method for assessing the site for those data.

In addition to analysing overall trends, data generated from the remote sensing survey shall be analysed spatially. Heat maps are one useful tool to highlight spatial trends in the data. Spatial analysis of remotely sensed data is crucial for determining whether the locations selected for field surveys accurately represent the entire site. Ideally, the planning of field surveys shall be guided by remote sensing imagery to ensure comprehensive coverage of the site, as detailed in section 5. Field surveys shall be used to validate and corroborate the findings obtained from the remote sensing analysis. The remote sensing survey will produce data and trends in ecosystem attributes. The data shall be inspected to identify clear trajectories in sub-attributes relative to the reference and highly degraded ecosystems. Strong positive trends can provide a clear indication that a sub-attribute is improving and recovering towards the reference model. In contrast, negative trends can indicate ongoing degradation, leading to negative scores being assessed for these sub-attributes at the site. Sites that do not show strong positive or negative trends indicate that little change has occurred at the site for the respective sub-attribute.

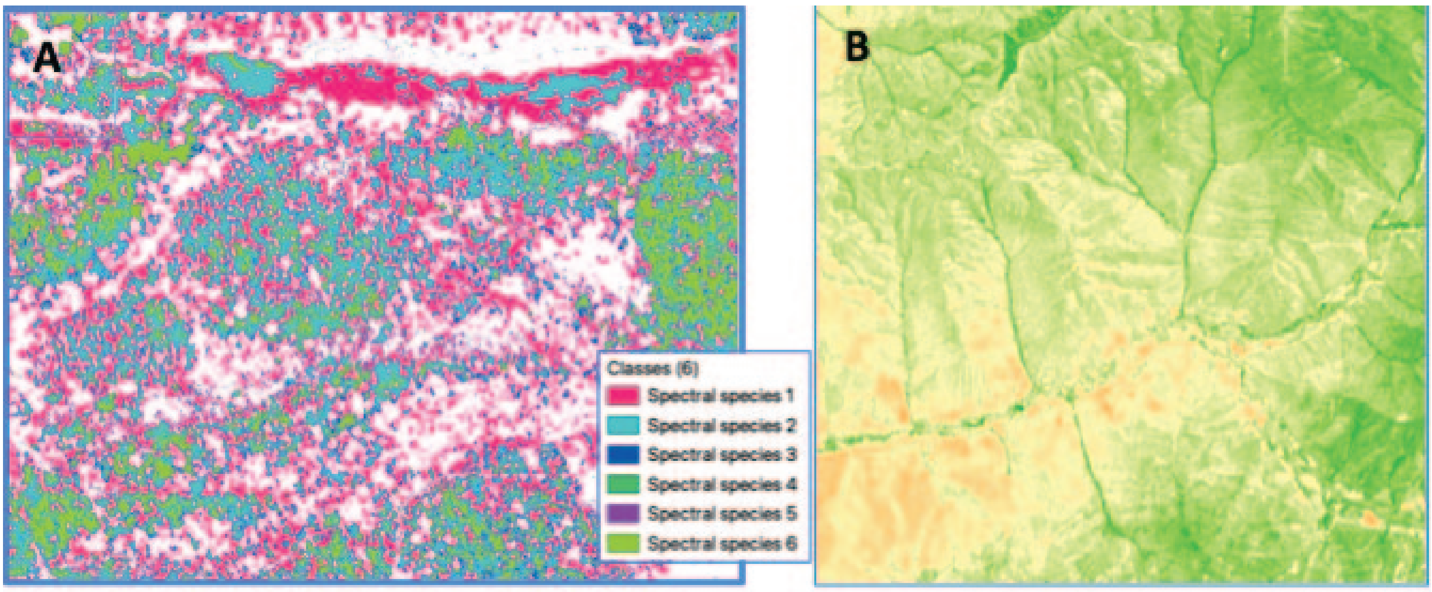


Figure 4.3 – *Examples of metrics that can be used in the remote sensing survey: (A) Spectral species product that can be used to identify and spatially analyse canopy species diversity; (B) Vegetation indices that can be used to measure biomass. Source: Reforest'Action.*

4.4 Use of Unoccupied Aerial Vehicles (UAVs) Equipped with Sensors in Field Surveys

Remote sensing technology, a key tool in the assessment toolkit of the TGBS, has undergone significant evolution with the development of unoccupied aerial vehicles (UAVs), commonly known as drones. This section explores the nuanced role of UAVs in the context of field surveys, supplementing traditional remote sensing methods to enhance the precision and efficiency of site assessments. However, it is essential to acknowledge the challenges and limitations associated with the widespread use of UAVs, particularly in regions where operational restrictions and difficulties may pose significant hurdles. Appropriate permissions must always be obtained prior to any use of UAVs in the TGBS assessment process.

In the preparatory phase, the inclusion of UAVs as a remote sensing tool introduces a dynamic dimension to site assessments. The identification of reference and highly degraded sites gains specificity, as UAVs allow for targeted and high-resolution data acquisition, aligning with the specific degradation signature experienced by the project site. The selection of a single UAV and sensor type for consistency in data collection minimises variability, ensuring standardised evaluations across diverse sites.

UAVs play a pivotal role in capturing high-resolution imagery, providing a detailed spatial and temporal perspective for the assessment of biophysical characteristics. A wide range of existing and emerging monitoring tools of restoration projects involve UAVs (de Almeida et al. 2019; McKenna et al. 2022; Robinson et al. 2022) and could be considered to support the field survey. The use of UAVs allows for a more flexible and targeted survey approach compared to traditional satellite imagery, and the detailed spatial and temporal information acquired facilitates the identification of patterns of change, aiding in the assessment of sub-attributes over time. The adaptability of UAV deployment, whether event-driven or mission-specific, adds a responsive layer to the assessment process.

The incorporation of UAVs in remote sensing surveys necessitates a collaborative effort in interpreting data between assessors and specialists. The results obtained from UAV-based surveys, integrated into the broader remote sensing dataset, offer nuanced insights. The ability of UAVs to capture high-resolution data aids in validating field survey locations and provides a detailed spatial understanding of ecosystem attributes. This spatial granularity is particularly crucial for assessing small-scale changes and validating trends observed in broader satellite imagery.

While UAVs offer unparalleled flexibility and targeted data acquisition, their use is not without challenges. Operational restrictions, regulatory frameworks and regional difficulties may impede the seamless integration of UAVs into field surveys. In areas with stringent regulations, obtaining the necessary permits for UAV deployment might be a time-consuming and bureaucratic process, potentially delaying the assessment timeline. Moreover, local topography and weather conditions could pose operational difficulties for UAV flights, limiting their applicability in certain regions. Also, the constant evolution of technology in both UAV platforms and deployed sensors may cause difficulties in maintaining temporal observations with the same parameters.

The adaptability of UAV deployment, while advantageous, is contingent on the regulatory landscape. Some regions of the world may have restrictions on flying UAVs near sensitive areas, such as protected areas and wildlife sanctuaries or even populated zones, restricting the comprehensive coverage needed for a thorough field survey. Additionally, concerns about privacy and data security may further complicate UAV operations, necessitating careful navigation of legal and ethical considerations. Consequently, the TGBS does not stipulate the required use of UAVs during the field survey of sites.

4.5 Use of Remote Sensing for Reassessment

Five years after the award of the Global Biodiversity Standard, a site must be reassessed before the certification can be renewed. A remote sensing survey must be done for all reassessments of a site to confirm that improvements in ecosystem integrity have been maintained since the previous assessment.

In addition to the remote sensing survey outlined in sections 4.1-4.4, remote sensing shall be used in the reassessment process to identify major changes that have occurred since the previous field survey. An analysis of land cover change and land productivity between field surveys at the site can highlight important areas that should be visited by the field survey team during the field survey required for reassessment. Large changes in land cover or productivity could identify areas that have become degraded or have had intensive management since the previous assessment. These areas could highlight both positive and negative activities implemented at the site since the previous assessment.

Training on how to use a drone for TGBS assessments. (Teresiah Mungai)

Ankafobe reference forest as viewed from a drone. (Toky Ralainaorina)

When employing remote sensing imagery for the reassessment of a certified site, it's crucial to adhere to the consistent methodology established in section 4.2. This involves using the same remote sensing mission that was used in constructing the time series analysis over the area, ensuring a reliable comparison of data across different time periods. Additionally, it is essential to account for critical factors that may affect the analysis, such as the type of atmospheric correction method used. By maintaining this consistency, the remote sensing approach can more accurately detect and quantify significant changes in land cover and productivity, as identified in the initial survey. This rigorous approach is vital for pinpointing areas that have undergone considerable ecological transformation since the last assessment, whether it be degradation or improvement.

4.6 Limitations of Remote Sensing

Remote sensing technology provides an important monitoring tool for the Global Biodiversity Standard and can give insights to the historical trends in biodiversity that may not be possible to achieve through field surveys alone. Despite the many advantages that remote sensing provides, there are several limitations that assessors should consider when interpreting and using remotely sensed data. These limitations shall be identified and considered before assessments are made. Here we present some of the most common limitations associated with remotely sensed data.

4.6.1 Indirect Measures of Ecosystem Attributes

Remote sensors on board satellites or aeroplanes measure the interaction of electromagnetic radiation with the Earth's surface. By quantifying this interaction, it becomes possible to infer the biophysical and biochemical properties of vegetation. These properties are closely linked to key ecosystem processes, including carbon sequestration and biodiversity. However, it's important to note that these estimates often tend to be conservative and require field validation.

Indirect measures of biodiversity and ecosystem attributes may also provide unreliable data if different targets give similar results. For example, some species may have similar spectral signatures that arise from similar traits and therefore they may be interpreted as the same species, resulting in lower than expected species diversity for the site (Rocchini et al. 2022). Moreover, it may not be possible to identify whether changes in an index reflect positive or negative changes with respect to biodiversity. This is a particular limitation for methods that are unable to distinguish between native and non-native species. The sensitivity of remote sensing to measure biodiversity improves with the spectral resolution, which is covered in detail in section 4.6.3 Spectral Resolution.

4.6.2 Spatial Resolution

The spatial resolution of remote sensing refers to the size of the smallest object that can be reliably identified and distinguished in an image captured by a remote sensing instrument, such as a satellite or an aerial camera. Associated to the spatial resolution on an image is the ground sampling distance (GSD), which indicates the actual ground distance, in metres or centimetres, represented by each image pixel. For instance, a GSD of 1 metre means that each pixel in the image represents a square of 1 metre by 1 metre on the ground. Due to technological limitations inherent in satellite remote sensing, the spatial resolution of data acquired from spaceborne sensors is currently capped. Low spatial resolution may affect the ability to detect features in the landscape and can be a particular challenge for the monitoring of biodiversity. Spatial resolution is a particular limitation for many spaceborne sensors when compared to airborne and ground-based technologies.

The spatial resolution of the sensor used in the remote sensing survey should be compared with the size of the organism or feature being monitored to understand if the spatial resolution of the data is sufficient. In cases when the spatial resolution is lower than the size of the organism or feature, data will represent an average for the pixel, which could lead to both over- and underestimation of variables.

4.6.3 Spectral Resolution

Spectral resolution is characterised by the quantity and the bandwidth of the spectral bands that a remote sensing instrument can capture. Multispectral sensors typically capture images using a small number of broad spectral bands, usually fewer than five, each with a bandwidth greater than 50 nanometres, and these bands are non-continuous. In contrast, hyperspectral sensors are designed to capture images across hundreds of continuous, narrow spectral bands, each less than 10 nanometres in width. This feature of hyperspectral sensors enables them to provide highly detailed information about the spectral response of the Earth's surface, capturing subtle variations that multispectral sensors might miss.

For biodiversity assessments the spectral resolution plays a key role. Hyperspectral sensors are particularly effective in assessing biodiversity due to their ability to capture detailed spectral information across hundreds of narrow, continuous bands. This fine-scale spectral resolution allows for the precise discrimination of different species of vegetation and other surface materials. Each species has a unique spectral signature – a distinct pattern of reflection and absorption across various wavelengths – which can be accurately identified with hyperspectral data.

Measuring a tree to ground truth remote sensing data and ensure accuracy. (David Bartholomew)

4.6.4 Temporal Resolution, Revisit Time and Longevity

Temporal resolution in remote sensing refers to the frequency at which a sensor or satellite system captures images of the same area on the Earth's surface over time. Temporal resolution and revisit time, while related, are distinct concepts in remote sensing, particularly for very high resolution (VHR) sensors (with a GSD of less than 1 metre). Temporal resolution refers to the frequency at which a sensor can capture images of the same area over time. It's a broader term encompassing the sensor's ability to monitor changes at regular intervals. Revisit time, on the other hand, specifically denotes how frequently a satellite can physically pass over and record data from the same location.

VHR sensors often have advanced capabilities, such as off-nadir imaging, which allow them to capture images of areas not directly beneath their orbital path. This capability significantly enhances their ability to revisit specific areas more frequently than their standard orbital cycle would suggest. As a result, while the inherent revisit time of a sensor might be limited by its orbital parameters, the actual temporal resolution can be improved through off-nadir imaging capabilities. However, it's important to note that images obtained at large off-nadir angles (exceeding 20 degrees) may exhibit distortion issues. These distortions can affect the clarity and accuracy of object recognition within the images, thus impacting their overall utility in certain applications.

While VHR sensors offer enhanced capabilities like off-nadir imaging to frequently capture images of specific areas beyond their standard orbital cycles, there are inherent limitations in the temporal resolution of remote sensing products. The revisit period for spaceborne sensors can vary significantly, ranging from days to years, which might not always align with the timing requirements of a project or its corresponding field survey. Moreover, certain conditions can hinder data collection during these revisits. For instance, passive optical sensors are unable to penetrate clouds or operate without daylight, and depend on daytime conditions for effective data acquisition. In areas with regular cloud cover, this dependence can lead to lower temporal resolution and intermittent data, causing potential gaps in monitoring.

The temporal resolution of time series generated from the remote sensing survey may be longer or shorter than the timeline for the project applying for certification. A time series longer than the project may capture impacts that were caused by the previous management activities at the site, whilst a shorter time series may miss impacts that were implemented in the earlier stages of the project. The assessor should compare the dates for the remote sensing time series with the project timeline to ensure appropriate interpretation of results of the remote sensing survey.

Limitations around sensor longevity can also limit the capacity for sites to be remotely sensed. The mission time for spaceborne sensors may not encompass the time of the management activities at the site. Like limitations around temporal resolution, a sensor launch date that post-dates the initiation of the project may cause the remote sensing survey to miss impacts that were implemented beforehand.

Combining data from multiple sensors is one option for overcoming spatial coverage and temporal limitations of spaceborne remote sensing of a site. Whilst this can be a useful method, the assessor should be aware that sensors often have different specifications, and therefore resolutions that can result in data that may not be fully comparable.

4.6.5 Seasonal Changes

Seasonal variations in vegetation, driven by phenological changes, significantly impact time series of remotely sensed data. Plant phenology refers to the seasonal variation in plant characteristics, and it may alter the spectral signatures captured in remote sensing imagery over time. For example, the increase in green leaf cover during spring enhances the reflectance in the visible and near-infrared wavelength range, which is captured by sensors. Conversely, autumnal leaf falls or vegetation dormancy leads to decreased reflectance. Such seasonal dynamics are crucial for understanding ecosystem processes, but they also introduce variability that must be accounted for when analysing remote sensing time series data for monitoring biodiversity.

4.6.6 Cost

Remote sensing surveys can be expensive to implement because of the costs of acquiring and processing data, maintenance of equipment and technical expertise. Assessors should therefore carefully consider the priorities for the remote sensing survey, the additional data and evidence the remote sensing survey can provide, and the costs involved for different remote sensing options.

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 5
Field Survey


Temiar foresters Din and Baki collecting tree data with TRCRC at the Amanjaya Forest Reserve. (TRCRC)

The Global Biodiversity Standard

TRAFFIC

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

PLAN VIVO For nature, climate and communities

Section 5: Field Survey

Contents

TGBS field survey in Ramco Cements Mine Restoration, Pandalgudi, Tamil Nadu, India. (Auroville Botanical Gardens)

The Global Biodiversity Standard employs on-site field surveys that together with other sources of information will allow a rigorous evaluation of how well a site meets the criteria. Data and evidence are collected during the field survey to support the assessment process, by monitoring ecosystem integrity, including biodiversity, stakeholder engagement, the level of protection of a site, and monitoring, evaluation and adaptive management activities.

The Global Biodiversity Standard uses data in conjunction with other sources of information to:

- Complement and validate remote sensing surveys to support assessments
- Identify species presence and abundance
- Increase the spatial resolution of data collected
- Monitor current ecosystem integrity conditions and record evidence, e.g., photographs, observations, species occurrences
- Improve accuracy for ecosystem integrity sub-attributes that are difficult to monitor with remote sensing surveys
- Verify baseline data collected from remote sensing and the application form
- Infer baseline conditions based on features in the landscape
- Build baselines by assessing nearby proxy sites that match the baseline of the applicant site
- Build reference models
- Monitor the level of stakeholder engagement and social benefits
- Monitor the effectiveness of conservation management activities
- Identify level of protection of the site and sources and risks of degradation

Field survey data can be collected through a variety of methods. Rapid biodiversity assessments can be implemented using well-established field methods. The TGBS promotes the use of both traditional methods and the use of novel technologies, including remote sensing, acoustic monitoring, camera traps and environmental DNA, which can support data collection. Assessment of stakeholder engagement and social benefits through field surveys can be achieved using semi-structured interviews and focus groups with stakeholders.

5.1 Preparing for a Field Survey

Prior to a field survey, the assessors shall prepare an assessment plan. The assessment plan shall include an overview of the topics and agenda for the field survey, with the intention of helping the applicant and assessors prepare for the assessment and to ensure the assessment is time efficient. The assessment plan shall provide a rough outline for the assessment but may be modified by the assessor together with the applicant as necessary during the field survey. The assessment plan shall be sent to applicants before the field survey to provide an overview of the visit.

The assessment plan shall state that applicants will be asked whether they are willing for anonymised field survey data to be shared with relevant third parties to improve the TGBS methodology and processes, and improve scientific understanding. The assessors shall sign a confidentiality agreement and assessment contract with the applicants for this purpose. Applicants shall be made aware that during the field survey, the assessor must be given unrestricted access to all documents, facilities and sites relevant for certification. Refusal to provide unrestricted access may result in any TGBS certification being rejected, suspended or withdrawn.

The assessment plan shall cover all activities that are necessary to complete the field survey, including the preparation phase. Prior to the site visit to undertake the assessment, the assessor will:

- Review the application form.
- Complete a risk assessment, including occupational health and safety. This must be approved by the hub lead prior to the field survey.
- Apply for any permits required for the field survey, including permits to access land and permits to fly UAVs.

Testing the TGBS assessment methodology in Nerimalai coffee estate, lower Palani, Tamil Nadu, India. (Auroville Botanical Gardens)

- Hold an introductory online meeting prior to the field survey that covers:
  - A presentation by the lead assessor
  - A summary of the project presented by the applicant organisation and site manager
  - A presentation of the scope, proposed schedule and methods for the assessment
  - The risk assessment
  - Personnel availability to assist assessors, including local communities and stakeholders
  - Discussion of logistics and activities for the field survey
- A spatial delineation of land management types, land uses, biomes and ecosystems of the site prior to the field survey (section 5.3)
- A review of resources relevant to the site to allow assessors to:
  - Identify the reference ecosystem or verify the reference ecosystem when provided by the applicant
  - Identify whether a pre-survey is needed for the assessors to familiarise themselves with the reference ecosystem (Note this might not be near to the site under assessment depending on the land use surrounding the site. Assessors shall obtain the relevant permissions when accessing sites used to build a reference ecosystem)
- Selection of an appropriate plant, fungal or lichen indicator group
- Selection of an appropriate animal indicator group
- Species surveys of the chosen floral and faunal groups
- A plan for the social surveys with local communities and stakeholders used to assess stakeholder engagement and social benefits
- Checks of the legal protection status of the site
  - A list of documents that the applicant should prepare prior to the site visit (see below)
- A schedule and logistical plan for the assessment process, including accommodation, food, breaks, etc.

During the site visit for the field survey, the assessor shall undertake:

- An introductory meeting on arrival that covers:
  - Introduction of all assessors and representatives from the applicant organisation who will facilitate the field survey
  - An orientation to the site, including any hazards or safety requirements identified in the risk assessment
  - Presentation of documents requested by the assessor for the field survey
- An interview with the applicant and/or site manager about the site
- Site checks to measure ecosystem integrity and restoration activities
- Site checks to assess the protection management activities
- A review of the monitoring, evaluation and adaptive management activities
- An exit meeting

The assessment plan shall be shared with the applicant prior to the site visit. It will outline any documents necessary for the field survey to allow the applicant to prepare these documents in advance. These include any documents that may not be submitted via the application form because they are only available in paper format or in local languages. Example documents may include purchase records, traceability documents, employment contracts, first-aid registers, accident records, etc.

In addition to the assessment plan, assessors shall prepare in advance all the necessary equipment, tools and other logistics required for the field survey. The lead assessor ensures that all required expertise needed for the assessment is represented on the assessment team.

5.2 Assessment Team Time and Personnel

The time and personnel needed for a field survey will vary depending on the conditions of the site and the methods deployed by the assessment team.

The length of the field survey will typically take between two and 10 days, with the time required increasing with site size, topographic complexity, remoteness, difficulty of access and vegetation complexity. Additional time may be required for the deployment of technology and other off-site laboratory analyses or tests, if being used to monitor biodiversity.

An assessment team shall consist of a minimum of two people but may vary with site conditions or expertise. As a minimum requirement, the assessment team should include the following expertise:

- Expertise in the chosen plant, fungal or lichen indicator group
- Expertise in the chosen animal indicator group
- Expertise in ecological restoration best practices
- Expertise in socio-economic survey techniques

The lead assessors must hold a certificate as a Global Biodiversity Standard Assessor; however, in most cases there will be additional personnel in the field survey team for specific tasks, e.g., sample collection for lab analysis, local experts in specific groups of flora/fauna, translators and assessors-in-training. The assessment team shall also be supported by personnel with experience in spatial analysis, data analysis and biodiversity science, who may not need to be present during the field survey.

Recording coordinates for a TGBS field survey in Ramco Cements Mine Restoration, Pandalgudi, Tamil Nadu, India. (Auroville Botanical Gardens)

5.3 Spatial Delineation of Sites

Different land management activities will have varying impacts on biodiversity and across different biomes or ecosystems. Changes in ecosystem integrity are thus measured independently for each land management type under the Global Biodiversity Standard, with scores weighted according to the proportional area of each land use (section 6.2). To calculate the area of different zones, sites shall be delineated by land management types, land uses, biomes and ecosystems.

To support this proportional weighting system, when two agroforestry sites exist within the project but are physically separate or have different management or systems, sites need to be divided into different land management types. Under the TGBS, sites are delineated into:

- Protected areas under restoration
- Other ecological restoration areas
- Rehabilitation areas, including:
  - Agroforestry areas
  - Plantation areas
  - Agricultural areas

In addition to delineating land management types, sites that have multiple target reference models or ecosystems require additional spatial delineation. Sites with different reference models have different quantitative assessment thresholds (Appendix F). For example, a site may include a lake within a wider forest ecosystem that will have a different target reference model than the surrounding forest. Consequently, sites with multiple ecosystems must be delineated accordingly.

In the online application, applicants identify the site for which they are seeking certification by providing a polygon of the site boundary. This area may not be the entire area over which the applicant is working. This boundary is provided via a file upload of a spatial file or by drawing the polygon within the application form directly. Some applicants have the capacity to delineate different land management types within the application form, but this may not be possible in all cases. Prior to a field survey, assessors are responsible for verifying spatial data provided by the applicant and for delineating the land management types when applicants are unable to provide it. If the applicant has no capacity for providing geospatial data, or if an applicant desires a detailed map of their project site, a mapping survey can be provided by a hub prior to the TGBS application as an additional service.

It is also important to identify adjoining or nearby land uses so that the project can be placed into the local context, and positive and negative connectivity with adjoining sites can be assessed.

Assessors should use the following tools to spatially delineate the land management types of a site, as well as other adjoining or nearby land uses.

Measuring vegetation in Jordan using a quadrat. (RBG, Jordan)

- **Remote sensing imagery and products**
  The spatial boundary of a site can be laid over remote sensing imagery and products, such as Google Earth, to assist in the identification of different land management types, land uses, biomes and ecosystems. These images and products allow for unique features and patterns to be detected in the landscape, such as the layout and density of trees. Fences that separate land management types can sometimes be detected with satellite imagery and can be used to support delineation. Not all features of a landscape may be detected by optical remote sensing imagery. Remote sensing products from non-optical sensors, such as multispectral sensors, may provide a more accurate method to allow different land uses to be detected in some circumstances.

- **Vegetation and ecosystem maps**
  The spatial boundary of a site can be laid over vegetation and ecosystem maps to delineate ecosystems. Vegetation maps that may be used include national or regional vegetation maps. Potential vegetation maps are preferred to current superior vegetation maps because the vegetation types should reflect the reference ecosystem rather than the altered vegetation state although they may be coarse and may not reflect the reference model. Potential vegetation maps should, where possible, have a minimum pixel resolution of 30 m. Potential vegetation maps may also depend on given climate models that themselves have a degree of uncertainty. Given these limitations, potential vegetation maps should be used carefully.

During the spatial delineation process, assessors should be careful to consider the following to ensure accurate data:

- **The coordinate reference system (CRS):** Use of the wrong CRS will mean that spatial data is not mapped reliably. The recommended CRS to use is WGS84.
- **The file type:** Geopackage (GPKG) files are the favoured file type given that they are open, non-proprietary and platform independent. GPKG files can store layers of different geometries (line, point, polygons, etc.) as well as vector and raster data in the same file and do not have size limitations. Some format conversions may be needed from Shapefiles (SHP) or Google Earth (KML/KMZ) files for users who prefer those formats.

Materials for soil analysis during a field survey of ecosystem integrity. (Narindra Ramahefamanana)

- **Data resolution:** The resolution of data should be considered to ensure the area is mapped as accurately as possible.
- **Time series:** Time series data can provide a useful tool to identify activities that indicate different land histories. For example, the growth of vegetation over time may indicate ecological restoration areas including areas of land abandonment.

Verification of the spatial delineation of a site is a key objective of the field survey. Boundaries of land management types and ecosystems can be recorded in the field using handheld GPS devices and used to contribute to the spatial analysis of the site.

5.4 Equipment and Tools for Data Collection

Equipment and tools for data collection play a key role in conducting accurate and reliable assessments under the Global Biodiversity Standard. The purpose of these assessments is to evaluate the integrity of ecosystems in a consistent and standardised manner. The selection of appropriate equipment and tools is essential to ensuring consistent data collection and reliable results. The equipment and tools used for data collection in TGBS assessments may vary depending on the specific sub-attributes being evaluated. Assessors shall consider the following types of equipment:

- **Species identification lists and guides:** The identification of plant, animal, fungal and lichen species requires the use of field guides, species lists and taxonomic keys. These guides are collated beforehand to assist field assessors in determining the presence and abundance of key species in the assessment area, including native and invasive species. The provision of these resources is a primary responsibility of the hubs.
- **Transect or plot markers:** Transect or plot markers are used to define specific sampling areas. They ensure consistent and uniform sampling across multiple sites, allowing for accurate data collection and comparisons.
- **Handheld GPS devices:** Handheld GPS devices are used to record the geographic coordinates of sampling locations. GPS data aid in spatial mapping and the precise documentation of assessment areas.
- **Measuring instruments:** Various measuring instruments will be required depending on the sub-attributes assessed and methods used. These measuring instruments can include tools such as tapes, callipers or rulers for measuring tree diameters, quadrats for assessing plant abundance, or water-quality testing kits for evaluating aquatic ecosystem parameters.
- **Camera and photography equipment:** Cameras and photography equipment can record species presence, habitat conditions and ecosystem features. Cameras attached to UAVs can provide informative fixed-point images of specific parts of the landscape. Images can be used to validate assessment data visually.
- **Sampling equipment:** Depending on the specific assessments, sampling equipment may be needed, such as soil corers, water samplers, botanical presses, insect traps, secateurs, long hand pruners, catapult throw lines or tree climbing gear. These tools enable the collection of samples as records and further analysis and measurement of sub-attributes.

- **Analysis equipment:** Various analytical instruments are used to analyse samples and measure specific parameters related to soil, water or vegetation, such as pH meters, nutrient testing kits, DNA sampling kits and spectrophotometers.
- **Field notebooks:** Field notebooks are used to record observations, measurements and other relevant data during field assessments. They function as a logbook for field assessors to document their findings and ensure systematic data collection.
- **Data recording devices:** Alongside field notebooks, digital devices such as smartphones, tablets or laptops can be used for data entry, allowing for real-time recording and easier data management. The TGBS mobile app is a useful tool to structure data records (section 5.4.1).
- **Social survey instruments:** Surveys, questionnaires and interview tools aid in gathering stakeholder perspectives, assessing stakeholder engagement, and evaluating project-related social aspects (section 5.7).
- **Laboratory equipment:** In some cases, laboratory equipment may be required to analyse collected samples, such as microscopes, DNA analysis equipment or spectrophotometers. These tools help assess specific attributes like genetic diversity or biochemical composition.
- **Safety gear:** Depending on the assessment environment and potential hazards, field assessors will require personal protective equipment such as gloves, safety glasses, snake chaps and sturdy footwear to ensure their safety during data collection. Assessors shall carry a first-aid kit.

It's important to note that the selection of equipment, tools and protocols for data collection shall be based on standardised protocols and guidelines provided in this manual. When reporting on the methods used in the assessment form, assessors shall provide the manufacturer and model of equipment used to allow specifications to be compared. This will help to provide greater consistency, accuracy and comparability of data over time and across different assessments and sites.

5.4.1 Mobile Application

The TGBS mobile application (app) is a bespoke app that has been developed to support the assessment process. The app has been designed for assessors to use in the field and to support the completion of the assessment form. The mobile app is available on smartphones and tablets that use either an Android or iOS operating system. The mobile application has been developed by RadixWeb. Users of the TGBS mobile app are assessors and must have their credentials approved by the Secretariat. Each assessor will have a unique login profile.

Assessments that are assigned to the assessor are displayed on a dashboard within the summary tab of the app, helping to support the management of assessments. Activities within the app are logged and displayed here, allowing for easy tracking of an assessment.

The review tab of the mobile app can be used by assessors to review applications that have been assigned to them for assessment. Here, answers submitted and documents uploaded by the applicant can be downloaded and reviewed.

Measuring the microbiological activity of soil using the USDA methods. (Narindra Ramahefamanana)

The mobile app has a field survey tab that facilitates effective data collection in the field. Within the field survey tab, the app has a number of tools to support the assessment process:

- **Random sampling:** A tool to support random sampling approaches. Random GPS coordinates are generated within the project area where field surveys can be implemented. Assessors can choose to approve these locations or can reject them with a justification of why a non-random sampling approach is taken. For example, a randomised point may be in a dangerous or inaccessible area.
- **Species survey:** A tool to capture data records of species encountered in the field survey. The species table from the online application is automatically entered into the species survey tool to allow for easy verification of applicant data. An assessor can download and upload species lists to help support surveys. For example, assessors may wish to download species lists to verify species names and remove synonyms, before re-uploading the data. Assessors may also wish to upload a species list for the area of interest (e.g., the region or ecosystem where the assessment site is located) to facilitate easier data entry when in the field. Within the species survey tool, an assessor can easily record data related to the species. This includes the option to take geo-referenced photos and record data on the abundance, regeneration and planted status of individuals.
- **Geospatial tracking tool:** A tool to support tracking of the assessor's path through the assessment site. The assessor has the option to track their movement directly using the mobile device or to upload a tracking route collected from another device.
- **Ecosystem integrity:** A tool to allow evidence and observations to be recorded related to each of the 21 sub-attributes of the Five-star System of ecosystem integrity. Here assessors can take or upload photos and documents within the app as well as note down observations in the field. This evidence can be used to support the assessment and verification process.
- **Level of protection:** A tool to allow evidence and observations to be recorded related to the level of protection provided at the site. Here assessors can take or upload photos and documents and note down observations within the app. This evidence can be used to support the assessment and verification process, including evidence related to the legal status, protection and management activities of the site.

Collecting a sample for the Auroville herbarium during a TGBS assessment in Ramco Cements Mine Restoration, Pandalgudi, Tamil Nadu, India. (Auroville Botanical Gardens)

- **Stakeholder engagement and social benefits:** A tool to allow evidence and observations to be recorded related to stakeholder engagement, benefits distribution, knowledge enrichment and sustainable economies provided by the project. Here assessors can take or upload photos and documents not provided in the application form and note down observations within the app, for example, during interviews with local stakeholders. This evidence can be used to support the assessment and verification process.
- **Monitoring, evaluation and adaptive management:** A tool to allow evidence and observations to be recorded related to monitoring, evaluation and adaptive management of biodiversity implemented by the project. Here assessors can take or upload photos and documents and note down observations within the app. This evidence can be used to support the assessment and verification process.

Under the 'Assess' tool of the mobile app, assessors can submit their assessment of the site. Here assessors must submit ratings related to the four assessment frameworks:

- **Ecosystem integrity:** Report the reference model used in the assessment. Rate the sub-attributes of ecosystem integrity of the site from zero to 5 stars under baseline and current conditions (section 5.5, Appendix C & Appendix F).
- **Level of protection:** Rate whether activities of protection and management are sufficient for long-term conservation objectives, leading to the level of protection of the site from zero to 5 stars under baseline and current conditions (section 5.6 & Appendix G).
- **Stakeholder engagement and social benefits:** Rate the stakeholder engagement, benefits distribution, knowledge enrichment and sustainable economies of the project (section 5.7, Appendix E & Appendix H).
- **Monitoring, evaluation and adaptive management:** Report which are being implemented related to (i) ongoing planning, (ii) long-term resourcing, (iii) adaptive management, and (iv) continuous improvement of management activities, as well as (v) the monitoring and evaluation activities (section 5.8).

On submission of the ratings through the assess tools, a score is automatically generated for the site using the scoring system outlined in section 6.2. The assessment is also evaluated by a reviewer before a final decision on the TGBS scoring is made. If necessary, the assessor may be asked to revisit or reassess certain elements of the projects to ensure a complete and robust conclusion.

5.5 Assessing Ecosystem Integrity, including Biodiversity

'Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.'

Kunming-Montreal Global Biodiversity Framework Target 2

For the Global Biodiversity Standard, assessing ecosystem integrity including biodiversity entails comparing the current state of an ecosystem to both a baseline condition and a reference model. The baseline represents the ecosystem's starting point or pre-project condition, whereas the reference model represents the condition the ecosystem would be in had degradation or conversion not occurred, and against which restoration is measured.

The TGBS adapts the SER Five-star System from the SER Standards to measure progress for five of eight TGBS criteria (Appendix C). The Five-star System allows assessors to report changes from the baseline condition relative to the reference model. Assessors use the Five-star System to evaluate attributes and sub-attributes with the change in star rating then used to evaluate progress against the relevant criteria (section 6.2).

Beginning at zero stars with essentially no native biodiversity or ecosystem functions, the highest potential level of recovery is (five stars/★★★★★) described as: *Threats effectively absent. A characteristic assemblage of biota present, exhibiting structural and trophic complexity of very high similarity to the reference ecosystem. Self-organising potential on a trajectory to emulate the reference ecosystem functions and processes and are likely to be sustained. Appropriate cross-boundary flows are enabled, and resilience is restored with the return of appropriate disturbance regimes.*

5.5.1 Rapid Biodiversity Assessments

The TGBS uses rapid biodiversity assessments (RBAs) to understand the biodiversity of a site, which also contributes to an overall assessment of ecosystem integrity. Rapid biodiversity assessments are a time-efficient tool to collect key information on biodiversity, not every species present, but specific taxonomic or functional groups that can serve as proxies for overall site biodiversity.

In forests, the default plant indicator group recommended by the TGBS is trees because they are keystone species that support a wide range of other biodiversity (e.g., Bargali et al. 2015). They can also be effectively surveyed because there are a large number of tree taxonomic specialists, they are easily detectable because of their size and perennial growth form, and mature canopy species can be assessed using UAVs (section 4.4). The default recommended indicator group for animals is birds because of the large number of habitat specialists, the ease to rapidly detect and identify species visually and from acoustic calls, and their representation across multiple trophic levels (Lewandowski et al. 2010). Most bird species are diurnal, are easy to identify with limited time and effort needed for post-survey data processing, and are highly cost-effective to sample (Gardner et al. 2008; Kessler et al. 2011; Herzog et al. 2016). Whilst suggested as recommended indicator groups, the TGBS neither prescribes nor restricts assessors to use trees and birds as indicators. Instead, taxonomic groups shall be selected appropriately according to the ecosystem (e.g., trees are likely to be an inappropriate indicator in grasslands) and/or the expertise of the assessment team. Where capacity exists, multiple taxonomic groups should be assessed using overlapping or complementary methods, e.g., bioacoustic recordings could be analysed for multiple taxa.

Appendix C outlines a comprehensive toolbox of methods that can be utilised to assess the biodiversity and other ecosystem integrity attributes of a site. Many of these methods are complementary and can be combined to assess multiple sub-attributes of the Five-star System.

5.5.2 Plots and Transects

Sampling plots and transects represent effective techniques for surveying ecosystem integrity at a site. Plots and transects collect data on the relative diversity of plant communities in a rapid and reliable way and can be used for both woody and herbaceous plants (Monteagudo et al. 2016). A wide variety of methods for plots and transects exist, with the most appropriate method varying by ecosystem type, e.g., Sheil et al. (2003) tropical forests. The orientation of vegetation plots or transects shall also be modified according to the landscape, and when used in areas with planted individuals, shall be oriented diagonally to the planting lines, following recommendations by The Biodiversity and Natural Resources Coordination Office, that establishes the Ecological Restoration Project Monitoring Protocol in São Paulo State Department of Environment, in Brazil. Alongside sampling plots and transects, the location of vegetation surveys can be combined with dawn chorus recordings and/or point counts to record the richness and density of bird species (Herzog et al. 2016). These two complementary methods allow multiple assessments of the sub-attributes of the Five-star System (Box 5.1).

Box 5.1 – Combining sampling plots or transects with dawn chorus recordings or point counts within RBAs.

The installation of a vegetation sampling plot or transect can effectively be combined with dawn chorus recordings and point counts within an RBA to allow both vegetation and bird diversity to be assessed at a single location. Supplementing these with environmental monitoring of water and substrates can allow 19 of 21 sub-attributes of the Five-star System to be measured.

The vegetation survey completed in the sampling plot or transect can be used to detect the density of desirable (sub-attribute h), invasive (sub-attribute b), rare and threatened (sub-attribute j) and undesirable (sub-attribute k) plant species. Collecting data on the diameter at breast height (1.3 m) and height of the trees can allow a diameter class structure to be built. This data can be analysed to understand the presence of all vegetation strata (sub-attribute m) and to detect the presence of over-utilisation (e.g., logging; sub-attribute c) or other drivers of degradation (sub-attribute d). The identification of smaller regenerating individuals can allow for resilience and recruitment (sub-attribute r) to be measured. The distribution of the adult and regenerating trees can also provide insights into the spatial mosaic (sub-attribute o) of the vegetation community.

The dawn chorus recordings and point count surveys of birds can be used to measure the density of desirable (sub-attribute i), invasive (sub-attribute b), rare and threatened (sub-attribute j) and undesirable (sub-attribute k) bird species. Analysing the data to understand the trophic level of the species can detect the presence of all trophic levels (sub-attribute n).

Combining the data collected on bird and plant diversity can provide insights into the potential for intraspecific gene flow between the site and the surrounding environment in areas with known bird seed disperser or pollinator species (sub-attribute t). Meanwhile, analysis of the functional diversity of both plant and bird communities can provide insights into the habitats and interactions of the ecosystem (sub-attribute q).

The detection of habitats and interactions (sub-attribute q) can be supplemented within the transect with a coarse woody debris survey. Analysing the decay class of coarse woody debris can additionally support the assessment of nutrient cycling (sub-attribute p). Rapid water and soil tests at the same locations can be used to detect contamination (sub-attribute a), water chemo-physical conditions (sub-attribute e), substrate chemical (sub-attribute f) and physical (sub-attribute g) conditions of the site. Analysis of the rate and quality of surface and groundwater can contribute to an understanding of the landscape flows (sub-attribute s).

Timed-meander methods (Huebner 2007) provide an effective technique to survey plants, cover large areas of the site, and capture information about rarer species and features. The use of timed meanders is an effective method for capturing inherently patchy features, such as species associated with canopy gaps in forest ecosystems. Timed meanders can be combined with species list surveys to monitor bird diversity (Herzog et al. 2016). The use of 10–species lists, or MacKinnon lists provides an effective method to monitor species richness, relative abundance and composition of bird communities. The use of timed meanders and species lists in between sampling plots or transects and point counts allows for a coherent survey protocol that maximises the time and cost efficiency of RBAs.

Soil samples taken for carbon measurement. (Narindra Ramahefamanana)

The combination of different RBA techniques, such as those outlined above, can provide detailed and varied data on biodiversity and other aspects of ecosystem integrity. For example, transects, plots, dawn chorus calls and point counts, as outlined in Box 5.1, can provide detailed, intensive monitoring at various locations across the site. Meanwhile, timed meander walks and bird species lists, as outlined in Box 5.2, can effectively supplement this data by substantially increasing spatial coverage and allowing for rarer species and features to be recorded. Using the time spent travelling between transects, plots, dawn chorus calls and/or point counts to survey can provide a coherent method to optimise the survey time by an assessment team (Figure 5.1). Through a combination of these survey techniques, 20 of the 21 sub-attributes of the Five-star System can be effectively assessed. The remaining sub-attribute (provenance, genetic diversity and genetic resilience) can be assessed by analysing propagule collection and provenance records provided from the application or through collection of environmental DNA samples (Appendix C).

Box 5.2 – Combining timed meanders with species lists within RBAs.

The use of timed meander and species list surveys can be effectively combined within an RBA to understand vegetation and bird biodiversity. These methods provide an effective way to ensure large spatial coverage of a site, ensuring sampling efforts are representative of the site. When combined, these survey techniques can make an important contribution to understanding the star rating of a site for 18 of the 21 sub-attributes of the Five-star System.

Using a systematic walk across a site and recording the presence of plant and animal species within a period of time allows for the relative abundance of these taxa to be recorded. By recording the frequency and density of individuals, species can be assigned to one of six abundance categories:

1. Present – One or several individuals observed
2. Rare – Observed sparsely
3. Occasional – Observed regularly across the site but in limited numbers
4. Common – Observed in large numbers regularly across the site.
5. Locally Abundant – Observed in large numbers but constrained to a few distinct sites
6. Dominant – When a species covers at least 20 per cent of the site area

By measuring plants and birds across the landscape in this way, quantitative data are generated that can be used to assess a site for the area of threat of invasive species (sub-attribute b), the cover of desirable plants (sub-attribute h), desirable animals (sub-attribute i), rare and threatened species (sub-attribute j), no undesirable species (sub-attribute k). Recording the presence of regenerating plants can provide evidence to assess resilience and recruitment (sub-attribute r). Regeneration can be assessed according to three abundance categories:

1. Rare – Pockets of regeneration found in a few places
2. Common – Regeneration observed frequently
3. Locally abundant – Abundant regeneration found but in a few select areas only, not in an expected pattern

Analysing the data from the vegetation and bird surveys can also provide insights into the trophic diversity (sub-attribute n), functional diversity (sub-attribute q) and intraspecific gene flows (sub-attribute t).

During the systematic walk, additional data can be recorded that can provide data for analysis of other sub-attributes of the Five-star System. Visual evidence of contamination or contamination risks (sub-attribute a), indications of over-utilisation, such as over-grazed or logged areas (sub-attribute c), the presence of other degradation threats (sub-attribute d), and the presence of different vegetation strata (sub-attribute m) can all easily be recorded throughout the survey. Recording information about changes in habitat type can provide evidence to assess the spatial mosaic (sub-attribute o), habitat provision (sub-attribute q) and habitat links at the site (sub-attribute u).

Meanwhile, samples of water and soil can also be collected as appropriate during the systematic walk, allowing for water chemo-physical conditions (sub-attribute e) and substrate chemical (sub-attribute f) and physical conditions (sub-attribute g) to be measured. Scat samples, when detected, could also be collected for diet analysis to give further evidence to contribute to an understanding of trophic levels (sub-attribute n).

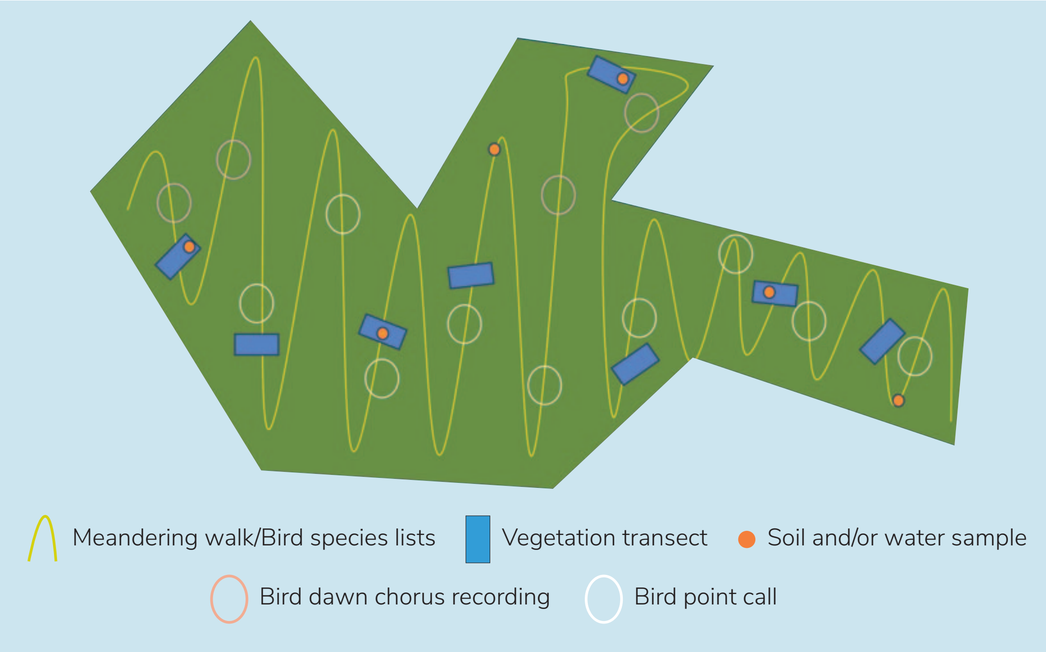


Figure 5.1 – *An example survey plan that combines the use of meandering walks (yellow lines), vegetation transects (blue rectangles), bird species lists (yellow lines), bird dawn chorus recordings (pink circles), bird point counts (white circles), and soil and water samples (orange dots) at a site under assessment (green polygon). The number of sampling locations (bird surveys /vegetation transects) is adjusted according to the size of the site.*

5.5.3 Area Covered by the Field Survey

Monitoring change across the full site is unlikely to be feasible and cost-effective, except at very small sites. Sampling a proportion of the site allows indicators to be estimated in a cost- and time-effective manner provided sampling is sufficient for data accuracy and validation (Quinn and Keough 2002). The recommended minimum area that should be sampled by assessors through the rapid biodiversity assessment is 2-4 per cent of the total site to avoid false positive or negative outcomes. This proportion should be applied to each land management type or distinct site from the application form.

The value of 2-4 per cent has been estimated as the optimal sampling area for monitoring restoration in tropical forests (Londe et al. 2022). Whilst the optimal sampling area is likely to vary across biomes and ecosystems, to date, limited data on optimal sampling area are available. As information on optimal sampling area for other ecosystems and biomes becomes available, the proportion of the area covered by monitoring shall be adjusted accordingly.

Species accumulation curves provide an important analysis tool to understand how detection of new species saturates with sampling effort and to compare species richness between different strata (such as vegetation types or times of sampling) of a surveyed landscape. Data collected through survey activities can be used to construct these curves and to predict the number of species that remain undetected from the sampling (Kindt & Coe 2005: Chapter 4; Kindt 2020). Resources such as the vegan and *BiodiversityR* R packages provide functions for the construction of species accumulation curves (Oksanen et al. 2022; Kindt 2023) *Vegan and BiodiversityR* functions can also be used to assess evenness by constructing diversity profiles with data that were collected during the surveys (Kindt & Coe 2005: Chapter 5; Kindt 2020). Assessors should also analyse how sampling effort affects diversity profiles when comparing different strata.

The location of monitoring activities shall, wherever possible, be selected randomly to minimise the risk of bias. Under some circumstances, random sampling may not be feasible or appropriate. This may be because of logistical challenges, e.g., distance, slope of terrain, inaccessibility or hazardous conditions, or because of a known heterogeneity in the site, as revealed through the online application or remote sensing survey. In these cases, monitoring locations may be modified, but justification must be provided by the assessor. In the case of non-random sampling, the assessor shall minimise bias to the extent possible.

Whilst the total proportion of the area covered by field surveys shall be at least 2-4 per cent of the land area within each specific management type, the number of samples for each survey activity (e.g., vegetation plots, timed-meander time intervals, dawn chorus recordings, soil samples, etc.) needed to reach that percentage will vary due to the size of the site and the different land uses within the site. The minimum number of samples for each survey activity per land use or distinct site within a project is as follows:

Area (hectares)	Minimum number of surveys per land use
Less than five hectares (<5 ha)	2
Between five and fifty hectares (5 - 50 ha)	4
Between fifty and two hundred hectares (50 - 200 ha)	6
Between two hundred and one thousand hectares (200 - 1000 ha)	6-10
More than one thousand hectares (>1000 ha)	>10

5.6 Assessing the Level of Protection

'Ensure and enable that by 2030 at least 30 per cent of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures, recognizing indigenous and traditional territories, where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories.'

Kunming-Montreal Global Biodiversity Framework Target 3

5.6.1 Introduction to Protected Areas

Providing protection to a site is a necessary step to ensure that positive biodiversity outcomes can be achieved over the long term. By enhancing the level of protection at the site, degradation of pre-existing biodiversity and ecosystem integrity can be avoided and natural regeneration and enhancement of biodiversity can be secured for the long term. Failure to enhance protection of a site can leave the site vulnerable to losses of biodiversity and may prevent the site from achieving net positive outcomes for biodiversity over the long term.

A protected area is defined as a site in which there is some form of either formal or informal protection in place. Protection can be achieved via legal protection of the site and/or management activities. To achieve the highest level of protection for biodiversity, thus avoiding degradation in biodiversity and ecosystem integrity, land should have both legal protection and have effective management in place.

5.6.2 The Level of Protection Rating

The TGBS assesses the level of protection of a site using a five-star rating system (5 stars high; 0 stars low). The rating system is developed to recognise projects that provide both legal protection to a site and implement management activities that are sufficient to ensure sustainable long-term recovery of biodiversity.

The highest level of protection rating (5 stars) is awarded to sites with (i) legal protection with biodiversity as a primary outcome, and (ii) management activities that are sufficient to halt the degradation and allow for the recovery of biodiversity. The TGBS recognises Strict Nature Reserves, Wilderness Areas, National Parks, National Monuments or Features, Habitat/Species Management Areas, Protected Landscapes/Seascapes and Protected Areas, *with sustainable use of natural resources* achieving the highest level of protection (IUCN 2008; Appendix G).

The lowest level of protection rating (0 stars) is assigned to sites that have (i) no legal protection and (ii) insufficient management activities to avoid the degradation of biodiversity. The TGBS assigns sites with management that align with the definitions of Threatened, Vulnerable or Collapsed under the IUCN Red List of Ecosystems as having the lowest level of protection (IUCN 2016; Appendix G).

The level of protection rating assigned to sites varies according to the management activities implemented at the site. As the management activities increasingly align with sustainable long-term biodiversity uplift objectives, the level of protection will increase, provided management activities are also sufficient. Sites can also increase the level of protection status by elevating biodiversity to be a primary objective of protection and management rather than a by-product thereof. Sites that can ensure sustainable use of natural resources and meet the IUCN definition of a protected area but are not legally declared a protected area (*Primary Conservation*) are awarded a 4-star level of protection rating.

The level of protection rating also varies according to the legal status of the site. Areas that have legally protected status with biodiversity as an objective are assigned a one star higher rating than sites with equivalent management activities but no legal protection for biodiversity. For example, a *Strict Nature Reserve* will be assigned one star rating higher than a *Primary Conservation* area because of its additional legal protected status, despite both having management activities that are sufficient to halt the degradation and allow for the recovery of biodiversity. Having legal protection of the site ensures that the site is protected for the long term even if there is a change of ownership.

5.6.3 Evaluating the Level of Protection

Evaluation of the level of protection requires assessing both the presence of legal protection status and the long-term sustainability of management activities with respect to biodiversity conservation and restoration. The assessor must evaluate whether management activities conducted for the protection of the site are sufficient to halt degradation and enhance biodiversity recovery.

The presence of legal status shall be verified by the assessor. Evidence of legal protection should come in the form of legal documentation that verifies the site is protected as stated in the application. Assessors may need to ask questions to the applicants about the reason for protecting the site to verify whether biodiversity conservation is a stated objective of the protection.

Management activities implemented at the site should align with sustainable long-term biodiversity objectives for biodiversity to be effectively protected. To assess the effectiveness of management activities, assessors shall (i) identify all management activities related to biodiversity that are implemented at the site, and (ii) assess whether these activities align with sustainable long-term biodiversity conservation and restoration objectives. The assessor shall assess whether the type and level of activity is sufficient to maintain or enhance the current level of ecosystem integrity with respect to the Five-star System (Appendix C & Appendix F). It should be noted here that the assessment is made according to the management activities rather than the sub-attributes of the ecological recovery wheel, but that equivalent data and evidence can contribute to the assessment process. Failure to implement a management activity that is needed for the sustainable long-term biodiversity objectives shall be considered as implementation at an insufficient level. Management activities that are not applicable to the site are not considered in the assessment process.

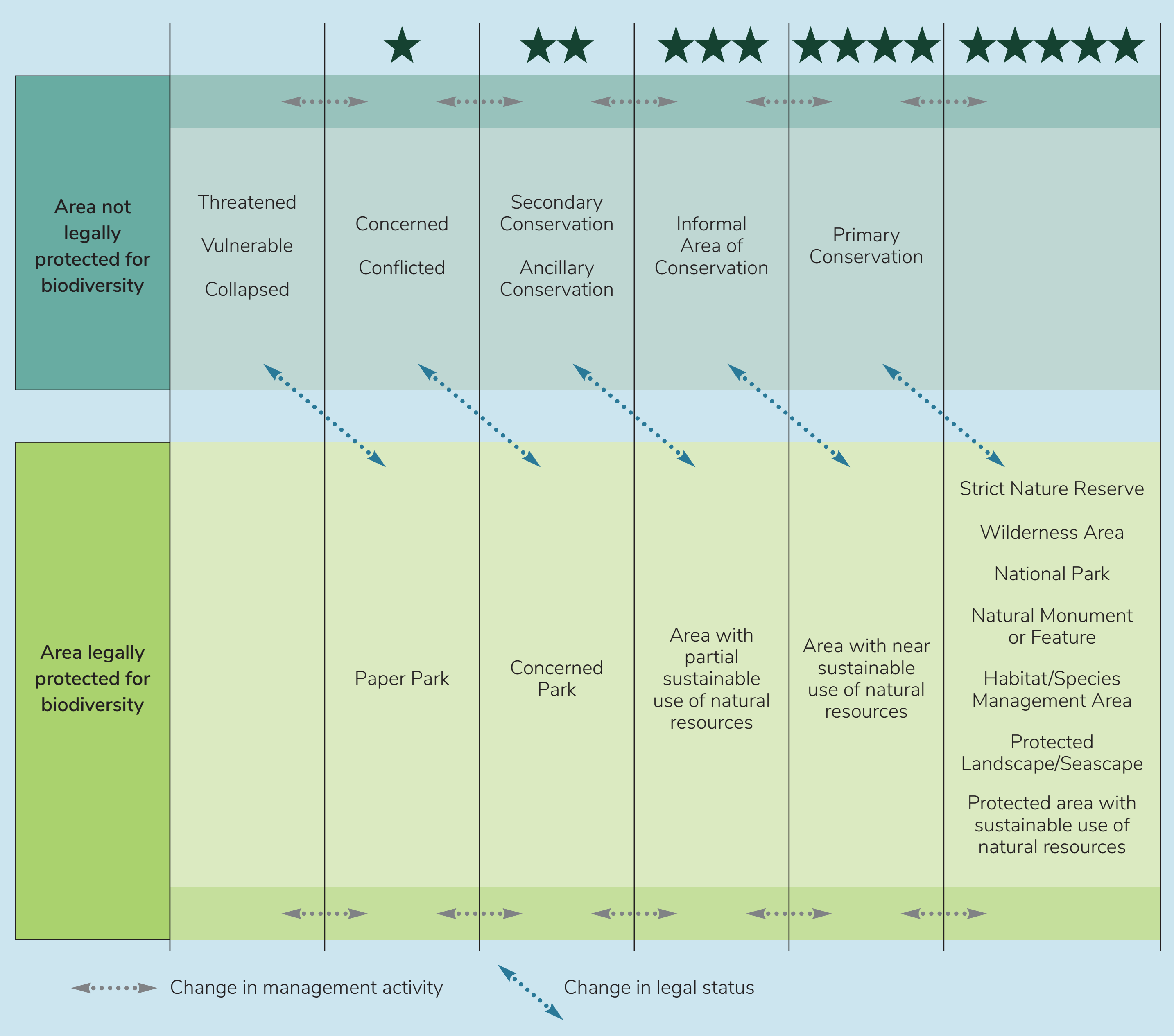


Figure 5.2 – *Visualisation of the five-star ratings for the level of protection of a site. The level of protection can change according to changes in management activities (green arrows) or because of a change in legal status (orange arrows). Full descriptions of the Five-star ratings are presented in Appendix F.*

After evaluating the legal status and the sustainability of management activities for biodiversity, assessors shall assign a level of protection star rating (Appendix G). The percentage of management activities consistent with long-term sustainable conservation objectives is calculated by:

$$\%\ \text{sustainable management activities} = 100\times\left(\frac{n\,\text{sustainable management activities}}{n\,\text{relevant management activities}}\right)$$

A star rating shall be assigned at the baseline and the current conditions for each land management type at the site. These star ratings are used to calculate the score for criterion 2 (section 6.2.2).

Assessing erosion during a field survey in Minas Gerais, Brazil. (Luiz H. R Baqueiro - Araribá Botanical Garden)

Introducing the TGBS methodology to the team from Kishan Bagh Sand Dunes Park, Jaipur, India. (Auroville Botanical Gardens)

5.7 Assessing Stakeholder Engagement and Social Benefits

'Ensure that the management and use of wild species are sustainable, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and those most dependent on biodiversity, including through sustainable biodiversity-based activities, products and services that enhance biodiversity, and protecting and encouraging customary sustainable use by indigenous peoples and local communities.'
Kunming-Montreal Global Biodiversity Framework Target 9

Successful long-term restoration requires a people-centred approach to achieve both social and ecological goals (Elias et al. 2021). To assess whether projects are managing biodiversity in consultation and partnership with local communities and stakeholders, assessors will be required to interact with local communities and other stakeholders to establish their level of involvement in the project, and how the project impacts them. Assessors will, where feasible, use participatory techniques to engage local communities and stakeholders.

Projects will be assessed under four attributes, adapted from the SER Social Benefits Wheel (Gann et al. 2019):

1. **Stakeholder engagement:** Restoration projects occur on lands that are used and owned by local stakeholders, including indigenous peoples and local communities (IPLCs), public-sector and private-sector actors. Stakeholder involvement increases a project's success in the long term, and local stakeholders often have insights into best management of the landscapes where they live and work.

2. **Benefits distribution:** Ensuring benefits are equitably distributed is important for improving social-ecological resilience and incentivising long-term sustainable land management that lead to biodiversity uplift.

3. **Knowledge enrichment:** Knowledge exchange and enrichment contribute to stakeholder engagement and awareness in ecological restoration initiatives. This increased understanding and involvement can lead to more effective and sustainable restoration efforts.

4. **Sustainable economies:** Providing employment and other income-generating opportunities for local stakeholders can create positive ecological and economic feedback loops in support of biodiversity conservation, protection and enhancement.

These attributes were chosen because of their ability to capture the social aspects of a restoration project. Additional sections within the SER Social Benefits Wheel not included here, such as 'Community Well-being', has been incorporated within attribute 2 on Benefits Distribution, whilst 'Nature Capital' has been incorporated within other aspects of the TGBS assessment criteria.

Assessors shall use a range of assessment methods to assess the four attributes of stakeholder engagement and social benefits (Appendix H).

5.7.1 Stakeholder Engagement

This section provides guidance to assessors on how to assess projects against criterion 3, attribute 1: Stakeholder Engagement.

5.7.1.1 Stakeholder Analysis

Projects can show stakeholder engagement through identifying relevant stakeholders and how they may influence and be impacted by the project (see case study in Box 5.3). Assessors shall draw on their knowledge of the project region and communities to check whether stakeholders have been reasonably identified. This can be cross-checked through interviews and focus groups as part of the field assessment, and a desk review of relevant documents, such as university studies from the region or official evidence from the country.

Focus group discussion with community members during the pilot testing in western Uganda. (TBG)

There are many ways to conduct a stakeholder analysis. What is important is that the key stakeholders are listed, with their interest level in the project and their potential to influence the project outcome.

5.7.1.2 Informing Stakeholders of the Project

Assessors shall confirm that stakeholders of the project have been informed about the project. This can take place in a variety of ways that include community meetings and grievance mechanisms.

Community Meetings

Community meetings are a useful way to share information about the project with local stakeholders. When assessing stakeholder engagement, assessors shall check whether community meetings are carried out in an appropriate way for the local context. This shall be monitored during the field survey by checking supporting evidence, e.g., meeting minutes. Assessors shall consider whether the following were implemented with respect to community meetings:

- Giving advance notice
- Communicating about the meeting in multiple ways (e.g., posted notices, word of mouth, public announcements)
- Making the purpose of the meeting clear
- Holding the meeting at a time that is most convenient for everyone
- Using breakout groups to ensure everyone's voice is heard despite traditional hierarchical social structures
- Providing incentives such as snacks

Grievance Mechanisms

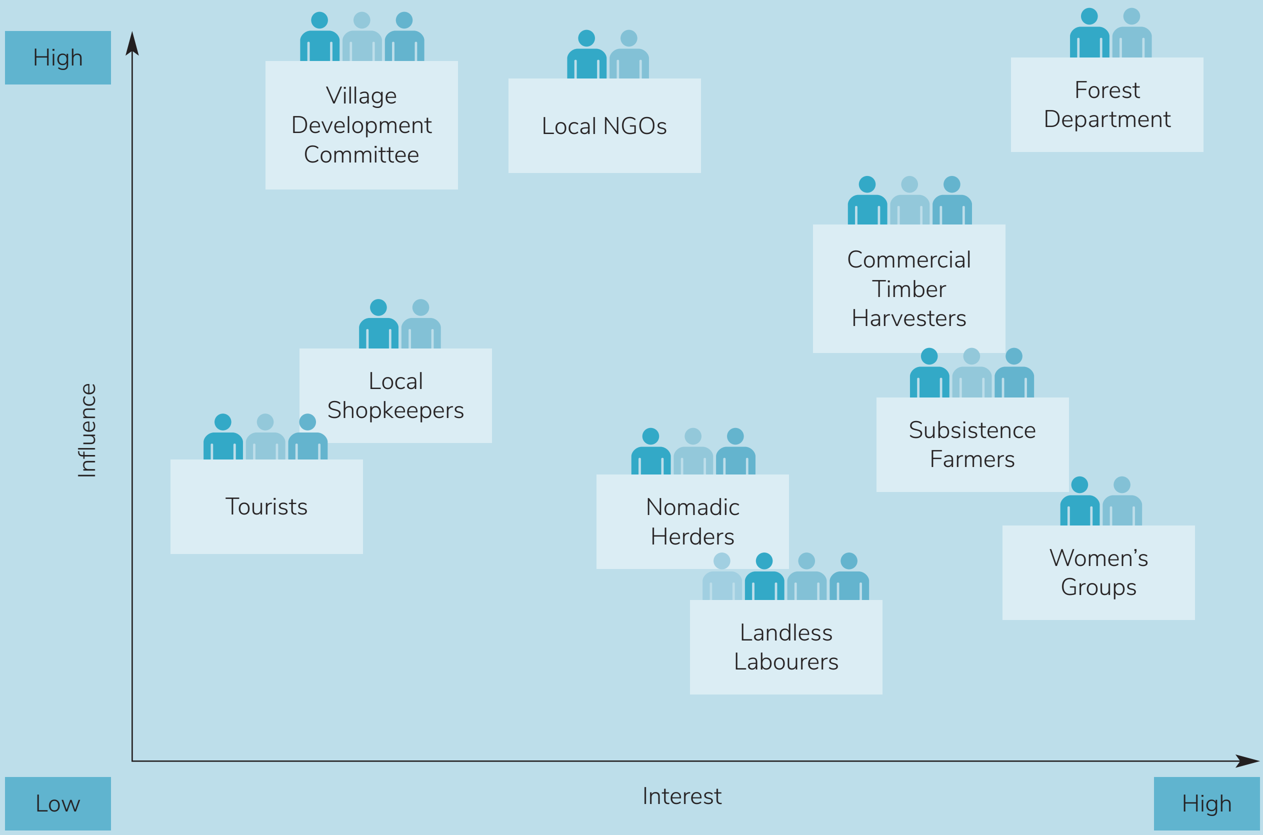
Assessors can verify stakeholder engagement by the existence and use of a grievance mechanism. Grievance mechanisms allow people to raise a grievance when they have an issue with the project, or if it is having a negative effect on them. Some examples of grievances include inappropriate behaviour by project staff or a project restricting someone's access to graze their cattle (see case study in Box 5.5).

Box 5.3 – Case study: Stakeholder analysis for mangrove management in Aceh, Indonesia.[3]

Stakeholder Categories	Interest Level	Power Level	Role
Regional Development Planning Agency	High	High	Regulation and implementation
Department of Forestry	High	High	Implementation, facilitation, budget
Department of Tourism	High	High	Implementation, facilitation, budget
Department of Maritime and Fisheries Affairs	High	High	Implementation, facilitation, budget
Forest Management Agency	Low	High	Borders, facilitation
Mangrove Forest Management Centre	Low	High	Technical support, monitoring and evaluation
Forest Management Unit	Low	High	Forest governance, forest management
Regional departments of fisheries, forestry and tourism	Low	Medium	Community implementation and development
Village Head	High	High	Implementation
Community Leader	High	High	Implementation
Village Communities	High	High	Implementation
Local NGOs	Low	Low	Advocacy, facilitation
Universities	Low	Low	Advocacy, facilitation
Local development planning agencies	Low	High	Regulation, implementation

[3] Adapted from: https://journal.ipb.ac.id/index.php/jmht/article/view/24921/16257

Box 5.4 – Case study: Interest influence matrix for a community forest in Vietnam.[4]



Stakeholder group	Stake/interest in the project
Village Development Committee	Political power, provision of services (e.g., education, health)
Local NGOs	Access to funds, availability of services (e.g., education, health)
Local Shopkeepers	Income
Tourists	Landscape and wildlife
Forest Department	Control of illegal activities, issuance of licences, revenue, fire protection
Commercial Timber Harvesters	Supplies of timber, income
Subsistence Farmers	Soil and water conservation, supplies of subsistence forest products (e.g., fuel, fodder, timber, etc.), availability of services (e.g., education, health)
Landless Labourers	Employment, household income, supplies of subsistence forest products
Nomadic Herders	Grass/fodder for sheep, household income
Women's Groups	Access to clean water, food from the forest, availability of services (e.g., education, health)

[4] Adapted from Plan Vivo Foundation, 2023. Participatory tools for use in PV Climate projects.

Box 5.5 – Case study: Halo Verde community-led agroforestry project, Timor Leste.

The project has developed a procedure which details the process to lodge a comment or complaint and the process to achieve a resolution within an allocated period of time. This process is open to all stakeholders, including non-project participants. Channels to express grievances include verbal and written communication (complaints box) and electronic means. The project has two logbooks located in Laclubar and Soibada respectively to register feedback, complaints and comments (verbal but also written, i.e., from the complaints box available to the public) and to record corresponding responses and resolution actions. All this information is stored in a central access database to facilitate tracking of actions. It includes dates, details of comments and/or grievances, who presented the grievance, responsible persons resolving and/or addressing the complaint as well as target dates for resolution.

Assessors shall also assess the presence of informal grievance mechanisms; whereby local stakeholders can raise issues with project staff in an unstructured manner. Effective informal grievance mechanisms rely on stakeholders feeling comfortable with the project staff, having regular contact with project staff, and project staff then elevating or resolving the grievance. When assessing an informal grievance mechanism, assessors shall check through interviews and/or focus groups whether participants actually raise issues. This shall be checked through the field survey, asking for evidence of a grievance procedure and results of any grievances raised.

5.7.1.3 Stakeholder Engagement Activities

Assessors can verify that projects have engaged relevant stakeholders by identifying the implementation of different stakeholder engagement activities, including the following:

- Projects incorporate local priorities when selecting species:
  - Incorporating local livelihoods and other priorities when selecting species to plant is a good way to show that local people have had input into the project design. Local people are more likely to support a project in the long term if it benefits them. Projects can use tools such as the GlobalUsefulNativeTrees database (Kindt et al. 2023) to identify native species that also have food, medicinal or income-generating benefits for local communities. When locals prioritise some plantation of non-native species, then this can be considered but in such a way as to minimise risks (e.g., of invasion). This can be cross-checked through interviews, focus groups and desk review of supporting documents and evidence.
- Community involvement in restoration activities, such as:
  - Tree planting days.
  - Involvement in boundary marking for a conserved area.
  - Fighting wildfires.
  - Digging trenches to restore hydrology in marine areas.
- Community meetings where local stakeholders have an opportunity to give their input on project design, activities, etc., including evidence that suggestions are considered seriously and accommodated where possible.
- Community meetings where achievements and challenges are shared and discussed with local stakeholders.
- Local stakeholders taking part in project monitoring, such as travelling to a restoration site and taking diameter measurements of trees.
- Meetings with relevant government officials.
- Collaboration with local or national NGOs.
- Participatory resource mapping: stakeholders are brought together by the project developer to understand what the different resources are in the project area, and how these are used by different groups. This then informs how the project is designed, ensuring that each group can still meet their needs.

5.7.1.4 Stakeholder Engagement Plan

If stakeholder engagement has not yet taken place, or is not yet complete, projects can still demonstrate stakeholder engagement through having a stakeholder engagement plan. This could include plans for future community meetings, plans to meet with relevant public-sector or private-sector stakeholders, or planned days where the local youth take part in restoration activities, for example. The implementation of these activities shall be verified at subsequent reassessments. Evidence for the plan can be cross-checked with interviews and desk review of documents, such as the stakeholder plan.

5.7.2 Benefits Distribution

This section provides guidance to assessors on how to assess projects against criterion 3, attribute 2: Benefits Distribution.

5.7.2.1 Relevant Groups & Stakeholders

In the online application form, applicants must state which benefits the project provides, and explain whether these are distributed equitably. Assessors shall verify that any benefits generated from the project, such as income, employment or training, are equitably distributed. Appropriate benefit distribution includes involving the most vulnerable and affected actors in decision-making about the design, implementation and monitoring of restoration projects, including the distribution of costs and benefits across actors. Assessors shall consider if the project takes into account the type and diversity of stakeholders for benefit distribution. Additionally, assessors shall identify if all the stakeholders including project staff, project partners and local communities (including the various groups within these communities) are aware and engaged in the project to determine how benefits should be distributed. Evidence of identification of the stakeholders' needs, current knowledge gaps, existing skills and variation in group abilities can verify that the most appropriate benefits across actors are delivered. Assessors shall consider if all the stakeholders within the project are included (see full list of potential stakeholders in Appendix H).

Benefits can be distributed in various forms and should be distributed in an equitable manner across stakeholders to lead to improved community well-being. This can be cross-checked through interviews, focus groups and desk review of documents such as stakeholders' agreements.

5.7.2.2 Capacity Building

Capacity-building Needs
Assessors shall identify whether the project developer has evaluated the long-term project objectives and how it aims to deliver them. Enquiring about the long-term project objectives will help determine if project-related staff, local communities and partners may require new skills now or in the future.

Capacity-building Delivery
Assessors shall explore if the capacity building and training have been designed in consideration of the stakeholders' variation in skills, resources and capacity. Consideration for factors including language, literacy levels, resources and equipment availability should be accounted for when delivering a training.

Different stakeholders may require different training, and a stakeholder consultation process will allow identification of knowledge gaps and priorities relevant to the project.

Areas of training/capacity building:
- Project awareness
- Knowledge transfer
- Skills development

Training (and ongoing mentoring) may be delivered by different actors relevant to the project. Consideration of who may be most suitable to deliver the training will promote success. To evidence the training and its credibility, assessors shall ask the project to provide some evidence of the training activities, for example, by enquiring about the credentials of the trainer, list of attendees and details of training topics.

Trainers could include but are not limited to:
- Project coordinators
- Private consultants including locals with specialist skills and knowledge
- Academics/specialists/experts
- Government
- NGOs, charities
- Development agencies
- Other projects (shared learning/knowledge exchange)

Examples of capacity building/areas of knowledge exchange include but are not limited to:
- Seed collection and propagation
- Tree seed nursery development
- Species selection training
- Land management planning
- Record keeping
- Agroforestry skills
- IT development
- Presentation skills
- Teachings on climate change
- Biodiversity monitoring
- Species identification skills
- Use of machinery and equipment

5.7.2.3 Capacity-building Assessment

Once the training(s) has been conducted, it is important to assess the quality and relevance of the training delivered. Assessors shall use interviews and focus groups with stakeholders to assess whether the stakeholders felt the training:

- Was relevant
- Increased awareness and understanding of the project
- Improved their skill set
- Provided them with new skills and knowledge

Assessors can cross-check this information through a desk review of relevant documents, such as training records.

5.7.2.4 Benefits Equitably Distributed

When evaluating the impact of the training(s) delivered, it is important to assess that the benefits were equitably distributed across the different stakeholder groups. Equitable distribution means that all stakeholders may not get the same number and extent of benefits, but that benefits are distributed fairly; for example, not all benefits are going to very powerful groups. Through stakeholder identification, interviews and focus groups (Appendix H), desk review of relevant documents, assessors shall have become aware of the variation in stakeholder groups and can explore whether these groups have fairly been included in the distribution of benefits.

Evidence of equitably distributed benefits/opportunities includes but is not limited to:

- **Equal opportunities policy**: The project may have formal documentation that outlines their commitment to ensure fair treatment of employees and other stakeholders regardless of gender, age, race, social status, religious or cultural beliefs. This may also include details about ongoing practices of how the project aims to increase transparency and accountability, whilst reducing any form of discrimination. The assessor shall ensure the policy is applied at project level by asking to see the policy.
- **Equal opportunities for recruitment:** A commitment to providing equal opportunities for hiring, advancement and benefits to everyone without discriminating because of protected characteristics like age, sex/gender, sexual orientation, ethnicity/nationality, religion, disability or medical history. This can also include specifics towards:
  - Recruitment of local versus non-local employees
  - Gender balance of employees
  - Employment of minority or marginalised groups

Assessors can assess equal opportunities for recruitment through interviews, focus groups and reviews of employment contracts.

Assessors shall evaluate through interviews and focus groups whether stakeholders feel benefits are equitably distributed. Assessors should also conduct a desk review of any relevant documents around benefit sharing to assess this.

TRCRC developed a native tree nursery in Royal Belum with the Jahai community to build seed stock for future restoration projects. (TRCRC)

5.7.2.5 Assessing Improved Community Well-being

Assessors shall also enquire how equitable distribution of benefits and inclusion of all stakeholders has led to improved community well-being.

Some examples of what assessors may consider evidence of improved community well-being include:

- Enhanced provision of ecosystem services:
  - Water security and purification, e.g., through improved management of watersheds
  - Biological control of disease vectors
  - Reduced disaster risk, e.g., through protection against flooding and coastal erosion from mangrove restoration
- Enhanced livelihood and community preferences:
  - Food security, e.g., through agroforestry projects
  - Fuel security
  - Gender equality
  - Health
  - Recreation value, e.g., access to green space
  - Reduced human-wildlife conflict
  - Reduced rural migration
  - Spiritual and educational value
- Improved land value:
  - Improved local infrastructure
  - Tenure or use rights clarity and enforcement

Assessors may use interviews and focus groups to assess whether people feel that the aspects of community well-being listed above have improved. Assessors can also cross-check relevant documents such as construction agreements, statistical data on risk between years, and official documents on migration.

5.7.3 Knowledge Enrichment

This section provides guidance to assessors on how to assess projects against criterion 3, attribute 3: Knowledge Enrichment.

Restoration planners and practitioners should understand local communities as more than just 'workers' or 'beneficiaries', and recognise them as powerful agents of change equipped with valuable local knowledge and capacities. Care should be taken to avoid 'cherry-picking' local knowledge and opinions to match desirable pre-defined narratives but rather take into account the full range of contributions, including those that may seem problematic.

Examples of ways projects are able to incorporate local and/or indigenous knowledge into the project implementation include:

- **Incorporating local and indigenous knowledge:** Project developers can incorporate local and/or indigenous knowledge into the project design by: (i) recognising IPLCs' customary institutions; and (ii) building partnerships with IPLCs.
- **Integrating scientific knowledge:** Project developers can consult local scientific and research institutions to ensure restoration activities are being applied according to best practice, as well as in line with regional objectives. Consulting regional expertise ensures that projects are not reinventing the wheel but rather build on lessons learned from previous relevant restoration initiatives.
- **Promoting knowledge exchange:** Projects can facilitate knowledge exchange between different stakeholders, including exchange between scientists, practitioners and IPLCs. These can be achieved in different ways, such as workshops, talks, activities and other interactive sessions.
- **Addressing knowledge gaps:** Projects can identify knowledge gaps through stakeholder consultations and collaborative research projects to help develop innovative solutions and restoration approaches.

5.7.3.1 Incorporation of Local and/or Scientific Knowledge in Project Planning versus Implementation

Assessors shall evaluate how local and/or scientific knowledge has been integrated into the project planning and project implementation. There are a variety of approaches to gather knowledge and information for decision-making in restoration projects. Some projects may include local knowledge through stakeholder consultations for project design and development, whilst others will not continue to engage all stakeholders, particularly local communities, in the decision-making process of project implementation. Project developers may, for example, consult local communities on the selection of appropriate plant species, how they may be used and if they provide any socio-economic benefits. Some projects may incorporate local knowledge further by including stakeholders with this knowledge in the decision-making and governance of the project.

Examples of local knowledge used in project planning include:[5]

- Species selection and mapping based on sociocultural significance, such as medicinal or edible species
- Understanding temporal and spatial patterns in natural resource use
- Gendered use of landscape and natural resources
- Understanding drivers of environmental degradation
- Understanding how to manage natural resources

Examples of local knowledge used in project implementation include:

- IPLCs included in the project governance structure
- Developing research programmes with socio-economic indicators as a measure of progress
- IPLCs included in research teams and programmes
- Facilitating inclusion of excluded or disadvantaged groups and other members of the community, encouraging cohesive community engagement

Box 5.6 – Case Study: Dampier Peninsula, West Kimberley, northern Australia (Adapted from Lindsay et al. 2022).

The project highlights the importance of incorporating local knowledge into the land management resulting in the best conservation outcomes. Through integration of cultural and scientific knowledge, the project was able to achieve greater outcomes for the management of the endangered monsoon vine thicket. These vine thickets occur in over 80 patches in the region, and hold significant cultural importance for the Peninsula Aboriginal groups for cultural ceremonies, food, medicine and laws. Unfortunately, the thicket has faced severe degradation through land clearing, wildfires and competitive weeds. Through the formation of the Monsoon Vine Thicket Project in 2008, which brings together scientific and Aboriginal knowledge systems, the project has resulted in considerable outcomes in weed and fire management; seed collection, propagation and revegetation; community education; and the documentation, transfer and practice of Aboriginal biocultural knowledge. The project strongly showcases its cross-cultural approach by allowing collaborative integration of ecological conservation and upholding of cultural values as well as learning and capacity building.

- Inclusion of local knowledge in prevention, early warning, preparedness, response and mitigation of natural disasters
- Sustainable management and harvesting of natural resources

5.7.4 Sustainable Economies

This section provides guidance to assessors on how to assess projects against criterion 3, attribute 4: Sustainable Economies.

Projects can provide short-term and long-term employment and other income-generating opportunities for local stakeholders, creating positive ecological and economic feedback loops in support of biodiversity conservation, protection and enhancement. Assessors shall examine the extent to which projects are contributing to sustainable local economies: through establishment of viable eco-businesses, generation of employment opportunities, and improvement to local supply chains.

It should be noted that there is an interplay between the **creation** of economic benefits (assessed under attribute 4 of the assessment methodology for criterion 3), and the **equitable distribution** of those benefits (including other, non-monetary benefits, assessed under attribute 2 of the assessment methodology for criterion 3). Thus, in field surveys, interviews and desk reviews, assessors shall pay attention to both the creation of benefits and the access to those benefits by local stakeholders, particularly disadvantaged groups, for scoring the different attributes appropriately.

5.7.4.1 Assessment of Economic Opportunities and Establishment of Sustainable Business Plans

Assessors can examine the extent to which opportunities to contribute to a sustainable local economy have been identified for a project, and whether a business plan is under execution that includes the realisation of these opportunities.

During the application process for the Global Biodiversity Standard, applicants will have uploaded relevant supporting documentation, including supply chain information and a business plan (if available). Before conducting a site visit, assessors shall review this documentation to understand which economic opportunities have been identified in association with the project, and to familiarise themselves with basic information such as the number of people currently employed by the project (or eco-businesses that are linked to it), other livelihood-generating activities provided by the project (such as provision of access to harvest natural resources, for subsistence or commercial purposes), and the supply chains associated with the project (e.g., provision of planting material for restoration projects; provision of building materials and labour for construction; provision of catering services for tourism, etc.).

Following the document review, the assessors can identify topics and questions to explore further during the on-site assessment. These can be approached through a combination of observations, semi-structured interviews and focus group meetings, and by requesting to review additional documentation that will help to fill the information gaps identified. Interviews can be carried out with project management representatives, project beneficiaries, and with other local stakeholders, e.g., local business providers who are supplying, or could potentially be supplying, goods and services to the project.

5.7.4.2 Utilisation of Local Infrastructure and Supply Chains

During site visits, assessors can examine how the project is utilising, or plans to utilise, local infrastructure and supply chains. For example:

- From where have the seedlings in restoration projects been sourced? Are suitable materials available locally?
- Are local providers being used for supply of construction materials and labour, catering services and transport providers, etc.?
- Are links being made with other initiatives and projects aimed at income generation and poverty alleviation, e.g., sourcing supplies and services from local micro-enterprises?

In understanding the relationship between the project and local infrastructure and supply chains, it is important to be aware that trade-offs may exist between competing environmental and socio-economic priorities. For example, there may be seedlings available to purchase locally, but these may not be the best source of material when considering the need to use a genetically diverse planting stock, or other ecological considerations. Project managers may be operating under constraints, for example, a procurement policy requirement to purchase materials from the least expensive source, as long as certain quality criteria have been met.

The assessors can examine the extent to which these trade-offs have been identified – and appropriately documented – and assess whether the project managers are taking steps to maximise both ecological and socio-economic impact of the project wherever possible. For example, educating local nursery managers on the needs of the project regarding planting stock diversity (native species; genetic diversity considerations) and allowing sufficient time for local providers to source and grow appropriate stock. Time may also be built into procurement processes and budgets to allow sufficient justification for the prioritisation of local providers and/or inclusion of specific ecological considerations in purchasing decisions (within reasonable grounds).

5.7.4.3 Provision of Local Employment and/or Other Livelihood Opportunities

Assessors shall examine whether the project has generated employment opportunities for local people; whether this is on afull-time or part-time basis, and whether it provides skilled or unskilled employment opportunities. Employment opportunities generated must be paid at least the applicable minimum wage for the sector and geographic area concerned and should be in compliance with relevant labour legislation and regulations, such as International Labour Organisation standards.

In addition, the assessors can examine whether the project has generated other livelihood opportunities which are making an important contribution to the local economy (noting that such benefits are also assessed under the attribute Benefit Distribution). Such livelihood opportunities may not include formal employment, but could include, for example, income generation through harvesting of resources from the site, or other micro-enterprises linked to the site.

For projects in an early stage of inception, the plans to hire employees can be taken into consideration. The pathway of employment generation can hence move from establishment of sustainable business and employment models, through to commencement, testing, trials showing success, and the full implementation of models showing strong levels of success. Employment relating both directly to the project, and to ancillary businesses, shall be considered. This can be cross-checked through interviews and desk reviews of documents such as employment contracts.

5.8 Assessing the Monitoring, Evaluation and Adaptive Management Activities

The assessment of criterion 8 begins with a comprehensive review of the monitoring framework. Assessors shall undertake an extensive review of the project objectives, monitoring, evaluation and adaptive management plan and implementation, data collection methodologies, sampling techniques, and data collection frequency.

The assessment shall consider the capability of the monitoring and evaluation activities to accurately measure progress and outcomes. A well-structured monitoring plan is characterised by its consistent use of tangible standards to measure certain ecosystem changes and stakeholder/community involvement in the project site. In addition, assessors shall evaluate the methods for data analysis and interpretation for their capacity to yield insights that can be used to inform decisions, such as future strategies in ecosystem restoration activities and additional TGBS recertification at project sites.

Monitoring data can also be used to track progress towards a reference model, as with the Five-star System. Assessors shall assess whether monitoring indicators and methodologies align with those of both baseline and reference models. The TGBS recommends the use of the Five-star System and Ecological Recovery Wheel for project monitoring (section 5.5; Appendix C; Appendix F).

Adopting the SER definition (Gann et al. 2019), adaptive management is 'an ongoing process for improving management policies and practices by applying knowledge learned through the assessment of previously employed policies and practices to future projects and programmes. It is the practice of revisiting management decisions and revising them in light of new information.' It emphasises the significance of gaining knowledge from past experiences and applying it to improve future management decisions. Because working with ecosystems is complicated and knowledge is constantly evolving, adaptive management is especially useful for ecosystem restoration projects. By re-evaluating and revising management decisions in the context of updated data, decisions can be revised to achieve better results.

When assessing the monitoring, evaluation and adaptive management of a project, the assessor can review many kinds of supporting evidence provided by the applicant, such as:

- **Documents:** Detailed plans, reports from previous projects or theoretical frameworks upon which the plan is based
- **Tools:** Methodologies, equipment, software/hardware that will be used to complete the monitoring
- **Resources:** Personnel involved in the process, training materials for monitoring

Restoration area on the slope of Tai Mo Shan, Kadoorie Farm and Botanic Garden, Hong Kong. (Fernanda Cardoso)

The absence of supporting materials during the application process does not necessarily indicate that the project is not viable or that the plan is ineffective. Some projects may have effective monitoring in place through informal plans, such as habitual routines by people living on site or by staff. There may also be a knowledge-sharing framework for visitors who record species on site, e.g., birdwatchers, entomologists, etc. There may be routines in place for observing survival rates of species after planting, observation, the recording of new species of flora and fauna on site and/or observation of related management activities, such as the hydrology of the site during heavy rains. The assessors shall evaluate the extent to which these activities are effective, e.g., frequency, timing, resources used and the methods of recording and archiving data. In such instances, the assessor may recommend that applicants apply for and obtain TGBS mentoring (section 7) that may help applicants formalise their methods and increase the scope and robustness of activities.

The following points can be used as a checklist by the assessor to verify a robust monitoring, evaluation and adaptive management plan and implementation (Prach et al. 2019, de Oliveira et al. 2021, Viani et al. 2018, Littles et al. 2022) at project sites:

- **Clear objectives:** Have the objectives of the monitoring plan clearly been defined and understood by all stakeholders? How is the management plan developed and its progress communicated to stakeholders and the public?
  The monitoring plan should include clear objectives to ensure that the indicators monitored align with these objectives. All stakeholders should clearly understand the objectives and the motivation for the monitoring actions that are undertaken.
- **Relevant indicators:** Have the indicators been chosen in a way that was relevant to the goals and TGBS certification criteria, and did they provide useful information?
  The monitoring plan should include indicators that provide useful information that is relevant to the goals of the project. These indicators should provide useful information so that they can be used to inform decision-making and improve outcomes relative to the goals through adaptive management.
- **Data acquisition and processing:** Has the information been gathered accurately and reliably? Have the data been analysed correctly? Did the analysis provide clear and useful insights?
  Data needs to be accurate and reliable to examine and be sufficiently informative to make decisions and understand biodiversity patterns and trends. Low accuracy and/or unreliable data can lead to decision-making that does not improve the project outcomes.
- **Interpretation of results:** Have the results been interpreted properly? Did the interpretation correspond to the monitoring objectives?
  Appropriate interpretation ensures that the results of the data analysis correspond to monitoring goals. It facilitates the understanding of the importance of the data in terms of biodiversity and restoration management.
- **Use of results:** Have the results been used to inform decisions? Has the monitoring contributed to any changes or improvements?
  The results of monitoring should be used to guide ecosystem restoration activities to inform policies and raise awareness for improved biodiversity restoration and ecosystem integrity outcomes.

- **Stakeholder engagement:** Have stakeholders been effectively involved in the monitoring and management process? Did they understand and accept the results?
  Stakeholders in biodiversity monitoring can include local communities, conservation organisations, researchers and policymakers. It is important that they are involved because they can provide valuable insights, support biodiversity restoration actions, and help ensure that the benefits of biodiversity are equitably shared. Their involvement can be part of management practices, sociopolitical actions, and strategy development to achieve sustainable and successful outcomes.
- **Review and adaptation:** Has there been a process in place to review and adjust monitoring based on its effectiveness and results? How do you evaluate the effectiveness of the plan on a regular basis? Are there criteria for determining when targets have been met?
  The ecosystem at the project site is dynamic and can change over time due to various factors like climate change, habitat loss or species invasion. Regular review and adaptation of monitoring activities ensure that they remain relevant and effective in tracking these changes.
- **Documentation and communication:** Have the results been documented and effectively communicated to all relevant stakeholders?
  Documenting and communicating the results effectively ensures that all relevant stakeholders are informed about the state of biodiversity and the impacts of threats. This promotes transparency and accountability and can help gain commitment to the conservation of biodiversity.
- **Overall impact:** Did the monitoring have a positive impact on the project or programme it was supporting? Did it provide value for the time and resources invested in it?
  The value of monitoring can be better understood by assessing its overall impact. It reveals whether the benefits obtained from monitoring (such as improved decision-making and better conservation outcomes) are sufficient to justify the time and resources invested in it or whether the monitoring strategy should be modified.

Some of the following questions may help assessors gain more insights into the assessment of adaptive management (Littles et al. 2022) and their effective implementation:

- **Decision-making:** Is there a clear process for making decisions based on the adaptive management plan? Are these decisions documented and communicated?
  Clear decision-making processes assure that decisions are made systematically, transparently and with accountability. It increases the predictability, trust and effectiveness of project management.
- **Learning process:** Is there a process for learning from actions and outcomes to improve future management?
  Giving time to digest and process knowledge from the actions and outcomes of adaptive management allows for continuous improvement. It fosters innovation, expands knowledge and improves future management.
- **Flexibility:** Is it possible to make changes to the management plan and to implementation in response to changing conditions or monitoring results?
  Flexibility enables modifications in response to shifting conditions or new data collected from monitoring. It ensures the continued relevance and effectiveness of management over time.
- **Risk management:** Does the management plan identify potential risks and include strategies to mitigate them?
  Identifying potential risks and having mitigation strategies for project management ensures that unanticipated events or problems do not disrupt the management plan. It increases robustness and reliability.

5.9 Assessing Baselines

Baseline data is used to document the state of the project site at the start of the project as defined by the TGBS (section 2.4), or just prior to the initiation of restoration (aligned with the SER Standards). Either way, baseline data can be compared to monitoring data collected throughout the life of the project to document project progress, or lack thereof.

Assessing baseline data is pivotal for understanding the current state and for providing a foundation for the management plan and to evaluate changes in the ecosystem as the plan is implemented. Obtaining and collecting baseline data is essential to document the initial condition before the project started. Projects require periodic evaluation in comparison to the trajectory derived from baseline data. The assessment needs to identify the following aspects:

- **Availability of baseline data:** The presence of data about the initial condition at project inception is critical. Applicants may be directed to mentoring in the absence or incompletion of baseline data.
- **Type of baseline data:** Both qualitative and quantitative data are employed to measure different aspects of multiple attributes. Some projects may have formal recordings of baseline conditions such as soil and/or water samples, flora and/or fauna surveys, and photos and/or videos. In cases where projects do not have this kind of data or if it is limited, assessors must rely more on qualitative data such as descriptions and stories of the site conditions. This should also be included in the social survey components as different stakeholders will have varying fields of knowledge. For example, stakeholders involved in agriculture may have knowledge on baseline fauna (maybe considered as pests) and water and substrate conditions, while other stakeholders may know about extraction and disturbances happening at the site.
- **Baseline data conformity with TGBS criteria:** Consider the degree to which the baseline data conforms to the TGBS criteria.
- **Comprehensive baseline information and documentation**: Consider whether information and documentation contains specific information about the species, habitat and ecosystem that are the focus of ecological restoration activities.
- **Baseline inventory and data sources:** The origin and reliability of data sources can be verified to ensure accurate assessment and monitoring.

Notes

[5] All examples of local knowledge used in project planning can be taken into implementation through long-term engagement and consultation with local communities.

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 6
Assessment, Verification and Certification


Lowland dipterocarp forest of Danum Valley Conservation Area, Malaysia. (David Batholomew)

The Global Biodiversity Standard

TRAFFIC

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

PLAN VIVO For nature, climate and communities

Section 6: Assessment, Verification and Certification

Contents

6.1 Assessment Form

On completion of both remote sensing and field surveys, assessors shall complete the Global Biodiversity Standard (TGBS) assessment form. The assessment form is in Appendix B.

The assessment form is completed by the lead assessor based on information collected from:

- The online application form
- The remote sensing survey
- The field surveys

The assessment form consists of nine sections:

1. Project details
2. Assessor details
3. Restoration activities
4. Remote sensing survey report
5. Field survey report
6. Final assessment of criteria 1, 4-7
7. Final assessment of level of protection (criterion 2)
8. Final assessment of stakeholder engagement and social benefits (criterion 3)
9. Final assessment of monitoring, evaluation and adaptive management (criterion 8)

6.1.1 Project Details

This section verifies or elaborates details about the project submitted during the application process.

6.1.2 Assessor Details

This section collects details on the assessor(s) of the project. The data collected in this section includes:

- Assessor name(s) and institution(s)
- Date of site visits
- The names of individuals or institutions consulted during the assessment process

These data are collected to identify the assessor(s) and to allow verification of the certification status of the assessor(s). Data on the individuals or institutions consulted during the assessment process are collected to facilitate any third-party independent reviews of the assessment that are required.

6.1.3 Restoration Activities

This section verifies information from the application form and elaborates details about the restoration activities implemented at the site, covering:

- Restoration of soil and water
- Restoration of vegetation and ecosystem structure
- Control of invasive species

These data are collected to provide an important context for the assessment process and help contribute to monitoring of ecosystem restoration activities.

6.1.4 Remote Sensing Survey Report

This section collects information on the methods and results of the remote sensing survey. The report shall cover details of what methods were used, including the indicators and remote sensing products used. Geospatial data on the reference sites and highly degraded sites used in the survey shall be provided. The report shall describe details about the time series used in the survey and the personnel and organisation that implemented the remote sensing survey. The original report provided by any third-party remote sensing specialist shall also be appended to the assessment form.

6.1.5 Field Survey Report

This section collects information on the methods and results of the field survey. The report shall include details of what methods were used, when data was collected, who collected the data and how data was analysed. Results shall also be presented, including graphs and statistics that are used to evaluate the site for TGBS assessment. Data (both raw and processed), photos and other evidence collected during the survey shall be appended to the field survey report to support the assessment review process and to keep a permanent record.

Beetles can be good indicators of below-ground biodiversity and physical conditions. (David Bartholomew)

6.1.6 Final Assessment of Criteria 1, 4-7

This section collects data on the level of ecosystem integrity across the 21 sub-attributes using the Five-star System. The type of data collected includes observations, recordings, photos, sample analysis and other evidence. Ratings shall be given for each land management type and ecosystem within the site under both the baseline and current conditions. These data are used to score criteria 1 and 4-7.

6.1.7 Final Assessment of Level of Protection (Criterion 2)

This section collects data on the level of protection rating for each land management type and ecosystem within the site under both the baseline and current conditions. Assessors shall provide data on the legal protection of the site and on whether activities implemented align sufficiently with sustainable biodiversity conservation goals of the project. These data are used to score criterion 2.

6.1.8 Final Assessment of Stakeholder Engagement and Social Benefits (Criterion 3)

This section collects the scores for the level of stakeholder engagement, benefits distribution, knowledge enrichment and sustainable economies of the project. These data are used to score criterion 3.

6.1.9 Final Assessment of Monitoring, Evaluation and Adaptive Management (Criterion 8)

This section collects the assessment of the monitoring, evaluation and adaptive management. In this section, the assessor(s) assess:

- The monitoring, evaluation and adaptive management plans and activities in place
- The implementation of the monitoring, evaluation and adaptive management plans

These data are used to score criterion 8.

6.2 Scoring

Each criterion is assessed with a score out of 10 points. An overall score out of 10 will be assigned to each project by taking the mean average score for each of the criteria. TGBS certification will be awarded to a project based on attainment of the required score outlined in section 1.7.

The TGBS uses four key frameworks for scoring projects:

1. The Ecosystem Integrity Five-star System (Appendix F; criteria 1 & 4-7)
2. The Level of Protection Five-star System (Appendix G; criterion 2)
3. The Stakeholder Engagement and Social Benefits rating (Appendix H; criterion 3)
4. The Robust Monitoring, Evaluation and Adaptive Management List (criterion 8)

Fungi in Andean montane forest, Peru. (David Bartholomew)

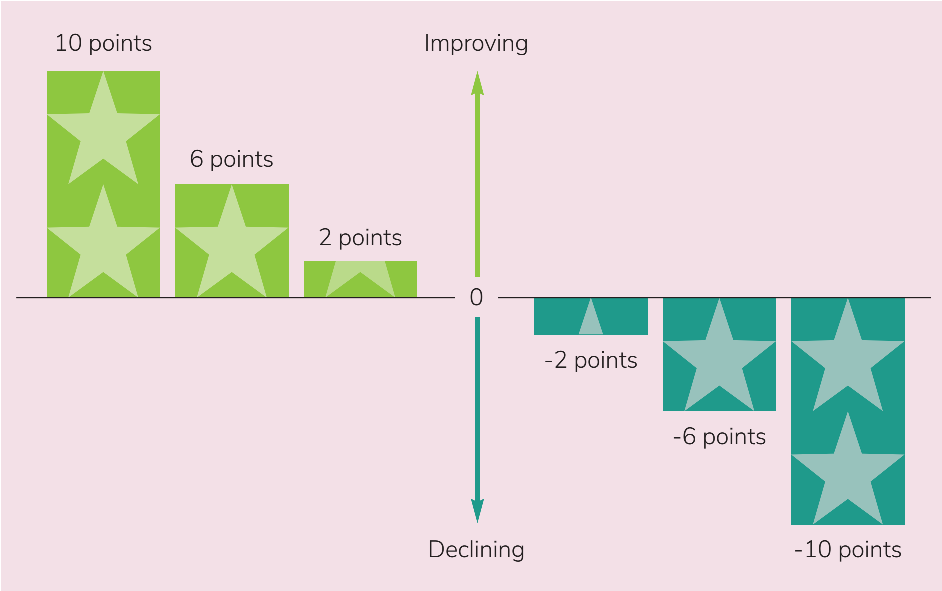


***Figure 6.1** – The score awarded for a change in star rating from baseline to current conditions for each of the sub-attributes of ecosystem integrity. Scores are averaged across sub-attributes and across land management types to give a score against criteria 1 and 4-7.*

For all criteria assessed under the Ecosystem Integrity and Level of Protection Five-star Systems, scores for the following five land management types will be measured:

- Protected areas under restoration
- Other ecological restoration areas
- Rehabilitation areas, including:
  - Agroforestry areas
  - Plantation areas
  - Agricultural areas

For these criteria, scores for each land management type will be averaged (mean), weighting the score according to the percentage area of the overall project that is represented by each land management type.

Under the scoring system for criteria assessed under the Ecosystem Integrity Five-star System (criteria 1 & 4-7), some sub-attributes have additional weighting, being used to score sites against multiple criteria. These sub-attributes have additional weighting because they reflect key components of biodiversity to be recovered. These sub-attributes are identified as those that most closely resemble the TGBS criteria and 10 golden rules for reforestation (Di Sacco et al. 2021) from which the criteria are adapted.

For all criteria assessed under the Stakeholder Engagement and Social Benefits rating and Robust Monitoring, Evaluation and Adaptive Management List frameworks, scores will be measured at the project level.

The scoring process for each criterion is as follows:

6.2.1 Scoring Criterion 1: Select appropriate sites to enhance native biodiversity

Criterion 1 is assessed according to the ecosystem integrity of the project. Ecosystem integrity is assessed according to six key attributes and up to 21 sub-attributes (Appendix F). For each sub-attribute measured, the site is assigned a star rating, ranging from zero (0) to five (5) stars. Star ratings relate to the level of recovery of the respective attribute (see Appendix F for a general description of the five-star ratings).

Each attribute is assigned a star rating under both baseline and current conditions. The number of points awarded for each attribute is calculated by subtracting the star rating under baseline conditions from the current star rating. Points are then awarded according to the following (Figure 6.1):

- Increase in star rating of two or more (2+) stars (10 points)
- Increase in star rating of one (1) star (6 points)
- No change in star rating but a trajectory of improving the star rating in the future (2 points)
- No change in star rating (0 points)
- No change in star rating but a trajectory of a declining star rating in the future (-2 points)
- Reduction in star rating of one (1) star (-6 points)
- Reduction in star rating of two or more (2+) stars (-10 points)

The ecosystem integrity score for the site is calculated by taking the mean average number of points for each attribute, which is calculated from a mean value for the attribute's sub-attributes. Under some circumstances, it may not be possible to assess all sub-attributes of ecosystem integrity. Any sub-attributes that cannot be assessed are not included when calculating the mean average.

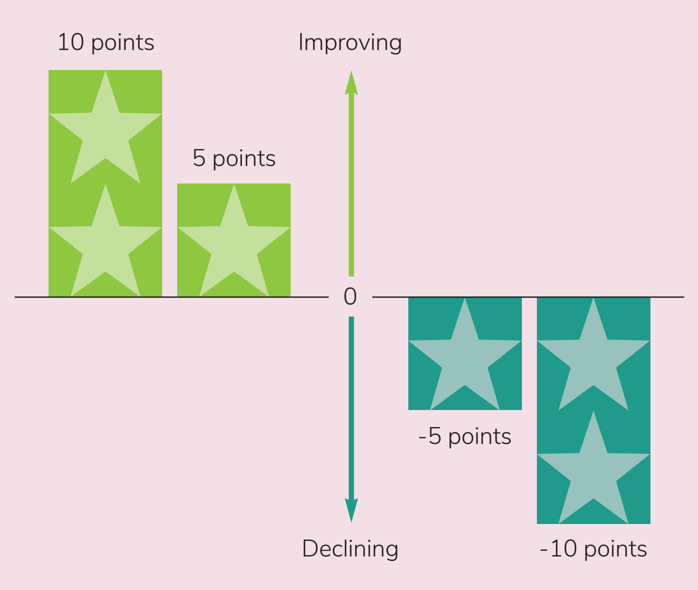


Figure 6.2 – The score awarded for a change in star rating from baseline to current conditions for the level of protection. Scores are averaged across land management types to give a score against criterion 2.

6.2.2 Scoring Criterion 2: Enhance protection of existing habitats and biodiversity

Criterion 2 is assessed according to the enhancement of the level of protection for biodiversity at the site. The site is assigned a level of protection star rating at the time of project inception and under current conditions (Appendix G). Points are then awarded according to the following (Figure 6.2):

- Increase in star rating of two or more (2+) stars (10 points)
- Increase in star rating of one (1) star (5 points)
- No change in star rating (0 points)
- Reduction in star rating of one (1) star (-5 points)
- Reduction in star rating of two or more (2+) stars (-10 points)

This scoring system applies to all sites, except for sites that are assigned a five-star level of protection. These sites with a five-star level of protection rating will score 10 points irrespective of whether there has been no change in star rating since the project was implemented.

6.2.3 Scoring Criterion 3: Protect, restore and manage biodiversity in consultation and partnership with local communities and other stakeholders

Criterion 3 is assessed according to the level of stakeholder engagement and social benefits of the project. The score for criterion 3 is calculated by adding the score on each sub-attribute.

- Stakeholder engagement (Total = 4 points)
- Benefits distribution (Total = 3 points)
- Knowledge enrichment (Total = 1.5 points)
- Sustainable economies (Total = 1.5 points)

Further details are outlined in Appendix H.

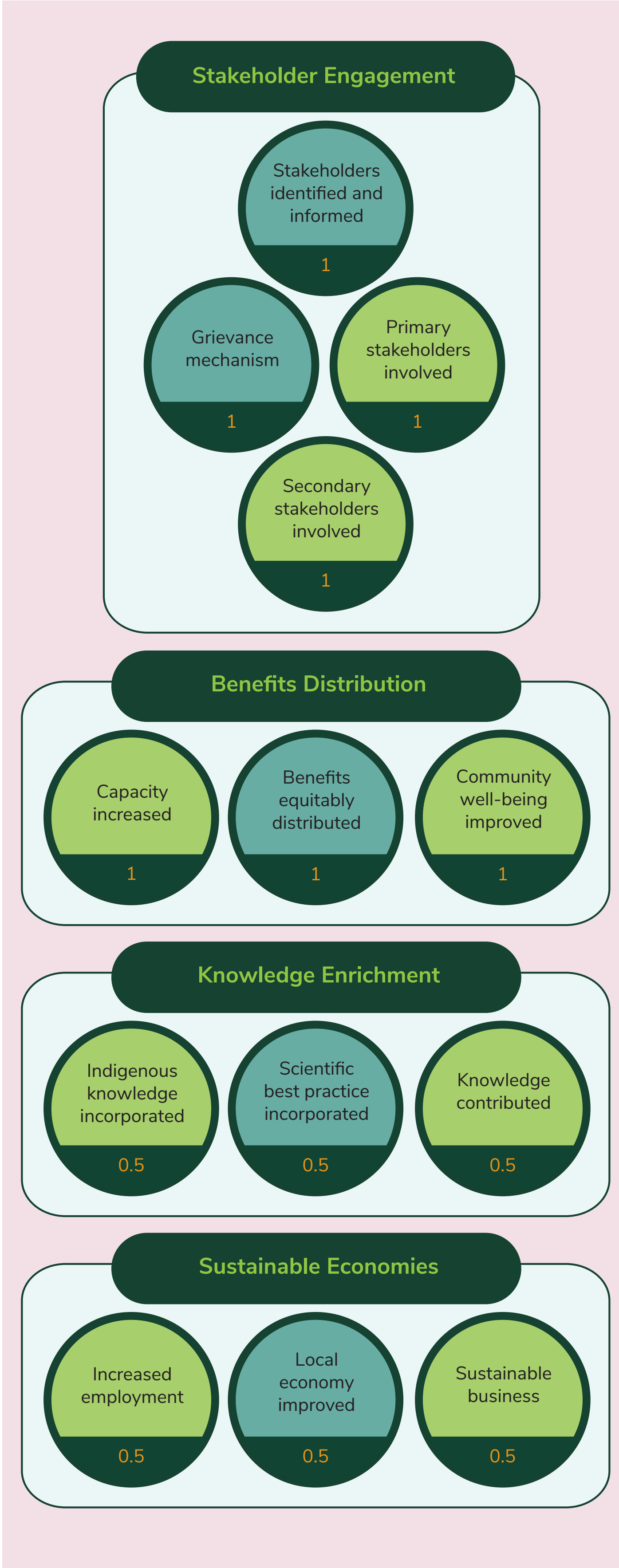


Figure 6.3 – Stakeholder engagement and social benefits scoring system.

6.2.4 Scoring Criterion 4: Aim to maximise biodiversity recovery through ecosystem restoration

Criterion 4 is assessed according to the biodiversity value of the project. Biodiversity value is assessed by taking the mean average change in the ecosystem integrity score from baseline to current conditions for the following sub-attributes (Appendix F):

- Species composition: Desirable plants, fungi and lichens
- Species composition: Desirable animals
- Species composition: Rare and threatened species
- Structural diversity: All vegetation strata
- Structural diversity: All trophic levels
- Structural diversity: Spatial mosaic

Ecosystem integrity scores for each sub-attribute are calculated according to the change in star rating from baseline to current conditions (as outlined in section 6.2.1). Note that these sub-attributes receive extra weighting because of their importance for biodiversity.

6.2.5 Scoring Criterion 5: Avoid and reduce invasive or potentially invasive species

Criterion 5 is assessed according to the presence, abundance and management of invasive species in the project. Invasive species are assessed by taking the mean average change in the ecosystem integrity score from baseline to current conditions for the following sub-attributes (Appendix F):

- Absence of threats: Invasive species
- Species composition: No undesirable species

Ecosystem integrity scores for each sub-attribute are calculated according to the change in star rating from baseline to current conditions (as outlined in section 6.2.1).

6.2.6 Scoring Criterion 6: Prioritise the use of native, threatened and rare species

Criterion 6 is assessed according to the presence and abundance of native, rare and threatened species in the project. Native, rare and threatened species are assessed by taking the mean average change in the ecosystem integrity score from baseline to current conditions for the following sub-attributes (Appendix F):

- Species composition: Desirable plants, fungi and lichens
- Species composition: Rare and threatened species

Ecosystem integrity scores for each sub-attribute are calculated according to the change in star rating from baseline to current conditions (as outlined in section 6.2.1).

6.2.7 Scoring Criterion 7: Promote biodiversity and adaptive capacity

Criterion 7 is assessed according to the genetic diversity and resilience of the project. Genetic diversity and resilience are assessed by taking the mean average change in the ecosystem integrity score from baseline to current conditions for the following sub-attributes (Appendix F):

Assessing a project in Malaysia. (Amarizni Mosyaftiani)

- Species composition: Provenance, genetic diversity and genetic resilience
- External exchanges: Intraspecific gene flows

Ecosystem integrity scores for each sub-attribute are calculated according to the change in star rating from baseline to current conditions (as outlined in section 6.2.1).

6.2.8 Scoring Criterion 8: Implement robust monitoring, evaluation and adaptive management of biodiversity

Criterion 8 is assessed according to the presence and comprehensiveness of the ongoing monitoring, evaluation and adaptive management of the project. Monitoring, evaluation and adaptive management are assessed by adding the total score achieved based on five questions. These questions are scored as outlined in section 9 of Appendix B, with projects scoring 0.5 points for each activity they implement, up to a maximum of 2 points for ongoing management planning, a maximum of 2 points for long-term resourcing, a maximum of 1.5 points for adaptive management, a maximum of 1.5 points for continuous improvement, and a maximum of 3 points for monitoring and evaluation (see Figure 6.4).

6.3 Assessment Verification and Award of Certification

Following submission by an assessor, the assessment will be verified by a reviewer. The reviewer is responsible for verifying that assessment scores correspond to the evidence provided by the assessor. The reviewer may request additional evidence or amendments to reports submitted by the assessor. The reviewer may recommend the assessment to be approved or disputed. All recommendations will be raised to an appropriate body designated by the Secretariat for final resolution. The final decision on whether certification is awarded or not will be communicated to the applicant by the Secretariat.

Figure 6.4 – *Adaptive management and monitoring and evaluation activities scored that contribute points to the assessment under criterion 8. Each activity contributes 0.5 points to the score (max. 5 points).*

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 7
TGBS Mentoring


Capacity building for biodiversity survey and monitoring with TRCRC's Temiar team. (TRCRC)

The Global Biodiversity Standard

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

Section 7: TGBS Mentoring

Knowledge transfer between the Temiar and Jahai at TRCRC's Banun site. (TRCRC)

Contents

The Global Biodiversity Standard (TGBS) provides mentoring for applicants to enhance understanding and improve practices of restoration. The TGBS Secretariat and hubs have a wide range of expertise in biodiversity, restoration and land management from global to local scales. The TGBS mentoring programme helps to mobilise this knowledge to enhance the impact that restoration projects can have for biodiversity.

The TGBS mentoring programme consists of modules, site-specific services and tailored support. TGBS mentoring is delivered by TGBS hubs as an additional service to the certification. Assessors that provide TGBS mentoring for a site shall not act as an assessor for any subsequent assessment or reassessments of the site. The following sections outline the three TGBS mentoring modules (section 7.1), services (section 7.2) and mentoring resources (section 7.3) available to applicants. Hubs can use these sections in addition to section 7.4 to develop and deliver TGBS mentoring.

7.1 TGBS Restoration Mentoring Modules Overview

There are three mentoring modules in the programme (Table 7.1): TGBS Essential, TGBS Sustainability and TGBS Enrichment. These modules facilitate the submission, assessment, certification and monitoring of TGBS projects at their respective sites. They also help improve restoration practice, promote sustainable practices, and achieve biodiversity conservation and ecosystem integrity targets. The scheduling of these modules can be completed in a flexible manner, for a duration between 15 and 90 hours depending on modules taken. Options will be available for the modules to be delivered in person or a virtual setting and are initially available in English, French, Spanish and Portuguese. Language interpreters can be arranged to provide translation to other languages if required.

7.1.1 Module A: TGBS Essential

The TGBS Essential module provides a foundational understanding of the TGBS and its key components. Applicants will gain insights into project eligibility, baselines, native reference ecosystems and reference models, assessment methods, and the TGBS certification process. Applicants will also get an introduction to biodiversity protection strategies, stakeholder participation, monitoring, evaluation and adaptive management. This module equips applicants with the essential knowledge needed to plan, execute and submit a TGBS project for certification. From understanding TGBS criteria to mastering data collection techniques, applicants will be well prepared to engage in effective project application submission and certification. This module serves as the core knowledge base for applicants embarking on TGBS project initiatives.

7.1.2 Module B: TGBS Sustainability

The TGBS Sustainability module focuses on ensuring the long-term success and impact of TGBS-certified projects. Applicants will explore strategies to enhance stakeholder participation, create and formalise comprehensive monitoring plans, optimise adaptive management practices, and facilitate continuous improvement of the projects. By understanding how to effectively engage stakeholders and implement adaptive strategies based on TGBS certification results, applicants will be able to increase the sustainability of projects. This module is intended to equip applicants with the knowledge and tools necessary to ensure the resilience of TGBS-certified projects and provide a framework with which projects can increase their score and move into the next tier.

7.1.3 Module C: TGBS Enrichment

The TGBS Enrichment module offers additional specialised knowledge to enhance projects before or after TGBS certification. Applicants will explore topics such as ecological restoration principles and techniques, genetic diversity conservation, seed-based restoration, propagation protocols, species identification, community and cultural engagement, and sustainable use in restoration projects. These add-on topics provide applicants with advanced skills to address specific challenges and opportunities in ecosystem restoration and biodiversity conservation projects. By incorporating these enrichment topics, applicants can expand their expertise and contribute to more holistic and effective TGBS project outcomes, further enhancing biodiversity and ecosystem integrity.

Seed collection using a big shot. (TRCRC)

Table 7.1 – *Comprehensive Topics of the Three Mentoring Modules.*
A comprehensive mentoring framework for TGBS training is shown in this table. It focuses on mentoring topics as well as their descriptions, instructional methods and duration. The table serves as a structured road map to help applicants successfully navigate their learning journey. The framework's goal is to provide applicants with comprehensive TGBS knowledge and skills.

No.	Mentoring Topic	Learning Objective	Target Outcomes	Approaches (e.g.)	Duration
A	**TGBS Essentials**	**Develop a fundamental understanding of the TGBS and its essential components**	**Achieve proficiency in understanding the core principles of TGBS**	**Various interactive mentoring techniques**	**15-25 hours**
1.	Introduction to TGBS	Gain comprehensive understanding of the TGBS	Achieve a thorough comprehension of the TGBS	Interactive sessions, presentations	1-2 hours
2.	Project eligibility	Acquire strategies for identifying and defining TGBS project sites, goals and objectives	Demonstrate proficiency in identifying and defining project sites, goals and objectives	Case studies, practical exercises	1-2 hours
3.	TGBS certification process	Receive a detailed explanation of the TGBS certification procedure, including overview of the TGBS criteria, the assessment frameworks and the scoring system	Master the TGBS certification procedures and related components	Presentations, interactive discussion, case studies, field visits	3-5 hours
4.	Baselines and references	Understand the importance of establishing baselines, native reference ecosystems and reference models	Be competent in establishing baselines, native reference ecosystems and reference models and reference ecosystems	Practical workshops, field visits	3-5 hours
5	Basic monitoring	Become familiar with basic data monitoring design and data collection	Be capable of designing and implementing basic data collection techniques for project monitoring	Presentation, practical exercises, field activities	3-5 hours
6.	Stakeholder engagement	Explore engagement strategy with stakeholders to ensure project success and collaboration	Develop effective stakeholder engagement strategies	Interactive discussion, case studies	2-3 hours
7.	Submission process	Understand the process of submitting TGBS project application for certification	Successfully navigate the TGBS certification submission process	Step-by-step guidance, Q&A sessions	2-3 hours

Saplings and seedlings at Cartagena Botanic Gardens, Colombia. (David Bartholomew)

No.	Mentoring Topic	Learning Objective	Target Outcomes	Approaches (e.g.)	Duration
B	**TGBS Sustainability**	**Maintain the long-term success and beneficial impact of TGBS-certified projects**	**Develop effective strategies to ensure the sustainability of the project and impact of certified TGBS projects**	**Various interactive mentoring techniques**	**10-20 hours**
1.	Advanced monitoring strategies	Develop advanced strategies for monitoring project progress and outcomes	Design advanced monitoring strategies	Presentations, workshop	2-3 hours
2.	Monitoring plan development and resources	Create effective monitoring plans including assessing available resources	Generate monitoring plans that are practical to implement	Practical exercises, simulation, field activities	3-5 hours
3	Adaptive management	Understand adaptive management practices	Develop effective adaptive management programmes	Presentations, case studies, interactive sessions	2-5 hours
4.	Ongoing management	Develop an ongoing management plan	Develop an ongoing management plan	Presentation, interactive group discussions	1-2 hours
5	Enhancing biodiversity protection	Understand how to improve the level of protection of biodiversity	Develop strategies to enhance the level of protection of a site	Presentation, case studies, interactive group discussions	1-2 hours
6.	Strategic planning for continuous improvement	Understand the strategy for implementing continuous improvement	Formulate strategic plans to ensure continued progress	Presentations, interactive discussion, case studies	1-3 hours

TRCRC planting trees with the local Temuan community from Kampung Kemensah along the Klang riverbank. (TRCRC)

No.	Mentoring Topic	Learning Objective	Target Outcomes	Approaches (e.g.)	Duration
C	**TGBS Enrichment (Add-ons)**	**Explore additional specific topics to enhance the knowledge of applicants before/after TGBS certification**	**Demonstrate advanced expertise in specialist topics relevant to TGBS certificate**	**Various interactive mentoring techniques**	**20-45 hours/ varies**
1.	Ecological restoration principles and techniques	Understand basic ecological restoration principles and practices	Basic understanding of ecological restoration principles and practices	Practical training, field activities, lectures	3-5 hours
2.	Genetic diversity conservation	Learn how to conserve and enhance genetic diversity	Basic understanding in genetic diversity and in genetic provenance strategies	Practical training, field activities, discussions, case studies	3-5 hours
3.	Seed-based restoration	Comprehend seed and other propagule collection and banking procedures	Competent in seed and other propagule collection and banking processes	Lectures, field activities and discussions	3-5 hours
4.	Propagation protocols	Learn protocols or how to conduct trials and record data for native plant propagation, including germination procedures and non-seed-based propagation	Basic implementation in various propagation techniques of native plant species	Practical training, field activities, demonstrations	3-5 hours
5.	Species identification	Learn how to recognise and utilise floristic data to identify faunal and floral taxa native to the area	Ability to use floristic data to identify locally native animal and plant taxa	Lectures, practical training, field activities	2-10 hours
6.	Control of invasive species	Learn strategies for controlling invasive species	Ability to implement activities to control invasive species	Presentations, practical training, discussions	2-5 hours
7.	Community and cultural engagement	Learn how to engage stakeholders and cultures and ensure equitable benefit sharing	Ability to engage different stakeholders and cultures with the aim of equitable benefit sharing	Presentations, practical training, discussions	2-5 hours
8.	Ecosystem restoration and sustainable use	Learn how to sustainably use products from ecosystem restoration programmes	Implementation of sustainable use of resources derived from ecosystem restoration projects	Presentations, discussions	2-5 hours
9.	Other topics	Cover additional topics that can be requested on the TGBS mentoring topic list (see sections 7.2 - 7.3)	Complete recommended additional topics	Various mentoring techniques	Varies

7.2 TGBS Mentoring Services

The TGBS hubs can provide a range of additional mentoring services that can improve the practices of applicants. In addition to delivering training as outlined above in the TGBS restoration mentoring modules, hubs can support applicants with:

- Monitoring of ecosystem integrity, including biodiversity
- Identification of appropriate seed sources
- Provision of seeds and seedlings
- Spatial analysis of sites
- Remote sensing surveys
- Species distribution modelling
- Species climate suitability analysis
- Identification of useful native species
- Tree counting
- Carbon estimation
- Development of monitoring and evaluation plans
- Development of adaptive management plans
- Facilitation to funders
- Support access to carbon and biodiversity credit markets
- Assistance with completing the application form

7.3 TGBS Mentoring Resources

Applicants and the mentoring programme can benefit from the existing standards and protocols that have been developed and widely used by TGBS technical partners and hubs and other organisations with expertise in biodiversity, restoration and/or land management. These are some of the resources from TGBS technical partners and hubs that can serve as references and guidelines for applicants for best practice and hubs developing the mentoring programme:

Botanic Gardens Conservation International (BGCI):

BGCI offers a wide range of tools and resources to provide technical training, education, research and advocacy on various plant conservation topics. The resources listed below that were developed by BGCI and our partners could be helpful for TGBS mentoring:

- Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits
- Principles on access to genetic resources and benefit-sharing
- Basic guidance for threatened tree conservation
- BGCI and IABG's Species Recovery Manual and series of guidance briefs on species recovery
- BGCI Databases
  - **PlantSearch:** BGCI's PlantSearch database is the only global database of plant taxa in botanic gardens and similar organisations.
  - **GardenSearch:** BGCI's GardenSearch database is the only global database of the world's botanic gardens and similar organisations.
  - **ThreatSearch:** BGCI's ThreatSearch database is the only global database of all known conservation assessments of plants.
  - **GlobalTreeSearch**: BGCI's GlobalTreeSearch is the only global database of all known tree species and their country-level distributions.
  - **GlobalTree Portal:** The GlobalTree Portal provides access to information on the world's nearly 60,000 tree species.
  - **PlantShare:** Researchers and practitioners are able to access and share plant material and associated data; identify and flag material that is subject to ABS, biosafety and CITES regulations to facilitate access to, and responsible acquisition of, plant material.
- BGCI Webinar library
- Climate Assessment Tool
- BGCI's online training platform
  - Vegetative propagation of threatened trees
  - Propagation protocols
  - Scaling up biodiverse forest restoration
- Forest restoration learning modules
- Index Seminum

Society for Ecological Restoration (SER):

SER's principle, standards and other resources serve as a foundational resource for ecological restoration practice. The following materials are recommended:

- International Principles and Standards for the Practice of Ecological Restoration
- International Principles and Standards for Native Seeds in Ecological Restoration
- International Principles and Standards for the Ecological Restoration and Recovery of Mine Sites
- Standards of Practice to Guide Ecosystem Restoration
- Restoration Project Information Sharing Framework
- Principles for Ecosystem Restoration to Guide the United Nations Decade 2021-2030
- Ecological Restoration for Protected Areas: Principles, Guidelines and Best Practices
- Seed information Database
- SER Webinar Library
- SER Restoration Resource Center
- Restoration Ecology Journal

CIFOR-ICRAF:

The CIFOR-ICRAF forestry and agroforestry tools and publications expand the mentoring material by providing useful knowledge on sustainable forestry and agroforestry techniques. The following is a list of resources that could be accessed:

- Global Tree Knowledge Platform
- Global Useful Native Trees (GlobUNT)
- Agroforestry Species Switchboard
- BiodiversityR Package and Tree Diversity Analysis Manual
- Agroforestree Database
- TreeGOER Platform: Tree Globally Observed Environmental Ranges (TreeGOER)
- Agroforestry: A primer
- WorldFlora Package to Standardise Plant Names with Backbone Data from World Flora Online or the World Checklist of Vascular Plants
- A collection of tools for land restoration

- Tree Nursery Manuals and other resources for tree planting
- The Community-Based Restoration Monitoring System (CBRMS): A guide to using CBRMS in peatland restoration monitoring

Plan Vivo:

Plan Vivo tools and publications offer valuable guidance to support smallholder and community projects that provide climate, livelihoods and environmental benefits. The following is a list of resources that could be accessed:

- Plan Vivo: Socio-economic manual
- Participatory toolkit for use in Plan Vivo projects

TRAFFIC:

TRAFFIC's tools and publications give useful guidance on topics surrounding the sustainability and legality of the trade in wild species, including timber, wild meat and other non-wood forest products such as wild plants and fungi. The following are some resources that could be used:

- Legal and sustainable wild species trade
- Cites-listed wildlife
- WildCheck platform for sustainable wild plant sourcing
- Non-detriment findings guidance for CITES-listed timber and perennial plant species
- FairWild Standard for sustainable trade of wild plants

Royal Botanic Gardens, Kew

As a renowned centre for plant science and conservation, and boasting an extensive collection of over 76,000 living plants and 8.5 million preserved specimens, Royal Botanic Garden, Kew offers many valuable resources:

- Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits
- Millenium Seed Bank Partnership (MSBP) Seed Conservation Standards
- Assessing a population for seed collection
- A Field Manual for Seed Collectors
- Botanical and Mycological collections
- Seed Biology Laboratories
- Medicinal Plant Names Services

IUCN Species Survival Commission, and other commissions

The IUCN Species Survival Commission (SSC) is a global network of 9,500 experts providing vital scientific advice for biodiversity conservation, especially the renowned IUCN Red List. Here is a list of accessible resources to be utilised:

- IUCN Green Status of Species
- IUCN Red List of Threatened Species
- A global register of competences for threatened species recovery practitioners

ECOSIA:

ECOSIA's reforestation resources, including case studies and best practices in tree planting projects, offer valuable insights. The following is a listing of accessible resources:

- Ecosia tree-planting portfolio

Reforest'Action:

Reforest'Action implements reforestation and agroforestry to protect, restore and create forests around the world. It supports climate action, regenerative agriculture, urban forests and local regeneration. Here are some resources:

- Take Action to Protect the Forest
- Reforestation in Ivory Coast
- The regenerated mangrove of Sumatra
- Assisted Natural Regeneration, a complementary solution to tree planting to restore degraded forests
- Agroforestry, a significant practice in regenerative agriculture
- What is an urban forest?

1t.org:

1t.org is a global initiative to conserve, restore and grow 1 trillion trees by 2030. It connects, empowers and mobilises a diverse community of stakeholders to take action for nature and climate. The following are some useful resources:

- Technology and MRV in Forest Carbon Finance
- Improving Livelihoods through Reforestation

Auroville Botanical Gardens:

The Auroville Botanical Gardens are situated in the international township of Auroville, Tamil Nadu, India. Established in 2000, they cover 50 acres and have a collection of over 1,300 plant species displayed in thematic gardens. Environmental education programmes run at the gardens for local schoolchildren.

Auroville Botanical Gardens undertake restoration, rehabilitation and landscaping work across the country, including projects with private individuals, corporates, local government and grant-based projects from international organisations. Some notable projects include:

- **Conservation of the Tropical Dry Evergreen Forest** – a comprehensive study of the remnants of the rare and endangered local forest type
- **Conservation of *Drypetes porteri*** – an endangered species endemic to a small area in Tamil Nadu

- **Eco-Restoration of Pandalgudi Mines with Ramco Cements Ltd** – a large-scale rehabilitation of depleted limestone mines
- **Mine Restoration Framework** – developing a framework for mine restoration in India using a case study in Ariyalur, Tamil Nadu

Centre for Ecosystem Research – Kenya:

The Centre for Ecosystem Restoration – Kenya (CER-K) is a Kenyan non-profit organisation headquartered in the highlands of Kiambu County, Kenya, and operates three research and restoration hubs in diverse landscapes within Kenya. CER-K's mission is to restore biodiverse ecosystems by engaging people and sharing knowledge. CER-K actively reverses degradation and restores ecosystems through action-oriented research and advanced evidence-based restoration at each target landscape. The key principles that guide our approaches are:

- **Scientific Rigour:** Actively reverse degradation and restore ecosystems through action-oriented research and evidence-based restoration
- **Functionality:** Make ecosystems work for people and the planet by meeting stakeholder needs and preserving ecosystem resilience
- **Biodiversity:** Prioritise biodiversity and nature-based solutions by employing a targeted approach that seeks to restore the distribution and populations of declining native species, with an emphasis on rare and endangered species
- **Resilience:** Build a resilient model against socio-ecological disturbances and changing climate patterns to ensure the longevity and stability of restoration projects

- Restoring Tropical Forests: A practical guide
- FAO Webinar and courses
- Guidelines on Mangrove Ecosystem Restoration for the Western Indian Ocean Region
- Guidelines for Seagrass Ecosystem Restoration in the Western Indian Ocean Region
- Kenya Trees, Shrubs and Lianas
- Field Guide to East African Reptiles
- Birds of Kenya and Northern Tanzania

Seedlings at Pwani University nursery, Kenya. (David Bartholomew)

Fish survey during TGBS Assessment of Siruseri Twin Lakes Rejuvenation Project, Tamil Nadu, India. (Auroville Botanical Gardens)

Huarango Nature:

Huarango Nature is a non-profit Peruvian organisation established in 2017 with the mission of advancing the conservation, protection and restoration of forests, habitats and agrobiodiversity through the sustainable utilisation of resources and collaboration with local communities. While Huarango Nature's primary expertise lies in the dry forests of Peru, they have expanded their initiatives to encompass projects in the Andean and Amazonian regions as well. Here are some resources:

- Plantas y vegetación de Ica, Perú. Un recurso para su restauración y conservación
- Plantas útiles del Bosque Seco. Etnobotánica de Chongoyape, Lambayeque-Perú

Kadoorie Farm and Botanic Garden – KFBG:

KFBG is a Hong Kong-based nature conservation and environmental education NGO. Its site is spread across 148 hectares of land on the northern slopes of Tai Mo Shan, Hong Kong's highest mountain. KFBG was established in 1956 as the Kadoorie Agricultural Aid Association (KAAA) to provide agricultural aid to farmers in need of support to help them lead independent lives; and to provide leisure and educational experiences for the public. KFBG's work and influence gradually spread far beyond its site, and in 1995 it was reborn as a botanic garden with a strong scientific remit. Nowadays, the organisation raises awareness of ecological and sustainability issues, undertakes species conservation and ecosystem restoration in Hong Kong, mainland China and neighbouring countries, reconnects people with nature, and promotes sustainable lifestyles.

KFBG's main areas of expertise and resources include:

- Herbarium collection (focusing on the flora of Hong Kong and South China)
- Conservation Genetics Laboratory
- Tai Po Kau Forest Dynamics Plot Handbook
- Experimental approach to forest restoration on site in Hong Kong

- Expertise in orchid ecology, propagation and reintroduction
- The Wild Orchids of Hong Kong
- A Guide to Orchids of Laos
- Extensive expertise in nursery management, plant propagation and horticulture
- Invasive species management – 30 of Hong Kong's Worst Weeds
- Expertise in GIS, remote sensing and spatial statistics
- Expertise in wildlife trade policy and monitoring
- Wildlife rescue and rehabilitation centre

Missouri Botanical Gardens:

Missouri Botanical Gardens (MBG) was founded in 1859 in St Louis and now has the mission: 'To discover and share knowledge about plants and their environment in order to preserve and enrich life.' The Garden's Division of Science and Conservation focuses on documenting and describing the Earth's flora and using botanical information and expertise to promote and achieve lasting conservation outcomes. MBG houses one of the world's largest herbaria comprising nearly 7 million specimens, and its publicly accessible database, TROPICOS. MBG's largest overseas programme, now 40 years old, is in Madagascar, where we support a team of some 150 staff and, in addition to botanical discovery, support the community-based conservation of 11 protected areas.

MBG's primary activities include:

- Botanical exploration and research in plant systematics, including taxonomy
- Development of the Catalogue of the Plants of Madagascar, hosted within TROPICOS, which provides an authoritative source of information on the island's flora
- Community-based management of priority areas for plant conservation in Madagascar, including the key activities of: patrolling, control of invasive alien species, fire management, provision of alternatives to over-exploited resources, awareness raising, restoration of critically degraded ecosystems, and monitoring evaluation and learning
- Building capacity of botanical research institutions in host countries, including the training of in-country students and experts
- Advocating for plant conservation, including guiding *ex-situ* conservation activities
- Developing tools for spatial biodiversity assessments, including informing the identification of key biodiversity areas (KBAs)
- Serving as an IUCN Red List partner responsible for promoting and conducting high-quality risk of extinction assessments and informing conservation priority setting and planning
- Advancing and implementing ecological restoration science

Royal Botanic Garden, Jordan:

The Royal Botanic Garden (RBG) in Jordan, established in 2008 as a non-profit, is nestled in Tal Al-Rumman, north of Amman, overlooking the King Talal reservoir. Spanning 180 hectares, it showcases diverse landscapes aimed at comprehensive biodiversity conservation, highlighting these following resources:

- **The Seed Bank:** Safeguards the genetic diversity of Jordan's native plants by storing seeds for restoration and research, ensuring the survival of rare and endangered species
- **The Jordanian National Herbarium:** Acts as a repository for plant specimens, documenting the country's plant biodiversity and serving as a critical resource for scientists and researchers
- **The RBG Nurseries:** Dedicated to the cultivation of native plants, focusing on species at risk of extinction, to support restoration projects and maintain ecological balance
- **The Virtual Herbarium:** Provides digital access to plant specimens, enhancing research and educational outreach by making botanical information widely available
- **The RBG Database:** Records detailed plant data, aiding in habitat restoration and garden management, while facilitating research and educational activities through comprehensive plant profiles
- **Research Centre:** In development to become a leading centre for biodiversity conservation, it aims to foster collaboration with academic and research institutions worldwide on conservation projects

Tropical Rainforest Conservation and Research Centre:

Tropical Rainforest Conservation & Research Centre (TRCRC) is a Malaysian NGO dedicated to the conservation of rare and endangered tree species. The NGO operates three different sites in Malaysia, namely TRLC Merisuli (Sabah), TRLC Banun (Perak) and the Elmina Rainforest Knowledge Centre (Selangor). The two Tropical Rainforest Living Collections (TRLCs) function as a living seed bank for species from the iconic Dipterocarpaceae family found in tropical rainforests, ensuring a diverse supply of seeds for future restoration projects.

Since 2012, TRCRC has worked to identify and source seeds from parent trees of this charismatic tree family, collecting seeds and wildlings from across the states of Sabah, Perak and Selangor. As of 2024, TRCRC manages 725 hectares of degraded forest lands, conserving the genetic material of tree species that are emblematic of this mega-diverse region.

TRCRC's main areas of focus and activities include:

- Tropical rainforest conservation
- Forest landscape restoration
- Environmental education
- Biodiversity assessment, recovery, conservation and restoration
- Conservation of Dipterocarpaceae trees
- Public awareness programmes
- Skills transfer and capacity building with indigenous and local communities
- Corporate awareness programmes
- Eco-tourism programmes

TRCRC works closely with a wide range of partners including government agencies, CSOs, NGOs, foundations, corporations, community groups and private entities to reach our shared goals of environmental protection and restoration.

7.4 TGBS Mentoring Development and Delivery

TGBS hubs are assigned by the Secretariat to prepare and deliver mentoring materials. These materials are developed based on the desired learning outcome(s). The mentoring programme is designed to be adaptable to various conditions and needs across different regions and restoration approaches. The following guidance can assist in the development and delivery of mentoring programmes:

- **Importance of the action plan for mentoring material:** The action plan for mentoring material serves as the guiding framework for the mentoring programme. It outlines the topics, content and learning objectives that participants (mentees) are expected to cover during the mentoring sessions (Action Plan Template). The action plan should be developed in a way that allows for effective delivery during mentoring sessions.

- **Customisation for regional needs:** TGBS projects can be diverse and are located in different regions of the world with varying ecological and social conditions. Therefore, the action plan must be adaptable and flexible, and customised to address the unique needs, challenges and conditions of the regions where the mentoring occurs. Here are some tips for tailoring mentoring:

  - **Assess regional needs:** Assess the specific needs and challenges in the region where the mentoring will take place. This assessment should consider ecological and social factors to tailor the mentoring content effectively.
  - **Engage local experts:** Collaborate with local experts, practitioners and community members who have in-depth knowledge of the region. Prioritise local engagement and support indigenous and traditional knowledge systems. Their insights are invaluable for customising the mentoring content and ensuring its relevance.
  - **Adapt content:** Modify the mentoring content to address region-specific topics, challenges and ecological conditions. Customise examples and case studies to make the content directly applicable to the region.
  - **Communicate in an accessible way:** Ensure that the language used in mentoring sessions is accessible and understandable to the mentees. Provide translations or bilingual trainers if needed to enhance communication.
  - **Involve the community:** Emphasise community involvement and participatory approaches. Encourage mentees to engage local communities in project planning and execution, as community support is often critical for project success.

- **Effective development and delivery:** The action plan should foster interactive and engaging learning experiences that enable mentees to grasp TGBS concepts, criteria and practices.

- **Ensuring learning outcomes:** The mentoring goal must ensure that applicants achieve specific learning outcomes. Trainers and assessors deliver the material in a way that empowers mentees to meet these outcomes.

Degraded land adjacent to a forest reserve in Malaysia. (Amarizni Mosyaftiani)

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 8
Becoming a TGBS Assessor or Trainer

TGBS assessment team in Ramco Cements Mine Restoration, Pandalgudi, Tamil Nadu, India. (Auroville Botanical Gardens)

The Global Biodiversity Standard

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

Section 8: Becoming a TGBS Assessor or Trainer

Contents

8.1 Becoming an Assessor

Assessors are persons responsible for assessing and scoring sites. Assessors are identified by the Secretariat and hubs based on their expertise in regional biodiversity, native ecosystems and ecosystem restoration (e.g., SER CERPs or CERPITS; members of BGCI's Ecological Restoration Alliance). All assessors are certified by the Secretariat. Certification is attained through completion of the Global Biodiversity Standard (TGBS) Assessor Module (section 8.3). This module includes the equivalent of 54 hours of training with both a theoretical and practical examination to assess knowledge of the TGBS assessment methodology.

8.2 Becoming a Trainer

Trainers are responsible for training assessors. Trainers are additionally certified as assessors. Trainers must complete the TGBS Assessor Module, an additional 14 hours/two days of field training in assessing ecosystem integrity, and demonstrate a knowledge base in the field of ecological restoration. Trainers must successfully complete both a theoretical and practical examination.

The knowledge base requirements for trainers align with the knowledge base requirements of the Society for Ecological Restoration's Certified Ecological Restoration Practitioner (CERP) programme. This knowledge base may be obtained through a combination of academic credentials obtained at accredited institutions and/or accumulation of knowledge relevant to the profession of ecological restoration. The knowledge base requirement is evaluated using the US-based semester credit hour framework, where 15 contact hours of lecture, lab and/or applied learning is equivalent to one credit. Trainers must have the following knowledge base:

- Biological Science (15 credits, including at least 9 credits in ecology)
- Physical Science (15 credits, including at least 6 credits in soils, hydrology and/or climate science)
- Resource Management and Conservation (12 credits, including at least 3 credits in ecological dimensions and at least 3 credits in human dimensions)
- Quantitative Science (9 credits, including at least 6 credits in inventory, monitoring or assessment)
- Ecological Restoration (6 credits)

The Secretariat is responsible for verifying the knowledge base requirements of trainers.

8.3 TGBS Assessor Module

The TGBS assessor module is a comprehensive guide to the assessment process of the TGBS. The module may be delivered by the Secretariat and/or trainers of the TGBS. Trainers must complete an extended version of the module with eight instead of four core field methods trained in lesson 5.

The module consists of seven lessons:

1. **Introduction to the TGBS application and assessment process (7.25 hours)**
   This lesson provides training on a broad overview of the methodology, governance, training procedure, criteria and assessment process. The lesson also trains assessors on how to identify suitable sites to apply, safeguarding procedures, and how to guide applicants through the application form.

A workshop during the 1st edition of the Indian Botanical Gardens Networking Meeting. (Auroville Botanical Gardens)

Explaining forest restoration. (Amarizni Mosyaftiani)

2. **Assessment preparation (4 hours)**
   This lesson provides training on how to prepare for an assessment of a site. Topics covered in this lesson include the procedure for field surveys, how to prepare an assessment plan, and how to assess and manage risks. The lesson also covers spatial delineation of land management types being assessed.

3. **The use of ecological restoration theory in the TGBS (3 hours)**
   This lesson provides training on key ecological restoration theory that is applied to the TGBS. In this lesson the restorative continuum is introduced, the SER Five-star System, and baselines and references.

4. **Assessment tools and strategies (9.25 hours)**
   This lesson provides training on important tools and strategies that can be used during the assessment process. The tools and strategies for the remote sensing and field surveys are introduced, with guidance provided on how to interpret and compare results from the two or more surveys. Training is also provided on the TGBS mobile application, data tools and social survey tools.

5. **Assessment of ecosystem integrity, including biodiversity (assessors – 14.25 hours; trainers – 28.25 hours)**
   This lesson provides training on the recommended field survey techniques to assess ecosystem integrity. The module covers theory, practical techniques and data analysis skills for core methods used in the ecosystem integrity assessment. Assessors must learn four core methods, whilst trainers must learn eight core methods.

6. **Assessment of criteria 2, 3 & 8 (8.25 hours)**
   This lesson provides training on how to assess criteria 2, 3 & 8. The lesson covers how to assess the level of protection of the site, how to assess stakeholder engagement and social benefits, and how to assess monitoring, evaluation and adaptive management activities.

7. **Scoring and certification (4 hours)**
   This lesson provides training on the scoring and certification procedure for assessments. Topics covered in this lesson include scoring sites against the eight criteria, the pre-certification procedure, how to prepare certification reports, ensuring ongoing compliance, and the process for recertification.

Verification of learning for each lesson is confirmed through a short examination. These examinations are marked as the module progresses with feedback provided on any questions that are completed incorrectly.

Assessors are required to complete the written examination, but the examination of field skills for assessors must be made by the trainer throughout lessons 5-6 of the module. The candidates may have access to this manual when completing both examinations. Completion of the module for trainers is dependent on passing both a practical and written examination.

The practical examination involves designing and implementing an appropriate field survey technique based on a scenario provided to the candidate. The field survey designed and implemented shall include relevant core methods, in addition to any relevant additional complementary methods. The practical examination is completed in a group of 2-4 people. The practical examination is assessed by the trainers.

The written examination involves a 90-minute paper that is taken by the candidate. The paper must be completed individually and is marked by the Secretariat of the Global Biodiversity Standard. The pass requirement for assessors is 70 per cent and for trainers is 80 per cent. Candidates may resit the examination any number of times.

Soil sample collection during a baseline survey of an inactive limestone mine. (Auroville Botanical Gardens)

Table 8.1 – *Content for the Global Biodiversity Standard Assessor Module.*

Lesson	Topic	Content for Assessors	Methods and Techniques	Hours
1	**Introduction to the application and assessment process**			**7.25**
1a.	Introduction to TGBS	Overview of TGBS and its methodology	Presentation, Discussion	0.75
1b.	Governance	Introduction to the role of the Secretariat and hubs	Presentation	0.75
1c.	Training procedure of assessors and trainers	Introduction to the requirements for trainers and assessors	Presentation	0.5
1d.	Safeguarding	Exclusion list and safeguarding procedures	Presentation, Workshop	1.5
1e.	Project identification	Identifying and assessing suitable TGBS sites	Workshop	1
1f.	Assessment process and criteria	Understanding the assessment process and criteria	Presentation, Discussion	1.5
1g.	Application submission guidance	Guiding the submission of the online application	Workshop	1
1h.	Verification of lesson 1		Examination	0.25
2	**Assessment preparation**			**4**
2a.	Introduction to the field survey	Procedure for a field survey	Presentation	0.5
2b.	Assessment preparation & logistics	Preparing an assessment plan and risk assessment	Presentation, Discussion, Workshop	1.5
2c.	Spatial analysis of sites	Spatial delineation of sites and land uses	Workshop	1.75
2d.	Verification of lesson 2		Examination	0.25
3	**The use of ecological restoration principles and tools in the TGBS**			**3**
3a.	Baselines and reference ecosystems	Establishing baselines, and target native reference ecosystems, and reference models	Presentation, Workshop	1
3b.	The Five-star System and assessment method	Understanding the Five-star System and its use in the TGBS assessment process	Presentation, Workshop, Discussion	1.75
3c.	Verification of lesson 3		Examination	0.25

Lesson	Topic	Content for Assessors	Methods and Techniques	Hours
4	**Assessment tools and strategies**			**9.25**
4a.	The use of remote sensing	Procedure of remote sensing for assessments	Presentation, Discussion	2
4b.	Field survey tools and strategy	Tools and strategies for effective field surveys	Workshop	1.25
4c.	Interpretation of field and remote sensing survey	Comparing remote sensing and field surveys	Discussion, Workshop	1
4d.	The TGBS mobile application	Use of the mobile application to support field surveys	Presentation, Workshop	1
4e.	Data tools	Use of data to support assessments	Workshop	2.5
4f.	Socio-economic survey tools	Assessment of socio-economic surveys	Workshop	1
4g.	Verification of lesson 4		Examination	0.25
5	**Assessment of ecosystem integrity**			**Assessors – 14.25; Trainers – 28.25**
5a.	Introduction to field survey techniques	Introduction to core field survey methods – four methods for assessors; eight methods for trainers	Presentation	Assessors – 3; Trainers – 6
5b.	Practical field survey techniques	Practice of field survey methods – four methods for assessors; eight methods for trainers	Presentation, Discussion, Workshop	Assessors – 7; Trainers – 14
5c.	Analysis of field survey data	Data analysis of field survey methods – four methods for assessors; eight methods for trainers	Workshop	Assessors – 4; Trainers – 8
5d.	Verification of lesson 5		Examination	0.25

A TGBS assessment team surveying a remnant sacred temple grove as a reference ecosystem. (Auroville Botanical Gardens)

Training on how to collect data using bioacoustic sensors. (Gabriela Orihuela)

Lesson	Topic	Content for Assessors	Methods and Techniques	Hours
6	Assessment of criteria 2, 3 & 8			8.25
6a.	Level of protection assessment	Assessment of protection status	Presentation, Workshop	1
6b.	Stakeholder engagement and social benefits assessment	Assessment of stakeholder engagement and social benefits	Presentation, Discussion, Workshop	5
6c.	Assessment of monitoring, evaluation and adaptive management	Assessment of monitoring, evaluation and adaptive management	Presentation, Workshop, Discussion	2
6d.	Verification of lesson 6		Examination	0.25
7	Scoring and certification			4
7a.	Scoring assessments	Scoring of sites against the eight criteria	Presentation, Workshop	1.5
7b.	Pre-certification and certified plans procedure	Procedure for early established projects	Presentation	0.5
7c.	Assessor recommendation report	Preparing assessment reports	Presentation, Discussion	0.75
7d.	Verification	Verifying assessment reports	Presentation	0.5
7e.	Project recertification	Process of project recertification	Presentation	0.5
7f.	Verification of lesson 7		Examination	0.25

8.4 Certification of Assessors and Trainers

Upon successful completion of the training, assessors and trainers become certified by the Secretariat. A list of all trainers and assessors is kept on a public registry.

Certificates are valid for a period of five years. Assessors and trainers can become recertified by completing a recertification application and by completing an e-learning course with examination.

Discussing the overview of the TGBS assessment methodology. (Adrihani Rashid)

The Global Biodiversity Standard:
Manual for assessment and best practices

Section 9
Conclusion


Temperate broadleaf forest in Dartmoor National Park, United Kingdom. (David Bartholomew)

The Global Biodiversity Standard

BOTANIC GARDENS CONSERVATION INTERNATIONAL

SER SOCIETY FOR ECOLOGICAL RESTORATION

Section 9: Conclusion

Contents

Fungal fruiting body, an indicator of decomposition, in boreal forest, Sweden. (David Bartholomew)

9.1 Importance of The Global Biodiversity Standard Certification

The Global Biodiversity Standard (TGBS) is an important tool to advance positive biodiversity outcomes from ecosystem restoration initiatives. It is important that these gains are made to secure the long-term future for biodiversity and to ensure the full functionality of terrestrial, freshwater and coastal ecosystems. The TGBS can provide:

1. **Assurance:** The TGBS establishes a set of criteria and best practices that projects should follow, ensuring that ecosystem restoration efforts successfully achieve positive biodiversity outcomes.

2. **Credibility:** Certified projects provide credibility to funders, stakeholders and the public about biodiversity impacts. This credibility is essential for attracting investment and community support, as well as for fostering trust in the project's outcomes.

3. **Robust monitoring:** The TGBS uses a robust monitoring and reporting framework of biodiversity impacts, which helps ensure that applicants can achieve robust reporting. This can also help projects to adapt and improve their practices based on the outcomes of TGBS assessments.

4. **Benchmarking:** The TGBS provides a benchmark against which the success of restorative initiatives can be measured. It allows for the comparison of effectiveness across different projects and regions, contributing to a better understanding of what practices achieve positive biodiversity outcomes and what practices do not.

5. **Knowledge sharing**: The TGBS collects and analyses data that can be shared with the broader restoration community, contributing to the global knowledge base and improving ecosystem restoration practices elsewhere.

6. **Community engagement:** The TGBS not only assesses projects concerning their impact on biodiversity but also the sustainability of the project from social perspectives. Projects must engage with local communities and integrate their knowledge and needs, leading to more resilient and locally supported outcomes. This holistic approach helps increase the likelihood that restored ecosystems can be maintained over the long term.

7. **Environmental compliance:** The TGBS can ensure that restoration projects are in compliance with environmental laws, regulations and performance standards, which is critical for protecting biodiversity and preventing negative impacts on the environment.

8. **Attracting funding:** The TGBS can provide a mechanism to ease the process of securing funding. The TGBS can be used by government or private grants as a requirement or can be used by potential investors who are looking for assurances that their funds will be used to effectively improve biodiversity.

9. **Risk management:** The TGBS can help identify potential risks associated with ecosystem restoration projects and establish guidelines for mitigating those risks, thereby protecting the investment in the project and the surrounding communities.

10. **Access:** The TGBS provides a cost-effective framework to comprehensively and objectively measure biodiversity and provides a mechanism for applicants to access expertise on biodiversity and ecosystem restoration through the TGBS mentoring programme.

9.2 Call to Action for Continued Improvements

Ecosystem restoration provides an effective way to recover biodiversity lost because of previous degradation, but requires that best practices are continually updated, adopted and implemented. The TGBS methodology identifies eight key criteria that when adhered to achieve positive biodiversity outcomes. The TGBS calls for action from the restoration community to adopt these criteria into practices to achieve positive biodiversity outcomes. By incorporating the latest scientific and local knowledge into its monitoring and mentoring, the TGBS facilitates the realisation of good outcomes. Applicants can use the knowledge gained from the assessment and mentoring processes to adapt their management and achieve continued improvements in their restoration practices.

Tree planting underway in the TRLC Merisuli forest restoration site. (TRCRC)

Frog nesting in cut bamboo, Khao Sok National Park, Thailand. (David Bartholomew)

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Glossary

The Australian bush being prepared for ecological restoration at Charles Darwin National Park. (SER)

Accountable – the government agency, civil society or private-sector institution which is accountable for the implementation of the activity.

Adaptive management – iterative process for improving management policies and practices by applying knowledge learned through the assessment of previously employed policies and practices to future projects and programmes. It is the practice of revisiting management decisions and revising them in light of new information.

Agroforestry – in dispersed interplanting, trees are grown alongside crops, usually in rows in between plots, to provide nutrients and organic matter for the soil, as well as shade for crops. In addition to improving crop productions, trees also provide fuel wood, building poles or fodder.

Attributes – see Key ecosystem attributes.

Baseline – see Baseline condition, Baseline inventory.

Baseline condition – the condition of the restoration site immediately prior to the initiation of ecological restoration activities.

Baseline inventory – an assessment of current biotic and abiotic elements of a site prior to ecological restoration, including its compositional, structural and functional attributes. The inventory is implemented at the commencement of the restoration planning stage, along with the development of a reference model to inform planning, including restoration goals, measurable objectives and treatment prescriptions.

Biodiversity – the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Carbon capture – any process for capturing carbon dioxide, whether from the atmosphere or from a smokestack or other concentrated source of carbon dioxide emissions.

CERP – senior level practitioner who meets the knowledge requirements AND has at least five years of full-time experience with restoration.

CERPIT – practitioner who meets either the knowledge requirements OR the experience requirement but not both.

Climate change – a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and which is in addition to natural climate variability observed over comparable time periods.

Climate resilience – landscapes, communities and individual livelihoods that are well suited to face rising temperatures, changing weather patterns, droughts and other effects of climate change.

Community well-being – the combination of social, economic, environmental, cultural and political conditions identified by individuals and their communities as essential for them to flourish and fulfil their potential.

Passiflora flower, Khao Sok National Park, Thailand. (David Bartholomew)

Conservation – the preservation, management and care of natural and cultural resources.

Default indicator group – groups of species to monitor environmental health and ecosystem integrity.

Degradation – a level of deleterious human impact to ecosystems that results in the loss of biodiversity and simplification or disruption in their composition, structure and functioning, and generally leads to a reduction in the flow of ecosystem services.

Destruction – when degradation or damage removes all macroscopic life, and commonly ruins the physical environment of an ecosystem.

Ecosystem attributes – see Key ecosystem attributes.

Ecosystem conversion – the condition of an ecosystem asset can change to the degree that results in a conversion of all or part of the area of the asset from one ecosystem type to another between the beginning and end of an accounting period.

Ecological restoration – the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed. (Ecosystem restoration is sometimes used interchangeably with ecological restoration, but ecological restoration always addresses biodiversity conservation and ecological integrity, whereas some approaches to ecosystem restoration may focus solely on the delivery of ecosystem services.)

Ecosystem integrity – the ability of an ecosystem to support and sustain characteristic ecological functioning and biodiversity (i.e., species composition and community structure). Ecological integrity can be measured as the extent that a community of native organisms is maintained.

Ecosystem restoration – the process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity. Ecosystem restoration encompasses a wide continuum of practices, depending on local conditions and societal choice.

Ecosystem services – the direct and indirect contributions of ecosystems to human well-being. They include the production of clean soil, water and air, the moderation of climate and disease, nutrient cycling and pollination, the provisioning of a range of goods useful to humans and potential for the satisfaction of aesthetic, recreation and other human values. These are commonly referred to as supporting, regulation, provisioning and cultural services. Restoration goals may specifically refer to the reinstatement of particular ecosystem services or amelioration of the quality and flow of one or more services.

Ecosystem structure – the individuals and communities of plants and animals of which an ecosystem is composed, their age and spatial distribution, and the non-living natural resources present.

Environmental DNA – genetic material obtained directly from environmental samples (soil, sediment, water, etc.) without any obvious signs of biological source material.

Evaluation – a review of whether the stated goals were adequate and the reasons for successes and failures. Such evaluation can take the form of a status assessment (based on, for example, population monitoring), performance assessment, impact assessment or systematic review.

Exclusion list – a list of criteria for rejecting or revoking certification from applicants who engage in human rights violations or environmental harm, intentional degradation of the natural environment, or the production or trade of any product or activity that is prohibited by the laws or regulations of the host country, international conventions and agreements or international bans.

Extending – the government entity (central, state or local government agency or department), or agency within an institution, financing the activity from its own budget.

Five-star System – a tool used to identify the level of recovery aspired to by a restoration or rehabilitation project, and to progressively evaluate and track the degree of native ecosystem recovery over time relative to the reference model. This tool also provides a means to report changes from the baseline condition relative to the reference. (Note: this system refers only to the recovery outcomes and not the restoration activities used to attain them.)

Funding – the country or institution which provides the funds.

Monitoring seedlings in Danum Valley, Malaysia. (David Bartholomew)

Checking beetle traps during assessment of below-ground biodiversity in central Uganda. (TBG)

Gene flows – the movement of genes into or out of a population. Such movement may be due to migration of individual organisms that reproduce in their new populations, or to the movement of gametes (e.g., as a consequence of pollen transfer among plants).

Genetic diversity – the variety of alleles and genotypes present in a population and this is reflected in morphological, physiological and behavioural differences between individuals and populations.

Grievance mechanisms – a set of arrangements that enable stakeholders to raise grievances with the project and seek redress when they perceive a negative impact arising from the project's activities. It is a key way to mitigate, manage and resolve potential or realised negative impacts of the project, as well as fulfil obligations under international human rights law and contribute to positive relations with communities and employees.

Habitat – the resources and conditions present in an area that produce occupancy – including survival and reproduction – by a given organism. Habitat is organism-specific; it relates the presence of a species, population or individual (animal or plant) to an area's physical and biological characteristics. Habitat implies more than vegetation or vegetation structure; it is the sum of the specific resources that are needed by organisms.

Implementing – the intermediary between the extending agency and the ultimate beneficiary. Also known as executing agency or channel of delivery. They can be public sector, non-governmental organisations (NGOs), public-private partnerships or multilateral institutions.

Indigenous knowledge – the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. It is spatially and/or culturally context specific, collective, holistic and adaptive.

Key ecosystem attributes – broad categories developed for restoration standards to assist practitioners with evaluating the degree to which biotic and abiotic properties and functions of an ecosystem are recovering. In this document six categories are identified: absence of threats, physical conditions, species composition, structural diversity, ecosystem function and external exchanges. From the attainment of these attributes emerge complexity, self-organisation, resilience and sustainability.

Local community – a group of people who live in or near the project area, who share a set of institutions that order all aspects of social life and could be affected by the project.

Marginalised people – individuals or groups of people prevented from full participation in social, economic and political life. Social, economic and political barriers can all contribute to the marginalisation of an individual or group, and people can be marginalised due to multiple factors such as geography, ethnicity, religion, caste, sexual orientation, gender, displacement, conflict or disability.

Natural ecosystem – an ecosystem where human impact has been of no greater influence than that of any other native species, and has not affected the ecosystem's structure since the industrial revolution. Human impact excludes changes of global proportions, such as climate change due to global warming.

Native species – an animal or plant that evolved in the location where it currently lives (as opposed to invasive species, which take over land and habitat from plants and animals that had already been living there for centuries).

Participatory mapping – a map-making process that attempts to make visible the association between land and local communities by using the commonly understood and recognised language of cartography.

Primary stakeholders – any individual or group that is resident in and/ or has the potential to influence the site area and is affected by the project interventions. This should include any individuals with customary user rights or who are impacted by and use the biodiversity of the area either legally or illegally.

Provenance – the original geographic source of seed, pollen or propagules.

Long-tailed sylph, Wayqecha, Peru. (David Bartholomew)

Rapid biodiversity assessment – rapid biodiversity assessment (RBA) refers to time-efficient tools that aid information collection on the present biodiversity in a given area. RBA in terrestrial environments is often based on key taxa (e.g., specific bird or mammal species) that are used as proxies for the health and integrity of ecosystems.

Rare species – species which have a restricted (world) range.

Recovery – the process by which an ecosystem regains its composition, structure and function relative to the levels identified for the reference ecosystem. In restoration, recovery is usually assisted by restoration activities, and recovery can be described as partial or full.

Reference condition – the set of attribute values or quantifiable characteristics of the reference ecosystem. Physical, chemical or biological parameters of ecosystem structure or function can be represented by a single value or a distribution.

Reference ecosystem – a representation of a native ecosystem that is the target of ecological restoration (as distinct from a reference site). A reference ecosystem usually represents a non-degraded version of the native ecosystem complete with its flora, fauna and other biota, abiotic elements, functions, processes and successional states that might have existed on the restoration site had degradation not occurred, adjusted to accommodate changed or predicted environmental conditions.

Reference model – a model that indicates the expected condition that the restoration site would have been in had it not been degraded (with respect to flora, fauna and other biota, abiotic elements, functions, processes and successional states). This condition is not the historical condition, but rather reflects background and predicted changes in environmental conditions.

Reference sites – an extant intact site that has attributes and a successional phase similar to the restoration project site and that is used to inform the reference model. Ideally the reference model would include information from multiple reference sites.

Reforestation – the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land.

Regenerative agriculture – any and all forms of agricultural practice that actively restore soil quality, biodiversity, ecosystems health and water quality while producing sufficient food of high nutritional quality.

Rehabilitation – management actions that aim to reinstate a level of ecosystem functioning on degraded sites, where the goal is renewed and ongoing provision of ecosystem services rather than the substantial recovery and integrity, including biodiversity, of a designated native reference ecosystem.

Reintroduction – returning biota to an area where it previously occurred.

Relative diversity – the proportion of different species or genes within a particular ecosystem, habitat or geographic area when compared with the total species or genetic diversity of the area. This measure provides insight into how evenly species or genes are represented or how dominant certain species or genes are in comparison to others within a population.

Restoration Project Information Sharing Framework – the Framework was developed to track progress and trends in ecosystem restoration and includes monitoring indicators and project descriptors that can be shared among the many platforms and databases that collect, aggregate, evaluate and provide access to data on ecosystem restoration.

Safeguarding – responsibility in acting to keep people safe from any form of harm caused by the misuse of power by making sure that staff, volunteers, programmes and communications do no harm to children and adults, nor expose them to abuse or exploitation.

Satellite imagery – images of Earth collected by imaging satellites that are operated either by governments or companies. Satellite images are one of the most powerful and important tools we have for monitoring the Earth. They track the physical environment (water, air, land, vegetation) and the changing human footprint across the globe.

Secondary invasive – see Secondary invasion.

Secondary invasion – an increase in abundance of non-target exotics following treatment of targeted invasive plants.

Secondary stakeholders – any individual with indirect influence or interest on the site area. This could include government officials, politicians, religious leaders, societies, academics.

Spatial delineation – the division of a polygon into different land management types.

Black and White Colobus Monkey, Brackenhurst Botanic Garden, Kenya. (David Bartholomew)

Crab-eating foxes, Itatiaia National Park, Brazil. (David Bartholomew)

Stakeholder – any individual, group, organisation or sector in society that has a clearly identifiable interest in the outcome of a policy or decision-making situation. The interest may be in the form of a specific management responsibility, a commercial interest (e.g., resource supply, revenue, employment, trading activity), a subsistence need or some other commitment, as a member of civil society.

Sustainable use – sustainable use is defined by the Convention on Biological Diversity since 1992 as 'the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.' As described in the Thematic Assessment of Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 2022, sustainable use is also an outcome of social-ecological systems that aim to maintain biodiversity and ecosystem functions in the long term, while contributing to human well-being. It is a dynamic process as wild species, the ecosystems that support them, and the social systems within which uses occur, change over time and space.

Taxonomic group – an organism's location in the biological classification system used to identify and group organisms with similar physical, chemical and/or structural composition.

Threatened species – number of species at risk of extinction in proportion to the total number of native species. Species in the Vulnerable, Endangered and Critically Endangered categories in the IUCN Red List are collectively described as 'threatened'.

Timed-meander method – a biodiversity survey method in which an observer walks through a habitat for a set period of time, identifying and recording all species observed within the target taxonomic group. The observer typically follows a flexible path, allowing for the exploration of various microhabitats and the maximisation of species encounters.

Vulnerable and/or disadvantaged people – individuals who may be more likely to be adversely affected by the project's impacts and/or more limited than others in their ability to take advantage of the project's benefits. These individuals may be more likely to be excluded from participating in the project and may require specific support to do so. These individuals may also be marginalised.

The Global Biodiversity Standard:
Manual for assessment and best practices

Appendices

The Global Biodiversity Standard

Appendix A: The Global Biodiversity Standard Application Form

Contact Information

Contact Information

Name (Required)

First Name

Last Name

Email (Required)

Enter Email

Confirm Email

Organisation Information

Name of applicant organisation, agency or institution (Required)

Name of the organisation applying for certification

Role of applicant organisation (Required)

- ❐ Accountable
- ❐ Extending
- ❐ Implementing
- ❐ Funding
- ❐ Monitoring & evaluation

Category of applicant organisation (Required)

- ❐ Academic, Training and Research
- ❐ Foundation
- ❐ Indigenous Community or Group
- ❐ International Non-Governmental Organisation
- ❐ Local Community or Cooperative Group
- ❐ Local Government
- ❐ Multilateral
- ❐ National Government
- ❐ National Non-Governmental Organisation
- ❐ Other Public Sector
- ❐ Partner Country-based Non-Governmental Organisation
- ❐ Private Landowner
- ❐ Private Sector
- ❐ Private Sector in Aid Recipient Country
- ❐ Private Sector in Provider Country
- ❐ Private Sector in Third Country
- ❐ Public-Private Partnership
- ❐ Regional Non-Governmental Organisation
- ❐ Subnational Government
- ❐ Other

Name of sponsoring organisation
(if different from applicant organisation)

Organisation Address

Address of applicant organisation (Required)

Street Address

Address Line 2

City

State / Province / Region

ZIP / Postal Code

Country

Project Information

Project Information

What is the name of your project? (Required)
If you have multiple projects, please use a unique name for each project.

Please describe the main objectives of the project (Required)

Hyperlink to project (optional)

Project Objectives

Project objectives (Required)

Please choose at least one from the list.

- ❒ Biodiversity: Connectivity
- ❒ Biodiversity: Protection
- ❒ Biodiversity: Quality
- ❒ Climate: Adaptation (e.g., coastal protection)
- ❒ Climate: Mitigation (e.g., carbon sequestration)
- ❒ Climate: Resilience
- ❒ Community: Equity
- ❒ Community: Health
- ❒ Community: Income
- ❒ Community: Practices
- ❒ Culture: Rights
- ❒ Culture: Values
- ❒ Ecosystem: Extent
- ❒ Ecosystem: Functionality
- ❒ Ecosystem: Integrity
- ❒ Energy: Management
- ❒ Energy: Quantity
- ❒ Energy: Scarcity
- ❒ Food and Products: Finance
- ❒ Food and Products: Market
- ❒ Food and Products: Yield
- ❒ Soil: Management
- ❒ Soil: Quality
- ❒ Soil: Stability
- ❒ Water: Management
- ❒ Water: Quality
- ❒ Water: Quantity
- ❒ Other

If other please specify (Required)

Project Duration

What is the actual/estimated start date of the project? (Required)
If your project has already started, please input a date in the past.

Does the project have an actual/estimated end date? (Required)

- ❒ Yes
- ❒ No

If Yes - what is the actual/estimated end date of the project? (Required)

Please explain the period of the project.

If your project has several phases

Land Information

Which biome best describes your project area? (Required)
For more information on biomes and physical landscape, please refer to this document.

- ❒ T1 Tropical-subtropical forests biome
- ❒ T2 Temperate-boreal forests and woodlands biome
- ❒ T3 Shrublands and shrubby woodlands biome
- ❒ T4 Savannas and grasslands biome
- ❒ T5 Deserts and semi-deserts biome
- ❒ T6 Polar-alpine (cryogenic) biome
- ❒ T7 Intensive land-use biome
- ❒ S1 Subterranean lithic biome
- ❒ S2 Anthropogenic subterranean voids biome
- ❒ SF1 Subterranean freshwaters biome
- ❒ SF2 Anthropogenic subterranean freshwaters biome
- ❒ SM1 Subterranean tidal biome
- ❒ TF1 Palustrine wetlands biome
- ❒ F1 Rivers and streams biome
- ❒ F2 Lakes biome
- ❒ F3 Artificial wetlands biome
- ❒ FM1 Semi-confined transitional waters biome
- ❒ MT1 Shorelines biome
- ❒ MT2 Supralittoral coastal biome
- ❒ MT3 Anthropogenic shorelines biome
- ❒ MFT1 Brackish tidal biome

What is the dominant land tenure system that best describes the surrounding landscape of your project area? (Required)

- ❒ Small private properties
- ❒ Large private properties
- ❒ Public (government) properties
- ❒ Common or collective or shared land managed by the local community
- ❒ Not known
- ❒ Not resolved or unclear

Are there any other land tenure systems in the surrounding area other than those specified above?

- ❐ Small private properties
- ❐ Large private properties
- ❐ Public (government) properties
- ❐ Common or collective or shared land managed by the local community

What is the site land tenure arrangement? (Required)

- ❐ Legal ownership or legal owner-like possession
- ❐ Short-term rent (less than 3 years)
- ❐ Medium-term rent (3 to 10 years)
- ❐ Long-term rent (more than 10 years)
- ❐ Non-legal ownership or non-legal owner-like possession
- ❐ Not known
- ❐ Other

Is your project area or sites subject to any legal frameworks or compliance requirements or constraints? (Required)
For instance, gazetted area, mining concession, formal protected area, forest reserve.

- ❐ Yes
- ❐ No

If Yes - please expand (Required)

Is your project area part of a biodiversity offset? (Required)

- ❐ Yes
- ❐ No

If Yes - please expand (Required)

Is your project area subject to other biodiversity or carbon certification schemes? (Required)
For instance VERRA, Gold Standard, HCV CCB, FairWild, Plan Vivo Standard, preferred by nature & others.

- ❐ Yes
- ❐ No

If Yes - please explain (Required)

Upload Documents

Please upload all project documentation pertaining to the above questions.
For instance, maps, plans, etc.
Max. file size: 500 MB.

Project Area

Project Area

How many distinct sites are there in your project? (Required)

How large is your total project area (in hectares)? (Required)
Where the project area covers multiple local sites, please give total area of all sites for which the applicant is responsible.

Is your site displayed on restor.eco?
(All certified sites will be required to be publicly visible on restor.eco)

- ❐ Yes
- ❐ No

Provide a link to your site on restor.eco

Please upload geospatial data relevant to your project.
Points to follow:

1. You have two options to add your geospatial data relevant to your site. You can either upload geospatial files or draw the site area directly on the map.
2. We are accepting geospatial files in KML, GPKG or SHP format. If you're using SHP files, they must be zipped, containing .shp, .shx and .dbf files, all with the same file name.
3. Select the 'By Area Draw' option to outline the site area directly on the map. Click on the draw icon available at the top centre of the loaded map to start drawing. Once you're done, make any necessary adjustments to the drawn area and then click the 'Confirm' button to save your site data.
4. You can clear the drawn data by using the reset button if you want to start over from the beginning.

Please upload a list of species found and being planted in your project area. (Required)
Please use the template found here. Please complete the relevant presence/absence data for each of the sites.
Max. file size: 500 MB.

The following questions should be completed for each distinct site.
Site type (Required)

Site 1 – Information

- ❒ Protected area under restoration
- ❒ Other ecological restoration areas
- ❒ Agroforestry areas
- ❒ Plantation areas
- ❒ Agricultural areas

What is the area of the site? (Required)
Please provide the area in hectares.

Please upload geospatial data relevant to your site.
Points to follow:
1. You have two options to add your geospatial data relevant to your site. You can either upload geospatial files or draw the site area directly on the map.
2. We are accepting geospatial files in KML, GPKG or SHP format. If you're using SHP files, they must be zipped, containing .shp, .shx and .dbf files, all with the same file name.
3. Select the 'By Area Draw' option to outline the site area directly on the map. Click on the draw icon available at the top centre of the loaded map to start drawing. Once you're done, make any necessary adjustments to the drawn area and then click the 'Confirm' button to save your site data.
4. You can clear the drawn data by using the reset button if you want to start over from the beginning.
   Max. file size: 500 MB.

Describe protective measures in place for existing native habitats. (Required)
Please provide a narrative detailing which protective measures are in place.

Provide evidence of protective measures.
E.g., formal protection letter, site management plans, conservation easement documentation.
Max. file size: 500 MB.

Restoration category of the project. (Required)

- ❒ Natural recovery
- ❒ Assisted natural recovery without planting, seeding or faunal introductions
- ❒ Assisted natural recovery with planting, seeding or faunal introductions
- ❒ Reconstruction or heavily assisted recovery

What restoration activities are being done at the site for soil and water management? (Required)
Select all that apply.

- ❒ Grading to establish topography
- ❒ Soil erosion control and reversal
- ❒ Addition of growth medium (e.g., topsoil, mulch, compost, microbial content, mining by product)
- ❒ Bed preparation (e.g., tilling, raking, disking, rolling, cultipacking, furrowing, pitting, ploughing, scalping)
- ❒ Reduced tillage
- ❒ Improved fertiliser and agrochemical use efficiency
- ❒ Conversion to organic or non-synthetic fertilisation and pesticide systems
- ❒ Improvement of soil fertility through vegetation management (e.g., crop rotation, cover crops, nurse crops)
- ❒ Improved irrigation and water use efficiency at site
- ❒ Improved water quality at site
- ❒ Improved watershed management
- ❒ Rainwater and run-off harvesting (e.g., terracing, stone cords, zaï, half-moons)
- ❒ Fog collection
- ❒ Desalination wastewater treatment
- ❒ Restoration of wetland hydrology
- ❒ Amelioration of contaminated or nutrient enriched soils
- ❒ Unsealing and decompaction of soils
- ❒ Other soil and water management
- ❒ None

What restoration activities are being done at the site for the restoration of vegetation cover and ecosystem structure? (Required)
Select all that apply.

- ❒ Increase in legal ecosystem protection (e.g., establishment of additional protected areas or conservation easements)
- ❒ Enforcement of restrictions or prohibitions of ecosystem conversion or destruction
- ❒ Implementation of sustainable ecosystem management practices in productive landscapes (e.g., organic farming, agroforestry, farmer-managed regeneration)
- ❒ Elimination of sources of degradation (e.g., protection from overhunting, overharvesting, overfishing or poaching; re-establishment of characteristic hydrology including dam removal and streambank repair; protection from uncharacteristic fire)
- ❒ Reinstatement of natural or semi-natural disturbance regimes (e.g., fire, flooding, grazing, haymaking)
- ❒ Fire management, including site preparation (e.g., thinning, hardwood reduction, establishment of fire breaks)
- ❒ Prescribed burning
- ❒ Grazing management (e.g., control of native grazer populations; reduction, removal or exclusion of non-native grazers)
- ❒ Weeding or pruning
- ❒ Tree planting
- ❒ Shrub planting
- ❒ Herbaceous species and subshrub planting (e.g., grasses, forbs, ferns, terrestrial mosses and lichens)

- ❒ Other vegetation introduction (e.g., epiphytes, hemiepiphytes, vines, parasites, hemiparasites)
- ❒ Direct seeding or dibbling
- ❒ Other terrestrial plant establishment methods (additions of hay, soil, use of conmods)
- ❒ Other restoration of vegetation cover and ecosystem structure
- ❒ None

What restoration activities are being done at the site for the control of invasive species? (Required)
Select all that apply.

- ❒ Quarantine measures
- ❒ Species control measures, physical or mechanical (e.g., cutting, pulling, burning, covering, digging up, ploughing, scalping, mowing, capturing, hunting)
- ❒ Species control measures, biological (release of biological control agents, grazing, predation)
- ❒ Species control measures, organic or non-synthetic chemical (e.g., organic herbicides)
- ❒ Species control measures, synthetic chemical
- ❒ Post-control measures
- ❒ Re-invasion monitoring and prevention measures
- ❒ Management of secondary invasives
- ❒ Other control of invasive species
- ❒ None

Was or is the project area you are restoring an undisturbed natural habitat in the last 30 years? (Required)

- ❒ Yes
- ❒ No

If Yes - what kind of habitat was or is it? (Required)

- ❒ T1 Tropical-subtropical forests biome
- ❒ T2 Temperate-boreal forests and woodlands biome
- ❒ T3 Shrublands and shrubby woodlands biome
- ❒ T4 Savannas and grasslands biome
- ❒ T5 Deserts and semi-deserts biome
- ❒ T6 Polar-alpine (cryogenic) biome
- ❒ T7 Intensive land-use biome
- ❒ S1 Subterranean lithic biome
- ❒ S2 Anthropogenic subterranean voids biome
- ❒ SF1 Subterranean freshwaters biome
- ❒ SF2 Anthropogenic subterranean freshwaters biome
- ❒ SM1 Subterranean tidal biome
- ❒ TF1 Palustrine wetlands biome
- ❒ F1 Rivers and streams biome
- ❒ F2 Lakes biome
- ❒ F3 Artificial wetlands biome
- ❒ FM1 Semi-confined transitional waters biome
- ❒ MT1 Shorelines biome
- ❒ MT2 Supralittoral coastal biome
- ❒ MT3 Anthropogenic shorelines biome
- ❒ MFT1 Brackish tidal biome

Please describe the target reference ecosystem of this project area. (Required)

- ❒ T1 Tropical-subtropical forests biome
- ❒ T2 Temperate-boreal forests and woodlands biome
- ❒ T3 Shrublands and shrubby woodlands biome
- ❒ T4 Savannas and grasslands biome
- ❒ T5 Deserts and semi-deserts biome
- ❒ T6 Polar-alpine (cryogenic) biome
- ❒ T7 Intensive land-use biome
- ❒ S1 Subterranean lithic biome
- ❒ S2 Anthropogenic subterranean voids biome
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- ❒ F2 Lakes biome
- ❒ F3 Artificial wetlands biome
- ❒ FM1 Semi-confined transitional waters biome
- ❒ MT1 Shorelines biome
- ❒ MT2 Supralittoral coastal biome
- ❒ MT3 Anthropogenic shorelines biome
- ❒ MFT1 Brackish tidal biome

Please describe the biodiversity of the target reference ecosystem. (Required)

Please describe the biodiversity of the site at project inception. (Required)

Please describe the current biodiversity of the site. (Required)

Provide evidence of native & threatened species planted in your project (i.e., photos, nursery records, etc.).
Max. file size: 500 MB.

Please provide evidence of the source of seed/seedlings and their destination habitats at the restoration sites.
Max. file size: 500 MB.

Have you undertaken measures to increase the climate resilience of your planting material? (Required)

❒ Yes
❒ No

If Yes - please describe measures taken to increase the climate resilience of your planting material. (Required)

If Yes - please upload evidence of measures taken to increase the climate resilience of your planting material.
Max. file size: 500 MB.

Partnerships

Stakeholder Engagement

Do you work in consultation and partnership with local communities and other key stakeholders? (Required)

❒ Yes
❒ No

Please list all primary stakeholders involved or associated with the project site. (Required)
Primary Stakeholder – Any individual or group that is resident in and/or has the potential to influence the site area and is affected by the project interventions. This should include any individuals with customary user rights who are impacted by and use the biodiversity of the area either legally or illegally.

Please list all secondary stakeholders involved or associated with the project site.
Secondary Stakeholder – Any individual with indirect influence or interest on the site area. This could include government officials, politicians, religious leaders, societies, academics.

Please describe how you work in consultation and partnership with each primary and secondary stakeholder listed above, and provide details whether activities are planned, operational or completed. Examples of stakeholder engagement can be found in the list below.
Guidance: If any indigenous peoples are identified as primary stakeholders, a free prior and informed consent (FPIC) process must be carried out. If applicable, please describe in this section.

- Stakeholder analysis and mapping completed (e.g., stakeholder map, list, plan)
- Stakeholders being made aware of the project (e.g., through flyers, community meetings, feedback and grievance mechanisms established or planned)
- Evidence of involvement in project activities (e.g., community tree planting days or other sensitisation activities, local priorities considered in project design, e.g., species selection, participatory monitoring strategies, community engagement strategies, political engagement strategies)

Benefits Distribution

Does the project provide benefits to primary stakeholders? Please explain in detail.

❒ Biological control of disease vectors | Please detail

❒ Improved local infrastructure | Please detail

❒ Food security | Please detail

❒ Fuel security | Please detail

❒ Gender equality | Please detail

❒ Health | Please detail

❒ Recreation value (access to green space) | Please detail

❒ Reduced human-wildlife conflict | Please detail

❒ Reduced disaster risk | Please detail

❒ Reduced rural migration | Please detail

❒ Spiritual value | Please detail

❒ Tenure or use rights clarity and enforcement | Please detail

❒ Water security | Please detail

❒ Other | Please detail

Does the project share opportunities or benefits equitably among primary or secondary stakeholders? (Required)

❒ Yes
❒ No

If Yes - please explain how the project shares opportunities or benefits equitably among primary or secondary stakeholders.
Examples:
Equal opportunities policy
Local vs. non-local employees
Gender balance of employees
Employment of minority groups

Does the project build capacity among primary or secondary stakeholders? (Required)
Yes
No

If Yes - please explain how the project builds capacity among stakeholders. (Required)
Examples:
Trainings conducted
Knowledge and skills sharing activities

Knowledge Enrichment

Does the project incorporate knowledge from one or more key stakeholders? (Required)

❒ Yes
❒ No

If Yes - please explain how the project incorporates knowledge from one or more key stakeholders. (Required)
Examples:
Local or indigenous knowledge
Science and conservation best practices

Sustainable Economies

Do you support your local economy by utilising local infrastructure and supply chains or providing local employment and/or other livelihood opportunities? (Required)

❒ Yes
❒ No

If Yes - explain how you support your local economy by utilising local infrastructure and supply chains or providing local employment. (Required)
Please explain if you employ local people, whether this is on a full-time/part-time basis, skilled or unskilled work, etc.

Please upload all relevant supporting documentation for sections 1-4.
E.g., upload supply chain information, letters of support, memorandums of understanding, contracts, etc. signed by stakeholders.
Max. file size: 500 MB.

Monitoring and Evaluation

Monitoring and Evaluation

Please describe your monitoring and evaluation protocols. (Required)

Please upload baseline biodiversity survey data from your site.
Add file or drag and drop files into this box.
Max. file size: 500 MB.

Please upload a monitoring and evaluation plan for your project.
Add file or drag and drop files into this box.
Max. file size: 500 MB.

Please upload a recent monitoring and evaluation report.
Add file or drag and drop files into this box.
Max. file size: 500 MB.

Please upload evidence of adaptive management for biodiversity conservation and/or sustainable use.
Add file or drag and drop files into this box.
Max. file size: 500 MB.

Terms and Conditions

❒ I agree to the Global Biodiversity Standard Exclusion List.

❒ I agree to the Global Biodiversity Standard Terms and Conditions.

Appendix B: Assessment Form

Contents

B.1 Project Details

a. Name of applicant individual:
b. Name of applicant organisation, agency or institution:
c. Name of project:
d. Site location (polygon):
e. Area (in hectares):
f. Number of zones of different restoration types:

g. Restoration type:
- Protected areas under restoration
- Other ecological restoration areas
- Rehabilitation areas, including:
  - Agroforestry areas
  - Plantation areas
  - Agricultural areas

h. Restoration approach:
- Natural recovery
- Assisted natural recovery without planting, seeding or faunal introductions
- Assisted natural recovery with planting, seeding or faunal introductions
- Reconstruction or heavily assisted recovery

i. Biome:[6]
- T1 Tropical-subtropical forests biome
- T2 Temperate-boreal forests and woodlands biome
- T3 Shrublands and shrubby woodlands biome
- T4 Savannas and grasslands biome
- T5 Deserts and semi-deserts biome
- T6 Polar-alpine (cryogenic) biome
- T7 Intensive land-use biome
- S1 Subterranean lithic biome
- S2 Anthropogenic subterranean voids biome
- SF1 Subterranean freshwaters biome
- SF2 Anthropogenic subterranean freshwaters biome
- SM1 Subterranean tidal biome
- TF1 Palustrine wetlands biome
- F1 Rivers and streams biome
- F2 Lakes biome
- F3 Artificial wetlands biome
- FM1 Semi-confined transitional waters biome
- MT1 Shorelines biome
- MT2 Supralittoral coastal biome
- MT3 Anthropogenic shorelines biome
- MT1 Brackish tidal biome

j. Ecosystem type:[7]
- T1.1 Tropical-subtropical lowland rainforests
- T1.2 Tropical-subtropical dry forests and thickets
- T1.3 Tropical-subtropical montane rainforests
- T1.4 Tropical heath forests
- T2.1 Boreal and temperate high montane forests and woodlands
- T2.2 Deciduous temperate forests
- T2.3 Oceanic cool temperate rainforests
- T2.4 Warm temperate laurophyll forests
- T2.5 Temperate pyric humid forests
- T2.6 Temperate pyric sclerophyll forests and woodlands
- T3.1 Seasonally dry tropical shrublands
- T3.2 Seasonally dry temperate heaths and shrublands
- T3.3 Cool temperate heathlands
- T3.4 Rocky pavements, lava flows and screes
- T4.1 Trophic savannas
- T4.2 Pyric tussock savannas
- T4.3 Hummock savannas
- T4.4 Temperate woodlands
- T4.5 Temperate subhumid grasslands
- T5.1 Semi-desert steppes
- T5.2 Succulent or thorny deserts and semi-deserts
- T5.3 Sclerophyll hot deserts and semi-deserts
- T5.4 Cool deserts and semi-deserts
- T5.5 Hyper-arid deserts
- T6.1 Ice sheets, glaciers and perennial snowfields

- T6.2 Polar alpine rocky outcrops
- T6.3 Polar tundra and deserts
- T6.4 Temperate alpine grasslands and shrublands
- T6.5 Tropical alpine grasslands and herb fields
- T7.1 Annual croplands
- T7.2 Sown pastures and fields
- T7.3 Plantations
- T7.4 Urban and industrial ecosystems
- T7.5 Derived semi-natural pastures and old fields
- S1.1 Aerobic caves
- S1.2 Endolithic systems
- S2 Anthropogenic subterranean voids biome
- S2.1 Anthropogenic subterranean voids
- SF1.1 Underground streams and pools
- SF1.2 Groundwater ecosystems
- SF2 Anthropogenic subterranean freshwaters biome
- SF2.1 Water pipes and subterranean canals
- SF2.2 Flooded mines and other voids
- SM1.1 Anchialine caves
- SM1.2 Anchialine pools
- SM1.3 Sea caves
- TF1.1 Tropical flooded forests and peat forests
- TF1.2 Subtropical-temperate forested wetlands
- TF1.3 Permanent marshes
- TF1.4 Seasonal floodplain marshes
- TF1.5 Episodic arid floodplains
- TF1.6 Boreal, temperate and montane peat bogs
- TF1.7 Boreal and temperate fens
- F1.1 Permanent upland streams
- F1.2 Permanent lowland rivers
- F1.3 Freeze-thaw rivers and streams
- F1.4 Seasonal upland streams
- F1.5 Seasonal lowland rivers
- F1.6 Episodic arid rivers
- F1.7 Large lowland rivers
- F2.1 Large permanent freshwater lakes
- F2.2 Small permanent freshwater lakes
- F2.3 Seasonal freshwater lakes
- F2.4 Freeze-thaw freshwater lakes
- F2.5 Ephemeral freshwater lakes
- F2.6 Permanent salt and soda lakes
- F2.7 Ephemeral salt lakes
- F2.8 Artesian springs and oases
- F2.9 Geothermal pools and wetlands
- F2.10 Subglacial lakes
- F3.1 Large reservoirs
- F3.2 Constructed lacustrine wetlands
- F3.3 Rice paddies
- F3.4 Freshwater aquafarms
- F3.5 Canals, ditches and drains
- FM1.1 Deepwater coastal inlets
- FM1.2 Permanently open riverine estuaries and bays
- FM1.3 Intermittently closed and open lakes and lagoons
- M1.1 Seagrass meadows
- M1.2 Kelp forests
- M1.3 Photic coral reefs
- M1.4 Shellfish beds and reefs
- M1.5 Photo-limited marine animal forests
- M1.6 Subtidal rocky reefs
- M1.7 Subtidal sand beds
- M1.8 Subtidal mud plains
- M1.9 Upwelling zones
- M2.1 Epipelagic ocean waters
- M2.2 Mesopelagic ocean waters
- M2.3 Bathypelagic ocean waters
- M2.4 Abyssopelagic ocean waters
- M2.5 Sea ice
- M3.1 Continental and island slopes
- M3.2 Submarine canyons
- M3.3 Abyssal plains
- M3.4 Seamounts, ridges and plateaus
- M3.5 Deepwater biogenic beds
- M3.6 Hadal trenches and troughs
- M3.7 Chemosynthetic-based ecosystems (CBE)
- M4.1 Submerged artificial structures
- M4.2 Marine aquafarms
- MT1.1 Rocky shorelines
- MT1.2 Muddy shorelines
- MT1.3 Sandy shorelines
- MT1.4 Boulder and cobble shores
- MT2.1 Coastal shrublands and grasslands
- MT3.1 Artificial shorelines
- MFT1.1 Coastal river deltas
- MFT1.2 Intertidal forests and shrublands
- MFT1.3 Coastal saltmarshes and reedbeds

B.2 Assessor Details

a. **Name(s) of assessor(s)**
b. **Affiliated institution**
c. **Date of visit**
d. **Persons consulted (representative of management/main landscape interventions/main community interfaces)**

Name	Position	Organisation

B.3 Restoration Activities

a. There is evidence of soil and water management restoration activities
- Grading to establish topography
- Soil erosion control and reversal
- Addition of growth medium (e.g., topsoil, mulch, compost, microbial content, mining by-product)
- Bed preparation (e.g., tilling, raking, disking, rolling, cultipacking, furrowing, pitting, ploughing, scalping)
- Reduced or no tillage
- Improved fertiliser and agrochemical use efficiency
- Conversion to organic or non-synthetic fertilisation and pesticide systems
- Improvement of soil fertility through vegetation management (e.g., crop rotation, cover crops, nurse crops)
- Improved irrigation and water use efficiency at site
- Improved water quality at site
- Improved watershed management
- Rainwater and run-off harvesting (e.g., terracing, stone cords, zaï, half-moons)
- Fog collection
- Desalination wastewater treatment
- Restoration of wetland hydrology
- Amelioration of contaminated or nutrient-enriched soils
- Unsealing and decompaction of soils
- Other soil and water management
- None

b. There is evidence of vegetation cover and ecosystem structure restoration activities
- Increase in legal ecosystem protection (e.g., establishment of additional protected areas or conservation easements)
- Enforcement of restrictions or prohibitions on ecosystem conversion or destruction
- Implementation of sustainable ecosystem management practices in productive landscapes (e.g., organic farming. agroforestry. farmer-managed regeneration)
- Elimination of sources of degradation (e.g., protection from overhunting, overharvesting, overfishing or poaching; re-establishment of characteristic hydrology including dam removal and streambank repair; protection from uncharacteristic fire)
- Reinstatement of natural or semi-natural disturbance regimes (e.g., fire, flooding, grazing, haymaking)
- Fire management, including site preparation (e.g., thinning, hardwood reduction, establishment of fire breaks)
- Prescribed burning
- Grazing management (e.g., control of native grazer populations; reduction, removal or exclusion of non-native grazers)
- Weeding or pruning
- Tree planting
- Shrub planting
- Herbaceous species and subshrub planting (e.g., grasses, forbs, ferns, terrestrial mosses and lichens)
- Other vegetation introduction (e.g., epiphytes, hemiepiphytes, vines, parasites, hemiparasites)
- Direct seeding or dibbling
- Other terrestrial plant establishment methods (additions of hay, soil, use of conmods)
- Other restoration of vegetation cover and ecosystem structure
- None

c. There is evidence of control of invasive species restoration activities
- Quarantine measures
- Species control measures, physical or mechanical (e.g., cutting, pulling, burning, covering, digging up, ploughing, scalping, mowing, capturing, hunting)
- Species control measures, biological (release of biological control agents, grazing, predation)
- Species control measures, organic or non-synthetic chemical (e.g., organic herbicides)
- Species control measures, synthetic chemical
- Post-control measures
- Re-invasion monitoring and prevention measures
- Management of secondary invasives
- Other control of invasive species
- None

B.4 Remote Sensing Survey Report

a. Methods

No.	Sub-attributes assessed	Method	Evidence	Attachments	Source (if new)
1.	(Add sub-attributes included)				
(Add)	(Add sub-attributes included)				

b. Results

No.	Sub-attribute	Assessment period	Evidence	Star rating	Attachment
1. (e.g.)					
2. (e.g.)					
(Add)					

B.5 Field Survey Report

a. Methods

No.	Sub-attributes assessed	Method	Evidence	Attachments	Source (if new)
1.	(Add sub-attributes included)				
(Add)	(Add sub-attributes included)				

b. Results

No.	Sub-attribute	Assessment period	Evidence	Star rating	Attachment
1. (e.g.)	Invasive species				
2. (e.g.)	Invasive species				
(Add)					

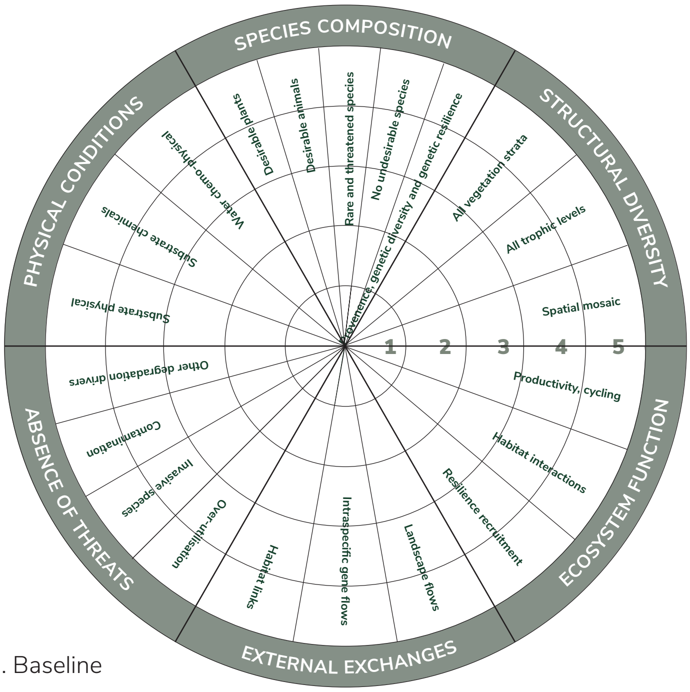
B.6 Final Assessment of Criteria 1, 4-7

Sub-attribute	Baseline Star Rating[8]	Current Star Rating	Trajectory	Reference Indicators (The five-stars condition)	Score	Description
a) Contamination	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
b) Invasive species	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
c) Over-utilisation	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
d) Other degradation drivers	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
e) Substrate physical conditions (both abiotic and biotic components)	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
f) Substrate chemical conditions	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
g) Water chemo-physical conditions	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			

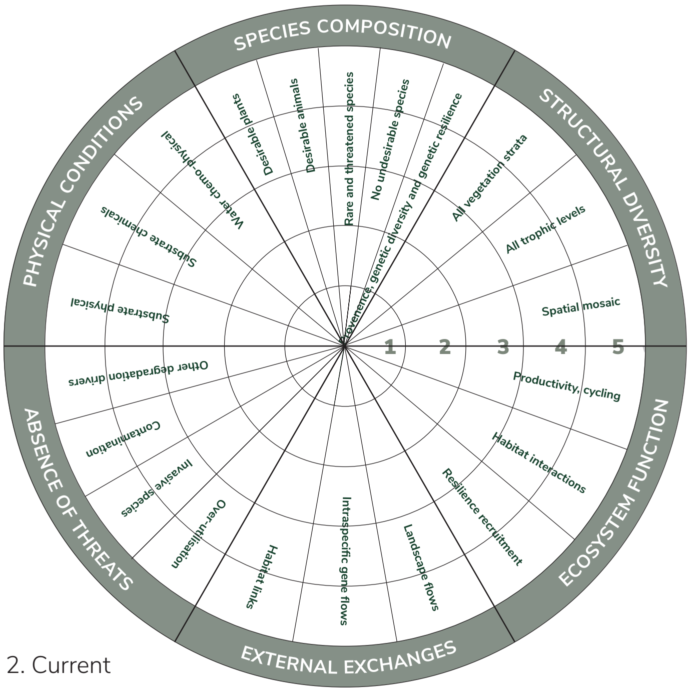
Sub-attribute	Baseline Star Rating[8]	Current Star Rating	Trajectory	Reference Indicators (The five-stars condition)	Score	Description
h) Desirable plants, fungi and lichens	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
i) Desirable animals	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
j) Rare and threatened species	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
k) No undesirable species	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
l) Provenance, genetic diversity and genetic resilience	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
m) All vegetation strata	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
n) All trophic levels	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			

Sub-attribute	Baseline Star Rating[8]	Current Star Rating	Trajectory	Reference Indicators (The five-stars condition)	Score	Description
o) Spatial mosaic	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
p) Productivity/ cycling	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
q) Habitat & interactions	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
r) Resilience/ recruitment	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
s) Landscape flows	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
t) Intraspecific gene flows	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			
u) Habitat links	0 1 2 3 4 5 Unable to assess	0 1 2 3 4 5 Unable to assess	No change Improving Declining Unable to assess			

Visualisation of Sub-Attributes Assessment Result



1. Baseline



2. Current

Figure B.1. *Blank Ecological Recovery Wheels. (Modified from Gann et al. 2019, Standards Reference Group SERA 2021, Young et al. 2022).*

B.7 Final Assessment of Level of Protection

Assessment of long-term sufficient management activities

a. There is evidence of sustainable soil and water management activities that are consistent with sustainable long-term biodiversity conservation objectives and sufficient to halt degradation and enhance biodiversity recovery.

Management activity	Sufficient level	Insufficient level	Not applicable
Soil erosion control			
Watershed management			
Management of wetland hydrology			

b. There is evidence of sustainable vegetation cover and ecosystem structure management activities that are consistent with sustainable long-term biodiversity conservation objectives. These activities are sufficient to halt degradation and enhance biodiversity recovery.

Management activity	Sufficient level	Insufficient level	Not applicable
Enforcement of restrictions or prohibitions on ecosystem conversion or destruction			
Implementation of sustainable ecosystem management practices in productive landscapes (e.g., organic farming; agroforestry; Farmer Managed Regeneration)			
Protection from overhunting, overharvesting, overfishing, or poaching			
Protection from uncharacteristic fire			
Maintenance of natural or semi-natural disturbance regimes (e.g., fire; flooding; grazing; haymaking)			
Fire management, including site preparation (e.g., thinning, hardwood reduction, establishment of fire breaks)			
Prescribed burning			
Grazing management (e.g., control of native grazer populations; reductions, removal, or exclusion of non-native grazers)			

c. There is evidence of control of invasive species management activities that are consistent with sustainable long-term biodiversity conservation objectives and sufficient to halt degradation and enhance biodiversity recovery.

Management activity	Sufficient level	Insufficient level	Not applicable
Species control measures, physical or mechanical (e.g., cutting, pulling, burning, covering, digging up, ploughing, scalping, mowing, capturing, hunting)			
Species control measures, biological (release of biological control agents, grazing, predation)			
Species control measures, organic or non-synthetic chemical (e.g., organic herbicides)			
Species control measures, synthetic chemical			
Post-control measures			
Re-invasion monitoring and prevention measures			
Management of secondary invasives			
Other control of invasive species			

d. Star rating of the level of protection

Time	Star Rating	Category[9]	Description	Evidence
Baseline	0 1 2 3 4 5 Unable to assess	Strict nature reserve Wilderness area National park Natural monument or feature Habitat/species management area Protected landscape/seascape Protected area with sustainable use of natural resources Area with near sustainable use of natural resources Primary conservation Area with partial sustainable use of natural resources Informal area of conservation Concerned park Secondary conservation Ancillary conservation Paper park Conflicted Concerned Threatened Vulnerable Collapse		
Current	0 1 2 3 4 5 Unable to assess	Strict nature reserve Wilderness area National park Natural monument or feature Habitat/species management area Protected landscape/seascape Protected area with sustainable use of natural resources Area with near sustainable use of natural resources Primary conservation Area with partial sustainable use of natural resources Informal area of conservation Concerned park Secondary conservation Ancillary conservation Paper park Conflicted Concerned Threatened Vulnerable Collapse		

B.8 Final Assessment of Stakeholder Engagement

Attribute	Score[10]		Description	Evidence
Stakeholder Engagement	+1	Stakeholders identified and informed		
	+1	Grievance mechanism		
	+1	Primary stakeholders involved		
	+1	Secondary stakeholders involved		
Benefits Distribution	+1	Capacity increased		
	+1	Benefits equitably distributed		
	+1	Community well-being improved		
Knowledge Enrichment	+0.5	Indigenous knowledge incorporated		
	+0.5	Scientific best practice incorporated		
	+0.5	Knowledge contributed		
Sustainable Economies	+0.5	Increased employment		
	+0.5	Local economy improved		
	+0.5	Sustainable business		

Field survey in a restoration site in Minas Gerais, Brazil. (Luiz H. R. Baqueiro – Araribá Botanical Garden)

B.9 Final Evaluation of Monitoring, Evaluation and Adaptive Management

a. What management is in place?

Adapted from Standards of practice to guide ecosystem restoration (Nelson et al. 2024).

i) Ongoing Management Planning (max. 2 points)

- The management plan is co-developed with stakeholders and rights and knowledge holders, including local restoration practitioners and implementers.
- The plan builds as far as possible on effective practices, including traditional and indigenous peoples' management practices.
- The plan incorporates relevant management agreements and includes a detailed description of all required activities specifying their duration of time and frequency.
- The management plan involves subject matter experts, including local restoration practitioners and other stakeholders and rights and knowledge holders, who can help develop innovative management methods based on lessons learned from other projects.
- The management plan is available to all those involved in the ongoing management of the project.
- The management plan identifies the ongoing management team, and clearly communicates roles and responsibilities of members of the team.
- The ongoing management plan is modified based on the results of periodic monitoring, and of changes in trade-offs or stakeholder or rights and knowledge holder interests or needs.

ii) Long-term Resourcing (max. 2 points)

- If not fully secured, appropriate long-term sources of funding for ongoing management are determined. There is coordination with other restoration projects to reduce costs and duplication of effort. These synergies can include, for example, alignment of schedules to facilitate sourcing of plant materials, sharing equipment and monitoring.
- The project conducts periodic monitoring of the site to check for recurrence of degradation and to protect the investment in restoration, involving local stakeholders and rights and knowledge holders, including indigenous peoples and key groups living in and adjacent to the project sites as much as possible.
- The project conducts site protection measures needed to prevent deleterious external or internal impacts (e.g., protection from unsustainable grazing, prevention of inappropriate fire, prevention of unsustainable harvesting, control of infestations by invasive species, management of weeds and other vegetative competitors).
- The project ensures essential ecosystem functions and processes are operating as appropriate and required to maintain ecosystem integrity and provide ecosystem resilience to degradation stressors (e.g., management of hydrological regimes, ensuring natural disturbance regimes such as periodic fire in fire-adapted ecosystems or flooding of riparian zones).
- The project facilitates beneficial external exchanges with the broader landscape, including the exchange of genetic material in fragmented landscapes (e.g., through hand pollination or movement of propagules), or for depleted populations suffering from inbreeding depression or other genetic deficiencies.
- The project develops or supports training and stewardship programmes for local communities and practitioners, to improve ongoing management of the site and prevent harm from inappropriate management.
- The project provides a governance structure to oversee ongoing management and stewardship of the site, and ensure legal protections for the investments made in restoration.

iii) Adaptive Management (max. 1.5 points)

- The project invests in knowledge sharing, acquisition and training to incorporate updated best practices when designing and implementing responses to unexpected or unforeseen events that threaten the integrity of the restoration site.
- The project prepares contingency plans and protocols in case known degradation drivers re-emerge (e.g., populations of invasive animals that were previously managed through a biocontrol agent that ceases to function).
- The project consults the monitoring and evaluation plan before conducting implementation and ongoing management, to avoid activities in a manner that reduces the ability to learn about treatment outcomes.
- The project identifies assumptions and uncertainty in implementation and ongoing management and verifies those activities into the restoration, monitoring and evaluation plan.

iv) Continuous Improvement (max. 1.5 points)

- The project adopts a policy of continuous improvement informed by reliable monitoring. Such a policy can allow managers to continually upgrade and build on project goals to advance initial recovery towards progressively higher outcomes, seeking the highest level of recovery possible over the long term.
- The project seeks opportunities for the implementation of additional restoration activities or projects at the project site or in the broader landscape or seascape through replication or scaling up.
- The project conducts additional restoration activities that take advantage of the improved condition of the site (e.g., infill planting, reintroduction or augmentation of rare species, reinstatement of natural disturbance regimes).
- The project promotes engagement and buy-in from local stakeholders and rights and knowledge holders, including indigenous peoples and key groups, so that they can foster and be part of continuous improvement.
- The project explores further funding mechanisms and capital investment to extend restoration to adjacent or nearby sites, including the development of partnerships with local agencies and other organisations.

b. What baseline and monitoring data are available?

Adapted from the Restoration Project Information Sharing Framework (Gann et al. 2022).

v) Monitoring and Evaluation (max. 3 points)

- The monitoring programme was planned while the restoration project or programme was being designed, rather than after implementation.
- The monitoring programme/activities is adequately resourced.
- The monitoring programme/activities has the proper timing, frequency and duration so that lessons learned can be applied to adaptive management.
- Monitoring questions are directly linked with restoration objectives.
- Monitoring questions are clearly described in planning documents, with specific measurable indicators that include the amount of change desired and a specified time frame.
- The monitoring programme/activities includes collecting, managing (including cleaning and meta-data documentation) and archiving data.
- The monitoring programme/activities includes statistical analyses (if appropriate).
- The monitoring programme includes a plan for interpreting results and sharing findings.
- The monitoring programme/activities is being used to apply lessons learned to adaptive management within and across programmes.
- The monitoring plan includes an evaluation of the efficacy of the monitoring programme itself.

Monitoring and Evaluation (max. 3 points)	
Planned before implementation +0.5	Collecting, managing and archiving data +0.5
Adequate resourcing +0.5	Statistical analyses +0.5
Proper timing, frequency and duration +0.5	Interpret results and share findings +0.5
Linked with restoration objectives +0.5	Informs adaptive management +0.5
Clear questions and specific indicators +0.5	Evaluation of monitoring programme +0.5

Adaptive Management (max. 1.5 points)
Incorporate updated best practices +0.5
Contingency plans and protocols +0.5
Consults monitoring plan +0.5
Verifies actions against uncertainty +0.5

Ongoing Management Planning (max. 2 points)
Stakeholder co-development +0.5
Builds on effective practices +0.5
Detailed management plan +0.5
Involves subject matter experts +0.5
Management plan available +0.5
Management team identified +0.5
Modify plan based on monitoring +0.5

Long-term Resourcing (max. 2 points)
Funding secured or determined +0.5
Periodic monitoring +0.5
Site protection measures +0.5
Ecosystem functions and processes operational +0.5
Beneficial external exchanges facilitated +0.5
Training and stewardship +0.5
Governance structure +0.5

Continuous Improvement (max. 1.5 points)
Continuous improvement +0.5
Replication or scaling up +0.5
Additional activities +0.5
Buy-in from local communities +0.5
Extend to nearby sites +0.5

B.10 Final Assessment Summary

Criteria	Requirements	Validation (by Assessor)	Score	Verification status (by the Secretariat)
Criterion 1*: Select appropriate sites to enhance native biodiversity **Criterion 1 assessment solely provides Criteria 4-7 sub-attributes data.*	❑ Sub-attributes assessed: __of 21 ❑ Critical: __of 11 ❑ Preferable: __ of 7 ❑ Optional: __of 3	❑ Completed ❑ Require additional data:		❑ Submitted ❑ On review ❑ Scoring process ❑ Clarification needed ❑ On verification ❑ Third-party verification ❑ Verified
Criterion 2: Enhance protection of existing habitats and biodiversity	❑ Assessment of long-term sufficient management activities ❑ Star rating of level of protection	❑ Completed ❑ Require additional data:		
Criterion 3: Protect, restore and manage biodiversity in consultation and partnership with local communities and other stakeholders	❑ Stakeholder engagement ❑ Benefits distribution ❑ Knowledge enrichment ❑ Sustainable economies	❑ Completed ❑ Require additional data:		
Criterion 4: Aim to maximise biodiversity recovery through ecosystem restoration	❑ Sub-attributes assessed: __ of 6	❑ Completed ❑ Require additional data:		
Criterion 5: Avoid and reduce invasive or potentially invasive species	❑ Sub-attributes assessed: __ of 2	❑ Completed ❑ Require additional data:		
Criterion 6: Prioritise the use of native, threatened and rare species	❑ Sub-attributes assessed: __ of 2	❑ Completed ❑ Require additional data:		
Criterion 7: Promote biodiversity and adaptive capacity	❑ Sub-attributes assessed: __ of 2	❑ Completed ❑ Require additional data:		
Criterion 8: Implement robust monitoring, evaluation and adaptive management of biodiversity	❑ Presence and comprehensiveness of the ongoing monitoring, evaluation and adaptive management of the project ❑ Availability of baseline and monitoring data	❑ Completed ❑ Require additional data:		

Notes

[6] Keith DA, Ferrer-Paris JR, Nicholson E, Kingsford RT (eds) (2020) The IUCN global ecosystem typology 2.0: descriptive profiles for biomes and ecosystem functional groups. International Union for Conservation of Nature, Gland, Switzerland

[7] Keith DA, Ferrer-Paris JR, Nicholson E, Kingsford RT (eds) (2020) The IUCN global ecosystem typology 2.0: descriptive profiles for biomes and ecosystem functional groups. International Union for Conservation of Nature, Gland, Switzerland

[8] Descriptions of Ecosystem Integrity star ratings are outlined in Appendix F.

[9] Descriptions of level of protection categories are outlined in Appendix G.

[10] Description of Stakeholder Engagement and Social Benefit ratings are outlined in Appendix H.

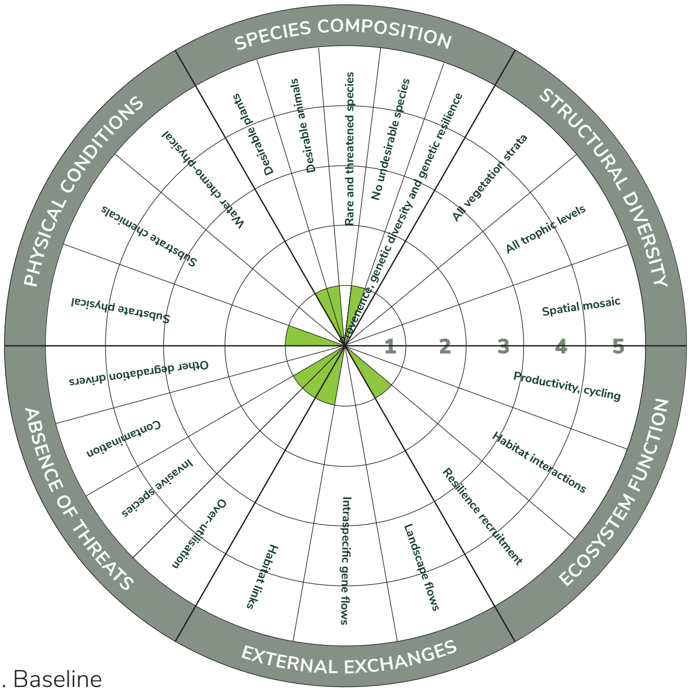
Appendix C: Using the Ecosystem Integrity Five-star System

Contents

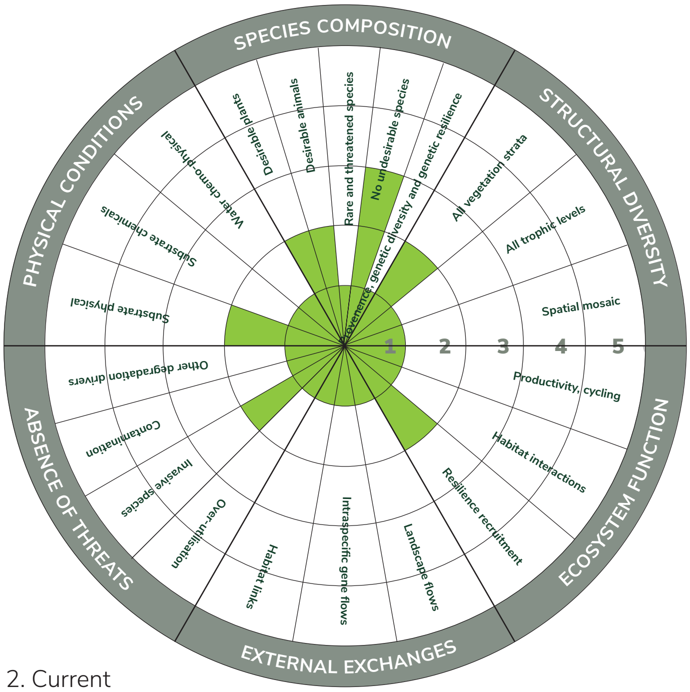
C.1 Introduction

The Global Biodiversity Standard (TGBS) utilises a comprehensive Five-star System to assess and score ecosystem integrity (criterion 1), including: biodiversity (criterion 4); absence of invasive species (criterion 5); native, rare and threatened species (criterion 6); and, adaptive capacity (criterion 7). The Five-star System utilised by the TGBS is adapted from the Five-star System and Ecological Recovery Wheel (ERW) published by the Society for Ecological Restoration (Gann et al. 2019, Standards Reference Group SERA 2021, Young et al. 2022; Figure B.1), which is a widely recognised and accepted framework for measuring, assessing and communicating the outcomes of restoration efforts. The 2019 SER Five-star System measures changes in six key ecosystem attributes and 18 sub-attributes identified in the SER Standards from a baseline towards an agreed native reference model. The TGBS Five-star System includes three additional sub-attributes (totalling 21 sub-attributes) that are key to assessing projects for the TGBS: other degradation drivers in Absence of Threats, and provenance, genetic diversity and resilience, and rare and threatened species in Species Composition (Figure C.1; Tables C1, C2).

The rating system, ranging from zero to five stars, provides a clear and concise method for categorising ecosystems based on their current condition relative to a baseline condition and a native reference model. The Five-star System is designed to help restoration practitioners, landowners, assessors, researchers and policymakers assess the state of an ecosystem, measure change following ecological restoration or rehabilitation efforts, and prioritise ongoing restoration and conservation efforts accordingly. **Full recovery** is defined as the state or condition whereby, following restoration, all key ecosystem attributes closely resemble those of the reference model (Gann et al. 2019). The concept of full recovery aligns with the concept of high ecosystem integrity, which is generally understood to be when dominant ecological characteristics (e.g., elements of composition, structure and functions) occur within their natural ranges of variation and can withstand and recover from most perturbations (CBD 2021). Where lower levels of recovery are planned or occur because of resource, technical, environmental or social constraints, recovery is referred to as **partial recovery**. In some TGBS projects, the restoration of a native ecosystem is not the target, but rather a regenerative agricultural system. In these cases, the major category of restoration is rehabilitation, in the area of overlap with ecological restoration on the restorative continuum (Figure 1.1).



1. Baseline



2. Current

Figure C.1. *The TGBS Ecological Recovery Wheel is used to visualise changes in ecosystem integrity relative to the site's baseline condition, including: biodiversity; native, rare and threatened species; the absence of invasive species; and genetic diversity. (Modified from Gann et al. 2019, Standards Reference Group SERA 2021, Young et al. 2022).*

A regional TGBS hub in Malaysia. (Tropical Rainforest Conservation & Research Centre)

Table C1. *Summary of generic standards for one- to five-star recovery levels. Each level is cumulative. Although this table provides a sketch of what different star conditions might look like, sites are likely to have different star levels for different attributes at any one time; hence it is preferable to use the Ecological Recovery Wheel, which tracks progress for six key ecosystem attributes and 21 sub-attributes through measurements of key indicators (section C.5) (Modified from Gann et al. 2019; Standards Reference Group SERA 2021, Young et al. 2022).*

Ecosystem Integrity	General Description
Zero stars	Threats are numerous and persistent and conservation status may not be secured. Substrates are physically and chemically distinct from the reference ecosystem. The site is without vegetation or dominated by undesirable species and no or few native species are present. Ecosystem processes, functions and exchanges are largely absent. There are limited or very low positive exchanges with the surrounding environment.
One star ★	Some threats absent and conservation status secured but other threats persist at a high level. Substrates physically and chemically showing some similarity to the reference ecosystem and some colonising species present. Foundational level of ecosystem processes, functions and exchanges present.
Two stars ★★	Threats intermediate in degree. Physical conditions capable of supporting some native species. Site has a small subset of characteristic native species with intermediate levels of undesirable species present. Low numbers and levels of ecosystem processes and functions present. Positive exchanges with the surrounding environment in place for a few species and processes.
Three stars ★★★	Low numbers of threats but still intermediate in degree. Physical conditions capable of supporting many native species. Key native species are established present over substantial proportions of the site. Intermediate levels of functions and processes present. Positive exchanges with the surrounding environment are in place for intermediate levels of species and processes.
Four stars ★★★★	Threats low in number and degree and physical conditions of high similarity to the reference. A substantial diversity of characteristic species present representing a diversity of function groups, along with characteristic structure, and substantial functions and processes. Positive exchanges in place for most characteristic species and processes.
Five stars ★★★★★	Threats effectively absent. A characteristic assemblage of species present, exhibiting structural and trophic complexity of very high similarity to the reference. All functions and processes are present and show evidence of being sustained. Exchanges are highly similar to the reference and show evidence of being sustained.

C.2 Attributes and Sub-attributes in the Five-star System

There are six key ecosystem attributes in the TGBS Five-star System, the same as in the SER original, and 21 sub-attributes, from which indicators and monitoring metrics are identified. Changes in values (i.e., star rankings) and trajectories are used to score projects for the TGBS.

- **Absence of threats:** This attribute focuses on the absence of harmful factors that can negatively impact the ecosystem. It includes the absence of contamination (a), invasive species (b), over-utilisation (c) and other degradation drivers (d).

- **Physical conditions:** This attribute relates to the necessary environmental conditions for the ecosystem to thrive. It includes water chemo-physical conditions (e), substrate chemical conditions (f) and substrate physical conditions (g).

- **Species composition:** This attribute pertains to the presence of desirable native species and the absence of undesirable species within the ecosystem. It includes desirable plants, fungi and lichens (h), desirable animals (i), rare and threatened species (j), no undesirable species (k), and provenance, genetic diversity and genetic resilience (l).

- **Structural diversity:** This attribute focuses on the diversity and complexity of the ecosystem's structural components. It includes all vegetation strata (m), all trophic levels (n) and spatial mosaics (o).

- **Ecosystem function:** This attribute relates to the functioning and processes within the ecosystem. It includes productivity and cycling (p), habitats and interactions (q), and resilience and recruitment (r).

- **External exchanges:** This attribute considers the interactions and connectivity of the ecosystem with its wider landscape. It includes landscape flows (s), intraspecific gene flows (t) and habitat links (u).

Table C2. *The Five-star System attribute ratings used to measure progress along a trajectory of recovery. This Five-star scale represents a gradient from very low to very high similarity to the reference model and is applicable to any level of recovery where a reference model is used. As it is a generic framework, users must develop indicators and monitoring metrics specific to the ecosystem and their key attributes. The starting point of an attribute can be zero or any star level, and examples in the table accumulate along the spectrum (adapted from Gann et al. 2019, Standards Reference Group SERA 2021, and Young et al. 2022, with additional contributions by Tein McDonald and Kingsley Dixon).*

Zero stars	One star	Two stars	Three stars	Four stars	Five stars
Absence of threats					
High numbers and degrees of direct degradation drivers present (e.g., over-harvesting, erosion, active contamination). Conservation status may not be secured.	Some direct degradation drivers absent and conservation status secured, but others remain high in number and degree.	Direct degradation drivers (including sources of invasive species, absence of appropriate natural disturbance regimes) intermediate in number and degree.	Number of direct degradation drivers low but some may remain intermediate in degree.	Direct degradation drivers, both external and on site, low in number and degree.	Direct degradation drivers (e.g., over-utilisation, active contamination, sources of invasive species, eroding land surfaces) are minimal or effectively absent.
Physical condition					
Landforms and most physical and chemical properties of the site's substrates and hydrology (e.g., soil structure, nutrients, pH, salinity, depth to water table) are highly dissimilar to the reference.	Landforms and most physical and chemical properties of the site’s substrates and hydrology still highly dissimilar to reference but some showing improved similarity.	Landforms, and physical and chemical properties of substrates and hydrology, remain at low similarity levels relative to reference but capable of supporting some biota of reference.	Landforms, and physical and chemical properties of substrates and hydrology, stabilised within intermediate range of reference and capable of supporting growth and development of many characteristic native biota.	Landforms very similar to the reference, and physical and chemical conditions of substrates and hydrology highly similar to reference and suitable for sustained growth and recruitment of most characteristic native biota.	Landforms very similar to reference, and physical and chemical conditions of substrates and hydrology very highly similar to that of the reference with evidence they can indefinitely sustain all characteristic species and processes.
Species composition					
Absence or very low presence of colonising native species and genes (e.g., <5% of the reference). Extremely high abundance of non-native invasive or undesirable species (e.g., >80% relative cover).	Some colonising native species and genes present (e.g., >5% of the reference). Very high levels of non-native invasive or undesirable species (e.g., <80% relative cover).	A small subset of characteristic native species and genes present (e.g., >25% of the reference) across site. High to intermediate levels of non-native invasive or undesirable species (e.g., <60% relative cover).	A subset of key native species and genes present (e.g., >50% of the reference) over substantial proportions of the site. Intermediate to low levels of non-native invasive or undesirable species (e.g., <25% relative cover).	Substantial diversity of characteristic native species and genes present (e.g., >75% of the reference) across the site and representing a wide diversity of functional groups. Low to very low levels of non-native invasive or undesirable species (e.g., <10% relative cover).	High diversity of characteristic native species and genes present (e.g., >95% of the reference), with high similarity to the reference ecosystem and high potential for colonisation of more native species over time. Very low to nil invasive or undesirable species (e.g., <2% relative cover).

Zero stars	One star	Two stars	Three stars	Four stars	Five stars
Structural diversity					
No stratum of the reference present, and spatial patterning and community trophic complexity dissimilar or highly dissimilar to the reference.	At least one stratum of the reference present but spatial patterning and community trophic complexity still largely dissimilar to the reference.	Multiple strata of the reference present but some similarity of spatial patterning and trophic complexity relative to the reference.	Most strata of the reference present and intermediate similarity of spatial patterning and trophic complexity relative to the reference.	All strata of the reference present and substantial similarity of spatial patterning and trophic complexity relative to the reference.	All strata present and spatial patterning and trophic complexity high. Further complexity and spatial patterning able to self-organise to highly resemble the reference.
Ecosystem function					
Processes and functions (e.g., water and nutrient cycling, habitat provision, natural disturbance regimes) absent or severely diminished compared to the reference.	Processes and functions at a very foundational stage only compared to the reference.	Low numbers and levels of physical and biological processes and functions relative to the reference are present (incl. plant growth, decomposition, soil processes).	Intermediate numbers and levels of physical and biological processes and functions relative to the reference are present.	Substantial levels of physical and biological processes and functions relative to the reference are present.	All functions and processes (including natural disturbance regimes) are present and show evidence of being sustained.
External exchanges					
No or very limited positive exchanges and flows with the surrounding environment (e.g., species, genes, water, fire, other ecological processes).	Positive exchanges and flows with surrounding environment in place for only very low numbers of species and processes.	Positive exchanges with surrounding environment in place for a few characteristic species and processes.	Positive exchanges with surrounding environment in place for intermediate levels of characteristic species and processes.	Positive exchanges with surrounding environment in place for most characteristic species and processes and likely to be sustained.	Evidence that exchanges with the surrounding environment are highly similar to the reference for all species and processes and likely to be sustained.

C.3 Sub-attributes in the TGBS Five-star System

Based on data from selected indicators and monitoring metrics, sub-attributes are assigned a star rating at project baseline and during the field assessment. While it is mandatory to assess all six key attributes, it is neither feasible nor required to assess all 21 sub-attributes for the TGBS (Table C3); however, at least one sub-attribute must be assessed for each criterion. For example, for overall ecosystem integrity, which is used to measure criterion 2, at least one sub-attribute for each key attribute shall be measured, but some are considered to be critical, while others are preferable or optional based on difficulty, feasibility and available tools. Some sub-attributes are highly essential to be evaluated and contribute to multiple TGBS criteria, while some sub-attributes are assessed based on site conditions and feasibility.

Table C3. *Assessment requirements for 21 sub-attributes in the TGBS Five-star System.*

Key Attribute	Sub-attribute	Assessment Requirement
Absence of threats	1. Contamination (a)	If feasible
	2. Invasive species (b)	Critical
	3. Over-utilisation (c)	Critical
	4. Other degradation drivers (d)	Preferable
Physical conditions	5. Water chemo-physical conditions (e)	If feasible
	6. Substrate chemical conditions (f)	Preferable
	7. Substrate physical conditions (g)	Critical
Species composition	8. Desirable plants, fungi and lichens (h)	Critical
	9. Desirable animals (i)	Critical
	10. Rare and threatened species (j)	Critical
	11. No undesirable species (k)	Critical
	12. Provenance, genetic diversity and genetic resilience (l)	Critical
Structural diversity	13. All vegetation strata (m)	Critical
	14. All trophic levels (n)	Preferable
	15. Spatial mosaic (o)	Critical
Ecosystem function	16. Productivity/cycling (p)	If feasible
	17. Habitat & interactions (q)	Preferable
	18. Resilience/recruitment (r)	Critical
External exchanges	19. Landscape flows (s)	Preferable
	20. Intraspecific gene flows (t)	Critical
	21. Habitat links (u)	Preferable

The number of points awarded for each sub-attribute are assigned according to the change in the star rating from the baseline to the assessment or other monitoring event (section 6.2).

C.4 Assessment Strategies

C.4.1 Preparation

Before assessing any of the 21 sub-attributes, a series of recommended steps can be taken to ensure a systematic and rigorous evaluation of the site.

1. Select random sampling locations to evaluate sub-attributes. Plots, transects and points are useful for long-term monitoring and assessment because they can be used consistently and also during re-evaluation of the site.
2. Develop a site sampling plan and analysis methodology. Based on agreed indicators, and a defined value for each star, the TGBS Five-star System's sub-attributes can be evaluated using a variety of cost-effective and time-efficient methods.
3. Determine the quantitative metrics to be used to monitor indicators for each sub-attribute (Appendix F).
4. Set the highest value (5 stars) to the lowest value (0 stars) for each sub-attribute based on the selected indicators and metrics for the reference model.
5. Collect data directly from sampling sites or through subsequent analysis.
6. Score each sub-attribute for which data are available and average available values for each attribute.
7. Ensure methods, raw data and analyses are stored, curated and available for future resampling or historical documentation.

Identifying vegetation in Jordan. (RBG, Jordan)

G-team Bino bird observations. (TRCRC)

Tips:

- Where appropriate, use methods that allow for the collection of evidence for multiple sub-attributes (section 5.5.1).
- Work with local and subject specialists to develop data collection and interpretation methodologies.
- Utilise multipurpose instruments to save time and cost. For example, some soil test kits measure soil pH, nutrient levels, organic matter content and certain heavy metals, contributing data for multiple sub-attributes (e.g., contamination, substrate chemical conditions and substrate physical conditions).
- Use calibrated equipment, follow sampling protocols, and measure sub-attribute indicators accurately.

C.5 Techniques

The assessment of ecosystem integrity is a complex process and there is no one-size-fits-all approach. Evidence and data collection methods for all 21 sub-attributes have been compiled below to help assessors make informed decisions about methods tailored to fit the unique characteristics of each site.

C.5.1 Absence of Threats

Direct degradation drivers (e.g., over-utilisation, active contamination, sources of invasive species, eroding land-surfaces).

1. Contamination (a)

Known threats from contamination (e.g., use of toxic herbicides, legal or illegal dumping, residual contamination, spraying for mosquitos, leakage from adjacent sites).

Table C5a. *Techniques for measuring contamination.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Contamination (a)	Contamination drivers and sources	Number of drivers and sources	Exposure pathway evaluation (ATSDR 2022)
			Sampling (MDE 2017, Baird et al. 1996, EPA 2020)
			Walkover survey (Reaney et al. 2019)
	Area of exposure/existing contaminant	Total estimated area/points/routes of exposure	Studying site plan, map and history by screening (ATSDR 2022)
	Concentration of pollutants or harmful substances in the ecosystem (soil, water and air)	Heavy metals in the soil (eg., Pb, As, Cu, etc.)	Aqua regia method/ISO 11466 (Shahbazi & Behesti 2019)
			Field portable X-ray fluorescence (pXRF) (Rouillon & Taylor 2016, Davidson 2012)
		Organic pollutants (e.g., oil hydrocarbons, chlorinated compounds)	Membrane Interface Probe (TIFSD-EPA 2023)
		High nutrient level (e.g., nitrogen, phosphorus)	Electronic sensing (Chen et al. 2018)
		Biological indicator	Biomonitoring (Holt & Miller 2010, EPA 2005)

2. Invasive species (b)

Threats from invasive species (e.g., high relative cover of reproductive invasive plants on site, soil seed bank, reproductive plants on adjacent sites).

Table C5b. *Techniques for measuring invasive species.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Invasive species (b)	Presence of invasive species	Number of invasive species detected, species richness	Exploratory (Rew and Pokorny 2006, WNY 2020)
			The timed-meander method (Huebner 2007)
		Area of occurrence/size of patches Density of individual invasive	Early detection survey (EI 2009, FICMNEW 2003, Vermont Invasive 2010, TNC 2010)
	Abundance of invasive species	Species, stages of the plant growth	Rapid plot (Ray et al. 2013)
	Level of risks	Risk rating	Risk Assessment (BLM 2016, Pyšek 2004, Morse et al. 2004)

3. Over-utilisation (c)

Threats from over-utilisation (e.g., over-harvesting, illegal logging or harvesting, mining, overgrazing, over-hunting, infrastructure development).

Table C5c. *Techniques for measuring over-utilisation.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Over-utilisation (c)	Harvesting survey	Volume of harvested species	Survey questionnaire (Abbas 2014)
	Tree damage	Number of trees damaged	Tree damage observation and number of cut tree stems in rapid plots (Cântar et al. 2022)
	Species composition in the habitat	Comparison of species diversity among habitats	Captured species (Estavillo 2013)

4. Other disturbance drivers (d)

Threats from direct degradation drivers (e.g., frequent and severe harmful wildfires, frequent and severe harmful flooding, absence of any appropriate natural disturbance regimes).

Table C5d. *Techniques for measuring other disturbance drivers.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Disturbance (d)	Disturbance characteristic Level of disturbances	Variable of disturbance regimes	Disturbance index (Calderon-Aguillera 2012)
		Disturbance types	Four universal disturbance types (Graham et al. 2021, pic)
		Species composition, richness or abundance of biological indicators	Spider assemblage (Gonzalez 2021)
			Termite assemblage (Schyra 2019)
	Spatial disturbance properties	Scale of disturbance	Plant community assembly (Escobedo 2020)
		Area affected by disturbance	Area measurement (FAO 2023)
	Temporal disturbance properties	Duration, frequency of disturbance/driver	Hierarchical complexity/Temporal dynamic (Ryo 2019)
			Tree-ring analysis (Stoffel & Bollschweiler 2007)
			Soil available nutrients (Guo et al. 2004)
		Social-ecological thresholds	Hierarchical complexity/Temporal dynamic (Ryo 2019)

C.5.2 Physical Conditions

Environmental conditions (including the physical and chemical conditions of soil, water and topography) required to sustain the ecosystem are present.

5. Substrate physical conditions (e)
Physical properties of the substrates (e.g., soil structure, topography) required to support growth and development of native biota.

Table C5e. *Techniques for measuring substrate physical conditions.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Substrate physical conditions (e)	Soil parameters	Soil texture (COD)	The feel method (FAO 2020)
			The shaking method (FAO 2020)
		Soil compaction	Core method (FAO 2020)
			Infiltration test (USDA 1999)
			Excavation method (FAO 2020)
		Moisture content	Gravimetric water content (FAO 2020, ISRIC 2002)
			Feel and appearance method (FAO 2020)
		Soil structure and consistency	Visual soil assessment (FAO 2020)
	Biological indicator	Number of earthworms	Earthworm sampling (FAO 2020)

6. Substrate chemical conditions (f)
Chemical properties of the substrates (e.g., pH, nutrients, salinity) required to support native biota growth and development.

Table C5f. *Techniques for measuring substrate chemical conditions.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Substrate chemical conditions (f)	Soil properties (Eco-SSL 2005)	Soil pH	pH meter (FAO 2020, ISRIC 2002, NCR 2011)
			pH strips (FAO 2020)
		Soil salinity	Electrical conductivity (FAO 2020)
			Field symptoms (FAO 2020)
		Rates of litter mass loss	The teabag method (FAO 2020)
		Soil nutrient availability	Soil nutrient analysis (Gillman et al. 2008)

7. Water chemo-physical conditions (g)

Physical and chemical properties of the site's hydrology (e.g., pH, nutrients, hydrological conditions, water table depth) required to support the growth and development of native biota.

Table C5g. *Techniques for measuring water chemo-physical conditions.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Water chemo-physical conditions (g)	Chemical condition (Batheria & Jain 2016)	pH	Electrometric method (APHA 2017)
		Biochemical oxygen demand (BOD)	BOD Test (APHA 2017)
		Chemical oxygen demand (COD)	Open reflux method (APHA 2017)
		Dissolved oxygen	Winkler titration method (Rizk et al. 2020, APHA 2017)
		Alkalinity	Titration method (APHA 2017)
		Electrical conductivity (EC)	Conductivity metre (Rizk et al. 2020)
		Hardness	EDTA titrimetric method (APHA 2017)
	Physical condition (Batheria & Jain 2016)	Water temperature	Temperature measurement (APHA 2017)
		Turbidity	Nephelometric method (APHA 2017)
		Total dissolved solids (TDS)	Dried method (APHA 2017)

Assessing substrate physical conditions in the Nandi Hills, Kenya. (CER-K)

C.5.3 Species Composition

The native species characteristic of the appropriate ecosystem are present, whereas undesirable species are minimal or effectively absent.

8. Desirable plants, fungi and lichens (h)

The native species characteristic of the appropriate ecosystem are present, whereas undesirable species are minimal or effectively absent.

Table C5h. *Techniques for measuring desirable plants, fungi and lichens.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Desirable plants, fungi and lichens (h)	Species occurrence (presence/absence of species)	Number of native/positive indicator/ desirable species	Sampling plots (Schulz et al. 2009, Elzinga et al. 2019, Dorazio et al. 2011, Gillison 2006, Peh et al. 2022) Walkover survey (NRA 2004)
		Number of endemic species	
		Number of protected species (local/national/international)	
	Species metrics	Density	Quadrats and transects (Elzinga et al. 2019)
			Distance measures (Elzinga et al. 2019)
		Frequency	Quadrats (Elzinga et al. 2019)
			Modified Gentry Plot (Larsen 2016)
		Cover-abundance of species (including fungi and lichens)	Dominant cover-abundance (Gillison 2006)
			Nested sub-plot (Barnett 2016)
		Species richness and abundance	Modified Gentry Plot (Larsen 2016)
		Species diversity	e-DNA (Banerjee et al. 2022, Johnson 2023, Vasar et al. 2023)

9. Desirable animals (i)
Characteristic native animal species and genes in terms of richness and evenness.

Table C5i. *Techniques for measuring desirable animals.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Desirable animals (i)	Species occurrence (presence/absence of species)	Number of birds and vertebrates	Point counts (Manley et al. 2005, Larsen 2016) Passive acoustic monitoring (Browning et al. 2017, Zwerts et al. 2021)
		Number of endemic species	
		Number of protected species (local/national/ international)	
		Number and abundance of mammals	Baited track plates and cameras (Manley et al. 2005, Sai et al. 2021)
			Sherman Live Trapping (Manley et al. 2005, Larsen 2016)
			Leech DNA samples (Baerholm Schnell et al. 2012)
		Number of bats	Bat mist netting (Manley et al. 2005)
		Number and abundance of herpetofauna	Pitfall traps (Larsen 2016)
			Aquatic point counts (Manley et al. 2005)
		Number and distribution of insects	Malaise trapping (Montgomery et al. 2021)
	Species metric	Composition of proxy community	Pitfall traps (Brooks 2012)
		Species richness of freshwater animals	e-DNA (Seymour 2021)
		Species diversity	Diurnal-line transect census (Larsen 2016)
			DNA barcoding (e.g., insect diversity) (Ashfaq 2018, CBG 2023)

10. Rare and threatened species (j)
Characteristic rare and threatened species and genes in terms of richness and evenness.

Table C5j. *Techniques for measuring rare and threatened species.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Rare and threatened species (j)	Species occurrence	Number of rare and threatened species planted	Focused or intuitive-controlled surveys (FFI 2013)
		Number of threatened and rare species	Nested sub-plot (Barnett 2016, Peh et al. 2022)
			Multiple soil e-DNA (Ariza et al. 2022)
			Occupancy sampling, targeted-species survey (Jeliazkov et al. 2022, Laskey et al. 2020)
	Species metric	Species abundance and richness	Systematic search (Morrison 2016)
			Adaptive (cluster) sampling (Jeliazkov et al. 2022)

11. No undesirable species (k)
Non-native, invasive or other undesirable plants, or non-native or undesirable animals (e.g., harmful livestock).

Table C5k. *Techniques for measuring no undesirable species.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
No undesirable species (k)	Species occurrence	Presence/absence of negative indicator species	Sampling plot (Schulz et al. 2009, Elzinga et al. 2019, Dorazio et al. 2011; Gillison 2006, Peh et al. 2022) Walkover survey (NRA 2004)
	Species metrics	Density	Quadrats (Elzinga et al. 2019)
			Distance measures (Elzinga et al. 2019)
		Frequency	Quadrats (Elzinga et al. 2019)
		Species richness	Alpha and gamma diversity (Gillison 2006)

12. Provenance, genetic diversity and genetic resilience (l)
Provenance of material appropriate to site and adequate genetic diversity and resilience.

Table C5l. *Techniques for measuring provenance, genetic diversity and genetic resilience.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Provenance, genetic diversity and genetic resilience (l)	Seed source location and its characteristics (climate, soil, other environmental characteristics)	Use of a seed matching software application or use of an ecological model	Seed source review (Erickson & Halford 2020)
		Number of collection sites	
		Number of provenance seed species	Provenance Seed Tree (Thomas 2016)
		Number of seed sources	Semi-structured interviews (NASEM 2023)
			Survey (NASEM 2023)
	Seed quantity	Number of seeds on each planted species	Seed quantity estimation (Willan 1987)
	Planted species provenance	Number of planted native seeds	Semi-structured interviews (NASEM 2023)
	Genetic composition	Genetic structure	Genotyping (Hansen et al. 2015)
			Polymorphism check (Breed 2018, Bansal 2012)
		Genetic diversity; number of maternal lines represented (e.g., unrelated parents)	Genotyping (Zumwalde et al. 2022)
			Counting number of maternal lines using genotyping or accession/passport data (Diaz-Martin 2023)

C.5.4 Structural Diversity

Appropriate diversity of key structural components, including demographic stages, faunal trophic levels, vegetation strata (including nesting and denning habitat), and spatial heterogeneity are present.

13. All vegetation strata (m)
Number of strata and spatial patterning in terms of the number, structure and complexity of strata present.

Table C5m. *Techniques for measuring all vegetation strata.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
All vegetation strata (m)	Vegetation structure	Native overstorey and midstorey projected crown cover and type	Transect and visual reference card (DCCEEW 2013)
		Leaf area index	Hemispherical photos (Zhang et al. 2005) Microclimate sensors as indicators (Hardwick et al. 2015)
		Percentage native ground cover	Transect (DCCEEW 2013)
		Vegetation cover by layer	Plot (Gautier 1994, Schulz et al. 2009, Barnett 2016)

14. All trophic levels (n)
Community trophic complexity in terms of primary producers, primary consumers, secondary consumers, tertiary consumers, apex predators and decomposers.

Table C5n. *Techniques for measuring all trophic levels.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
All trophic levels (n)	Trophic level	Configuration of prey-predator interaction	Field observation (Stier et al. 2016, Wootton and Emmerson 2005)
		Trophic diversity	Rectangular plots (Pearson and Dyer 2006)

** This evidence can be supported by evidence from desirable animal sub-attributes.*

15. Spatial mosaic (o)
Spatial distribution of features (e.g., vegetation, animal populations, habitats) in terms of the arrangement and distribution of species and habitats.

Table C5o. *Techniques for measuring the spatial mosaic.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Spatial mosaic (o)	Land mosaic structure and composition	Size, shape and connectivity of habitat patches	Systematic field survey (Pita et al. 2013)
	Patch history & size	Presence of arbuscular mycorrhizal fungi colonisation	Root sampling of host species (Pita et al. 2013)

C.5.5 Ecosystem Function

Appropriate levels of growth and productivity, nutrient cycling, decomposition, habitat, species interactions, and types and rates of natural disturbance regimes are present.

16. Productivity/cycling (p)
The appropriate levels of growth, productivity and nutrient cycling within the ecosystem, ensuring the availability of resources for organisms to thrive.

Table C5p. *Techniques for measuring productivity/cycling.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Productivity/cycling (p)	Primary productivity	Index of productivity	Direct method (Benke 2011)
			Indirect method (Benke 2011)
		Annual production	Herbaceous estimated production (DEQ 2009)
	Nutrient cycling	Index of nutrient cycling	Coarse woody debris decay class

17. Habitat & interactions (q)
Habitat provision for native species.

Table C5q. *Techniques for measuring habitat and interactions.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Habitat & interactions (q)	Nesti	Nest number	Nest search by sample plot (Ralph et al. 1993)
			Standing Crop and Marked Nest Count (Spehar et al. 2009)
	Coarse woody debris	CWD habitat quality index	Transect and the line intersect method (Van Galen et al. 2019)
	Epiphyte response	Richness and diversity of community indicators	Transect lines (Brosnan and Ellis 2020)

18. Resilience/recruitment (r)
Resilience or recruitment allowing for recovery from natural disturbances or maintaining species populations through reproduction.

Table C5r. *Techniques for measuring resilience/recruitment.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Resilience/ recruitment (r)	Seedling recruitment	Density of spontaneous seedlings	Stratified random sampling (Graae et al. 2011)
		Seed abundance	Seed collection in plot (Chen et al. 2014)
	Food web complexity and food chain length	Trophic gradient	Food web metrics (Kelly and Schallenberg 2019)
	Resilience to disturbance	Growth rates after disturbance	Tree-ring analysis (Yi & Jackson 2021)

C.5.6 External Exchanges

The appropriate integration of the ecosystem into its larger landscape and watershed context through positive abiotic and biotic flows and exchanges.

19. Landscape flows (s)
Positive exchanges or flows with the surrounding environment (e.g., of species, water, fire) for any species or processes.

Table C5s. *Techniques for measuring landscape flows.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Landscape flows (s)	Movement of matter	Rate and quality of surface and groundwater flow	Sampling (Mitchell et al. 2013, McLaughlin et al. 2019)
	Movement of organisms	Foraging	Field observation (Mitchell et al. 2013, McLaughlin et al. 2019)

20. Intraspecific gene flows (t)

The genetic flow between the site and its surroundings for any species.

Table C5t. *Techniques for measuring intraspecific gene flows.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Intraspecific gene flows (t)	Genetic connectivity	Genomic data	Association analysis (Gagic 2015)
	Species proxy	Pollinators travel distance	Distance travelled (Brunet 2019)
		Distance of gene flow	Gene marker & pollen viability (Umehara 2005)
		Dynamic of gene flow dispersal	Parentage analysis (Umehara 2005)

21. Habitat links (u)

Positive habitat links with the surrounding environment for any species.

Table C5u. *Techniques for measuring habitat links.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method
Habitat links (u)	Habitat buffer	Width of buffer strip	Survey (Serfis 1993, Zhang et al. 2021)
	Habitat corridor	Width of corridor at the site	Survey (Serfis 1993)
	Species networks	Habitat patches area	Survey (Neel et al. 2014)
			Integral Index Connectivity (Pascual-Hortal & Saura 2006)

Post-restoration landscape of forests in the Mudumalai Tiger Reserve, India. (SER Natural Regeneration Network)

C.6 Rating Procedure

The rating procedure shall be done by assessors after collecting data on sub-attributes based on measurable indicators, appropriate methods and tools, and ensuring consistency and accuracy in assessments. The rating procedure compares the site condition to the reference condition defined using the Ecosystem Integrity Five-star System (section C.7, Appendix F). Rating points indicate whether sub-attributes have improved or degraded.

In the final assessment of criteria 1 and 4-7 (Appendix B.7), the assessment ratings are recorded based on results of the remote sensing and field survey reports (Appendices B.4 and B.5), and changes in each sub-attribute are scored.

C.6.1 The Survey Reports

The remote sensing and field survey report in the Assessment Form (Appendices B.4 & B.5) record the methods and results used to conduct the assessment. They are divided into two parts: Methods and Results. The following are descriptions of the components:

Methods:

- **No.:** The numbering system to distinguish each different method used.
- **Sub-attributes assessed:** This section outlines the sub-attributes that are included in the assessment within each method.
- **Method:** Clearly stating the method under assessment, this part of the section articulates the approach or technique being used.
- **Evidence:** The assessment is only as robust as the evidence supporting it. This part highlights the specific evidence that is considered in the evaluation process, ensuring that assessments are anchored in verifiable information.
- **Attachments:** This refers to any additional supporting documents or files. It could include reports or other documentation that adds depth to the assessment.
- **Source (if new):** If the method being assessed is not described in Appendix tables C5a-C5u or D1, this component describes the reference or source of the method. It ensures due credit and traceability.

Results:

- **No.:** The numbering system distinguishes between different outcomes by number.
- **Sub-attribute:** This part elaborates on the specific sub-aspects or elements being evaluated within each result.
- **Assessment period:** Time is a critical factor in evaluations. This component specifies the time frame during which the assessment took place.
- **Evidence:** Describes the evidence used for the assessment. It could include details on the methods employed, data sources or any other information that validates the assessment findings.
- **Star rating:** This summarises the overall performance or status of the sub-attribute being assessed. The star rating can provide a representation of the assessment results.
- **Attachment:** Refers to any additional supporting documents, files, or references that complement or provide more in-depth information about the assessment. Attachments enhance transparency and allow stakeholders to delve deeper into the assessment details.

C.7 Developing the Reference Model

In order to assess changes and monitor projected goals through the TGBS assessment, it is necessary to define specific indicators and metrics appropriate to the project and describe the reference model for each project by calibrating the Five-star System (section 2.5, Appendix F). The reference model or condition is described by the five-star value for each sub-attribute.

Considerations for Developing the Reference Model

- Define the native reference ecosystem that informs the reference model (see section 2.5).
- Develop a general description of the reference model following guidance in section 2.5.
- Define indicators and metrics as evidence that can be used to monitor and assess projects from baseline to current and future condition.
- Calibrate the Five-star System using the 21 sub-attributes (Appendix F) to describe specific metrics for each star value for each sub-attribute to be used in the assessment. Not all sub-attributes will be assessed for all projects.
- Assess the baseline conditions using the calibrated Five-star System (see section 2.4).
- Assess the current conditions using the calibrated Five-star System and compare to baseline.
- Use the Ecological Recovery Wheel (C.8) to provide a visual representation of the project baseline conditions or progress.

To calibrate the Five-star System, ecological restoration success shall be defined in detail for severely damaged (zero stars) to fully recovered ecosystems (five stars). The rating of the Five-star System provides a gradient from low to high ecological integrity for each sub-attribute, from soil health and water quality to biodiversity and habitat structure.

With this effective calibration, practitioners may create clear, measurable restoration goals and track progress to ensure that restoration efforts are consistent with the goal of restoring healthy, self-sustaining ecosystems.

The format and detailed guidance in Table C.7 demonstrate the systematic approach to outlining criteria and conditions for each star rating within a sub-attribute and give assessors a practical and implementable format to evaluate ecosystem states, set reliable restoration objectives, and track progress towards these objectives over time.

Table C7. Example Template for Calibrating the Five-star System.

Date:	Native Reference Ecosystem:	Reference sites (if any):
Project Lead/Assessor:	Biome:	1. (address, kml, latitude/longitude) 2: 3:
Stakeholders:	Ecosystem Functional Group:	

Ref.	Attribute	Sub-attribute	Zero stars	One star	Two stars	Three stars	Four stars	Five stars	Reference conditions (metrics/ indicator)	Recommended method
h)	Species composition (example)	Desirable plants, fungi and lichens	No native plant, fungi and lichen species are present or their presence is negligible.	Some colonising native plant, fungi and lichen species are present (e.g., >5% richness [10 of 200 species] and evenness [5 of 100 trees per ha of dominant tree] of the reference).	A small subset of characteristic native plant, fungi and lichen species present (e.g., >25% richness [>50 of 200 species] and evenness [>25 of 100 trees per ha of dominant tree] of the reference) across the site.	A subset of key native plant, fungi and lichen species present (e.g., >50% richness [>100 of 200 species] and evenness [>50 of 100 trees per ha of dominant tree] of the reference) over substantial proportions of the site.	Substantial diversity of characteristic native plant, fungi and lichen species and genes present (e.g., >75% richness [>150 of 200 species] and evenness [>75 of 100 trees per ha of dominant tree] of the reference) across the site and representing a wide diversity of functional groups.	High diversity of characteristic native plant, fungi and lichen species and genes present (e.g., >95% richness [>190 of 200 species] and evenness [>95 of 100 trees per ha of dominant tree] of the reference or a somewhat lower % if high likelihood for further colonisation of all other main native species over time), with very high similarity to the reference.	Proportion of reference plant species richness and evenness based on 200 species/site and 100 trees/ha for dominant tree given project size and reference native ecosystem.	Combination of meandering walks and vegetation transects; distance measures.

Heather landscape on the Anglesey coast, United Kingdom. (David Bartholomew)

C.8 Visualise Ecosystem Integrity Change

The Ecological Recovery Wheel (ERW) is a tool for conveying progress of recovery of ecosystem attributes compared to those of a reference model (Gann et al. 2019; Figure C.7). It is a circular diagram with sections representing the ecosystem through six key attributes and 21 sub-attributes. The wheel shows the ecosystem's progress towards a desired state.

The ERW has major sections for the key ecosystem attributes of absence of threats, physical conditions, species composition, structural diversity, ecosystem function and external exchanges. Each key attribute is rated or scored using a five-star scale. Stars indicate attribute condition at the time of measurement.

Practitioners and stakeholders can assess biodiversity and ecosystem integrity through the TGBS assessment process and then visually display the result of these attribute ratings on the ERW (Figure B1). Displaying multiple wheels (e.g., baseline versus current condition), the ERW can be used to track changes, identify areas for improvement, and guide restoration decisions. It can help stakeholders visualise complex ecosystem attribute interactions and promote holistic ecological recovery.

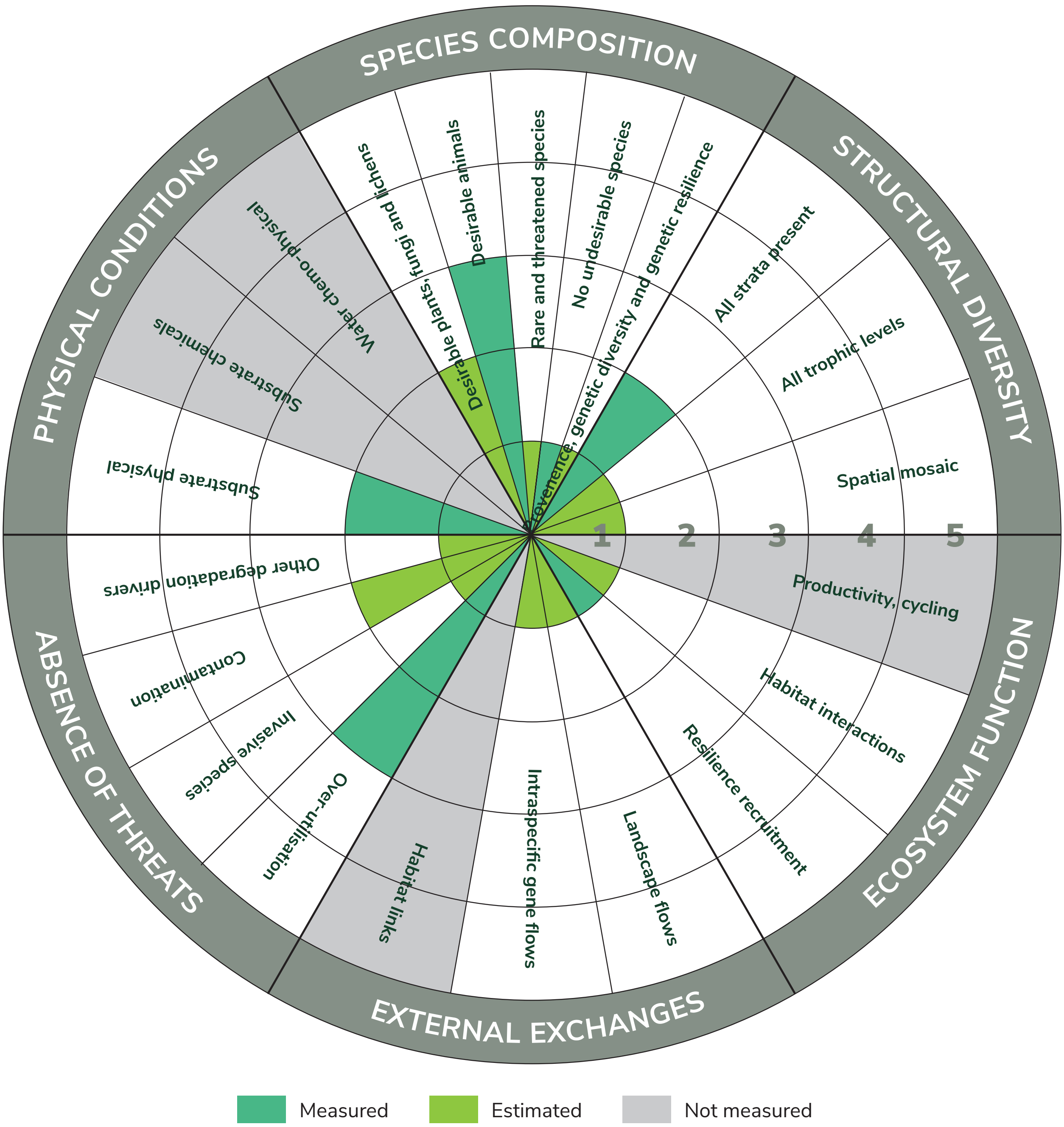


Figure C.2. *Ecological Recovery Wheel illustrating the use of colors to indicate different types of data used to track changes between the baseline and the current condition towards the designated reference model. (Modified from Gann et al. 2019, Standards Reference Group SERA 2021, Young et al. 2022).*

Appendix D: Remote Sensing Assessment Methods

This appendix provides a detailed description of the remote sensing assessment methods (RSAM) that were developed to evaluate the sub-attributes of the Five-star System of the Global Biodiversity Standard (TGBS). The RSAM is based on the analysis of satellite imagery and geospatial data to measure indicators of ecosystem integrity, including landscape connectivity, fragmentation, and the presence and distribution of threatened and rare species. The RSAM is designed to complement the field-based survey methods to provide additional information on the biodiversity values and threats at each site and support TGBS assessments. The RSAM can be applied at different scales to the sites, depending on the availability and resolution of the data sources. The RSAM is also useful to help define the baseline and develop the reference ecosystem as a comparison to field survey assessments.

Table D.1. *Suggested remote sensing methods for assessing sites against the Five-star System for the Global Biodiversity Standard.*

Sub-attributes	Options of evidence	Examples of evidence	Examples of method	Suggested sensor/ satellite
Contamination (a)	Area of exposure/ existing contaminant	Heavy metals in the soil (e.g., U, Pb, Cr, Ni, Cu, Pt, etc.)	Iron feature depth from hyperspectral and multispectral images of bare ground (Mielke et al. 2014, Peng et al. 2016, Shi et *al.* 2018)	EnMap, Sentinel-2
		Petrochemical contamination	Changes in leaf biochemical conditions measured using hyperspectral imagery of vegetation (Arellano et al. 2015)	Hyperion
			Tracking extent of oil slicks (Klemas 2010)	
Invasive species (b)	Area of invasive species cover	Spectral signatures	Identification of invasive species with unique spectral signatures (Fuller 2005, Glenn et al. 2005, Asner et al. 2006, Miao et al. 2006, Pengra et al. 2007, Underwood et al. 2007, Asner et al. 2008, Hestir et al. 2008, Pu et al. 2008, Walsh et al. 2008)	Quickbird, Hyperion
			Identification of invasive species with unique phenological patterns (Williams and Hunt 2004, Peterson 2005, Ge et al. 2006, Evangelista et al. 2009, Singh & Glenn 2009)	Landsat-7, ETM+
		Vertical structure	Changes in three-dimensional structure of habitat detected from LiDAR (Asner et al. 2008)	GEDI
	Invasion risk of invasive species	Predictive models of invasion risk	Habitat transformation data to monitor changes in habitat suitability for invasive species (Rouget et al. 2003, Morisette et al. 2005, Rew et al, 2005, Bradley & Mustard 2006, Stohlgren et al. 2010)	Landsat MSS, TM, ETM+, MODIS
Over-utilisation (c)	Intensity of over-utilisation	Intensity of logging	Soil fraction of images (Grecchi et al. 2017)	
	Vegetation trend retrieval	Detecting trends in forest disturbance and recovery	Vegetation recovery (Kennedy et al. 2010)	Landsat
	Disturbance retrieval	Monitoring forest disturbance	Disturbance retrieval (Ye et al. 2021)	Landsat

Sub-attributes	Options of evidence	Examples of evidence	Examples of method	Suggested sensor/ satellite
	Extent of over-utilisation	Extent of mines	High resolution images (Song et al. 2020)	
		Extent of infrastructure	High resolution images (Zhang & Seto 2011, Taubenböck et al. 2012)	
		Extent of deforestation and degradation	Changes in vegetation indices (Garonna et al. 2009, Souza Jr et al. 2003)	MODIS
			Historical deforestation monitored using land cover maps (Hansen et al. 2005, 2010, Bartholomé & Belward 2007, Arino et al. 2008, Friedl et al. 2010, Achard & Hansen 2012)	Landsat MSS, TM, ETM+, MODIS
		Extent of overgrazing	Change in vegetation indices and biomass (Otterman et al. 2002, Themistocleous et al. 2014, Jansen et al. 2021)	
Other degradation drivers (d)	Extent of potential degradation	Extent of fire disturbance	Burned area product (Justice et al. 2002, French et al. 2008, White et al. 2017)	MODIS, Landsat
		Extent of pest disturbance	Detection of defoliator outbreaks using changes in maximum Normalised Difference Vegetation Index (NDVI) (Eklundh, Johansson & Solberg 2009)	MODIS
		Extent of eutrophication	Detection of algal blooms from the colour of dissolved organic matter and chlorophyll indices (Blix et al. 2018, Kravitz et al. 2020, Pirasteh et al. 2020, Shen et al. 2020, Soomets et al. 2020)	Sentinel-2, Sentinel-3
		Extent of drought vulnerability	Anomaly vegetation change detection algorithms for normalised difference moisture index (NDMI) (Decuyper et al. 2022)	Landsat
		Extent of flooding	Flood monitoring and mapping (Hoque et al. 2011)	RADARSAT
	Risk of disturbance	Risk of fire	Normalised Difference Vegetation Index (NDVI) to estimate fire risk (Maselli et al. 2003)	AVHRR
		Drought probability	Vegetation Health Index (VHI) (Rojas et al. 2011)	AVHRR
Substrate physical conditions (e)	Quality of soil physical conditions	Soil moisture content	Optical imagery and reflectance spectroscopy of soil moisture (Lesaignoux et al. 2013, Zhang et al. 2013, Oltra-Carrió et al.2015, Sadeghi et al. 2015)	Landsat-7, MODIS
			Microwave sensing of soil moisture (Njoku et al. 2003, Wagner et al. 2007, 2013, Entekhabi et al. 2010, Garrab et al. 2015, Chan et al. 2016)	
		Soil temperature	Thermal infrared sensing of soils (Verstraeten et al. 2006, Sugathan et al. 2014)	
		Soil texture	Microwave sensing of soil texture (Garrab et al. 2015)	

Sub-attributes	Options of evidence	Examples of evidence	Examples of method	Suggested sensor/ satellite
Substrate chemical conditions (f)	Soil parameters	Soil salinity	Spectral vegetation indices (Peng et al. 2019, Wang et al. 2020)	
		Organic matter content	Curve of spectral reflectance of wavelengths 400-1000 nm (Baumgardner et al. 1986)	
Water chemo-physical conditions (g)	Quality of water chemo-physical conditions	Surface water quality	Total suspended matter, chlorophyll-a and coloured dissolved organic matter from multispectral images (Ma et al. 2020, Niroumand-Jadidi et al. 2020, Mansaray et al. 2021, Maimouni et al. 2022)	Sentinel-2
			Normalised Difference Water Index (NDWI) as an indirect measure of water turbidity (Khan et al. 2021)	Sentinel-2
Desirable plants, fungi and lichen (h)	Species metrics	Species richness proxies	Spectral variation in vegetation indices (e.g., NDVI, EVI, DVI) (Rocchini et al. 2004, Carlson et al. 2007, Levin et al. 2007, Oindo & Skidmore 2010, Gastauer et al. 2022)	Sentinel-2
			Richness of spectral species (Féret and Asner 2014, Féret & de Boissieu 2020, Rocchini et al. 2022)	Sentinel-2
		Species beta diversity	Beta diversity of spectral species (Rocchini et al. 2022)	Sentinel-2
Desirable animals (i)	Predictors of animal diversity	Vegetation metrics as predictors of animal species richness	Maximum vegetation growth (summer NDVI) as a predictor of bird species richness (Ribeiro et al. 2019)	
			Structural complexity as a predictor of animal diversity (Bae et al. 2019, Heidrich et al. 2020, Lee et al. 2023)	
			Spectral diversity as a predictor of animal diversity (Da Re et al. 2019)	
Rare and threatened species (j)	Presence of rare species	Area and density of rare species coverage	Direct detection with optical imagery of species with unique characteristics (Fletcher & Erskine 2012, López-Jiménez et al. 2019, Rominger & Meyer 2019, Cerrejón et al. 2021)	
			Direct detection of unique spectral signatures (Cerrejón et al. 2021)	
No undesirable species (k)	Area of invasive species cover	Spectral signatures	Identification of invasive species with unique spectral signatures (Fuller 2005, Glenn et al. 2005, Asner et al. 2006, Miao et al. 2006, Pengra et al. 2007, Underwood et al. 2007, Asner et al. 2008, Hestir et al. 2008, Pu et al. 2008, Walsh et al. 2008)	
	Field survey data		Identification of invasive species with unique phenological patterns (Williams and Hunt 2004, Peterson 2005, Ge et al. 2006, Evangelista et al. 2009, Singh & Glenn 2009)	
		Vertical structure	Changes in three-dimensional structure of habitat detected from LiDAR (Asner et al. 2008)	

Sub-attributes	Options of evidence	Examples of evidence	Examples of method	Suggested sensor/ satellite
Provenance, genetic diversity and genetic resilience (l)	Appropriate provenance	Appropriate seed sourcing	Verification against seed zone maps	
All vegetation strata (m)	Vegetation structure	Canopy height metrics	Canopy height metrics from LiDAR (Guerra-Hernández & Pascual 2021, Kacic et al. 2021, Popatov et al. 2021, Lang et al. 2022a, 2022b)	GEDI
		Percentage tree cover	Tree cover products (Hansen et al. 2008, Hansen & Loveland 2012, Pengra et al. 2015, Egorov et al. 2018, Nölke 2021)	Landsat, MODIS
			Global Forest Watch tree cover (www.globalforestwatch.org)	
		Biomass	Aboveground biomass (Bao et al. 2019, Santoro & Cartus 2023)	
All trophic levels (n)	Trophic levels	Trophic cascades	Changes in vegetation caused by changes in trophic levels (Fisher et al. 2021)	
Spatial mosaic (o)	Spatial mosaic of vegetation	Distribution of vegetation patches	Patch density (Bosch 2019, Uroy et al. 2021)	
		Percentage of edges	Proportion of habitat with edge effects (Bosch 2019, Uroy et al. 2021)	
Productivity/ Cycling (p)	Primary productivity	Net and gross primary productivity	Normalised difference vegetation index (NDVI)	Sentinel-2, Landsat-8, MODIS
			Absorbed photosynthetically active radiation (Field et al. 1995)	
	Water cycling	Evapotranspiration	Normalised difference water index (NDWI) as an indicator of evapotranspiration	MODIS, Landsat
Habitat & interactions (q)	Functional diversity	Functional diversity of vegetation	Diversity of vegetation morphological and physiological traits (Jetz et al. 2016)	
			Diversity of vegetation types and functional guilds (Vaglio Laurin et al. 2016)	
Resilience/ Recruitment (r)	Resilience to disturbance	Vegetation indices	Comparison of vegetation indices before and after disturbance events (Di Mauro et al. 2014, Yi & Jackson 2021)	Sentinel-2; Landsat-8; MODIS
Landscape flows (s)	Land cover	Habitat patch density	Patch density to measure number of patches in the landscape (Bosch 2019, Uroy et al. 2021)	
		Percentage habitat cover	Percentage of landscape with appropriate land cover (Friedl et al. 2002, Cai et al. 2014)	MODIS
Gene flows (t)	Field survey data only			
Habitat links (u)	Habitat connectivity	Connectedness of habitat patches	Cohesion index to measure the structural connectedness of patches in the landscape (Bosch 2019, Uroy et al. 2021)	
			Connectivity indices (Cisneros et al. 2021)	

Appendix E: Stakeholder Engagement and Social Benefits Assessment Methods

Contents

E.1 Document Verification

Applicants will submit policies and documents as part of the online application form (for example, an equal opportunities policy). Assessors shall verify these documents as part of the field survey.

E.2 Stakeholder Identification

Identifying different stakeholders is important for assessors for two reasons:

1. Assessors need to check that the applicant's stakeholder analysis is comprehensive and accurate.
2. Assessors need to identify relevant stakeholders to talk to as part of the field survey.

E.2.1 Identifying All Relevant Stakeholder Groups

Assessors shall use their knowledge of the local area to assess whether the project has reasonably identified all relevant stakeholders, such as engaging women, differently abled, and religious leaders to understand different uses and knowledge. If assessors are not familiar with the project area, they will ensure somebody on the assessment team has appropriate knowledge.

When assessing the impact of the project on local stakeholders, and whether they have been appropriately engaged, assessors must speak to a variety of stakeholders. Assessors will 'triangulate' information – meaning they shall get information from multiple sources to assess its accuracy.

The following are examples of stakeholders a project might have. These lists are not exhaustive and may include sub-categories of stakeholder groups:

- Local communities
  - Farmer groups/cooperatives
  - Resource user groups (e.g., community forest associations, water resource user associations, etc.)
  - Smallholder/subsistence farmers
  - Harvesters and traders
  - Large/commercial farmers
  - Landless labourers
  - Women's groups
  - Indigenous peoples
  - Children and youth
  - Elderly people
  - Migrants, refugees and asylum seekers
  - People with disabilities
  - Educated and less educated people
  - People of different social classes
  - General public
- Institutions
  - Local NGOs/service providers
  - Local government
  - National/international NGOs
  - National government
  - Companies
  - Universities
  - Donors/funders
- Project owner and implementer
- Private landowners

When interacting with local stakeholders during the assessment process, assessors shall consider the following:

- Does the assessment team have the requisite language(s) skills and knowledge of the cultural context to engage with local stakeholders effectively? This includes knowledge of gender and sociocultural norms, a gender-balanced assessment team, if necessary, and the ability to communicate in the language most commonly used by the stakeholder group.
- Do education, social hierarchy, literacy and language differences mean that local communities may not feel comfortable being open and honest with the assessor when asked questions?
- What are the power relationships between stakeholders and stakeholder groups as well as the project team, and how might this impact upon community perception of the project as well as project outcomes?
- Is the project bringing benefit to the wider community and/or specific members of the community? Local community members may be unwilling to give negative feedback in case the project is taken away.
- Does the selection of local community members or stakeholders to speak to only engage with those that the project owner points to? The project owner may simply choose those with the most positive views of the project, and this may not give a realistic picture.
- Does the selection of local community members or stakeholders to speak with provide a holistic view of how the project impacts local communities and stakeholders? Different people will have different experiences of the project based on their identities and position within society. For example, a wealthy shop owner may have a positive experience as a project is bringing tourists to the region, which increases their business; however, the project may limit access to fuel wood as it is conserving the forest, which has a negative impact for local women, who now have to walk much further every day to collect wood for cooking.
- Do assessors enable different groups, especially marginalised and vulnerable groups, to give their input? Different people will also have different levels of voice and ability to speak up about their experiences.
- Have assessors collected data appropriately and provided privacy safeguards for those providing information? How will information be recorded and stored? Anonymisation of information collected may be required.
- Has consent been given for recording and storing data once collected?

Some key stakeholder groups that assessors may come across, and some considerations for engaging them, are outlined below:

Disabled people
- Consideration of any adjustments that might need to be made to facilitate participation such as:
  - Interpretation
  - Improving physical access
  - Timing and location of consultation
- Different considerations may be required, such as having an interpreter for deaf people.
- Engaging at an appropriate time and place is important. Special attention and care must be paid to ethical considerations, if required.

Elderly people
- Identifying and approaching elderly people may be easy but sometimes they may not be able to clearly communicate because of (deteriorating) health conditions, memory loss and lack of information. A low elderly population in a village may also lead to bias if data is only collected from elderly people.

Indigenous peoples (IPs)
- IPs self-identify as indigenous, and generally have a historical continuity with a given region prior to colonisation and a strong link to their lands. They maintain, at least in part, distinct social, economic and political systems[11].
- IPs have the specific rights to Free, Prior and Informed Consent (FPIC) as outlined in the UN Declaration on the Rights of Indigenous Peoples (UNDRIP)[12]. Where projects work with IPs, or where IPs are in the region, it is crucial to establish whether FPIC has been granted.
- IPs may have specific rights to land and resources, and these may be in conflict with state-sponsored strategies. Access to land and natural resources may be contested by different stakeholder groups.

Landless people
- Landless people may be daily wage labourers. Assessors should locate this group and ensure they do not waste their time, as engaging with assessors may cause them to lose income. This applies to all stakeholders, but is particularly pronounced for daily wage labourers.

Migrants, refugees and asylum seekers
- Migrants, refugees and asylum seekers may be staying for short or long periods of time and may be temporarily or permanently resettled. The assessor should be aware of any tensions or sensitivities that may be present. Different linguistic and socio-cultural skills may be required to engage with this group vis-à-vis other stakeholders.

Private landowners
- May be less interested in engaging stakeholders in a project on their private land. Power imbalance may also exist, meaning it is crucial to engage these stakeholders.

Project owners
- May have vested interest in showing the project at its best, so may only direct assessors to those local stakeholders that will portray a project positively to assessors.

Smallholder farmers
- Smallholder farmers tend to have small landholdings producing smaller volumes of mostly subsistence agriculture. They may be part of the informal economy.
- Smallholder farmers may not be comfortable speaking in front of large landowners, so should be engaged separately where necessary.
- Smallholder farmers may be unable to articulate needs due to lack of information and knowledge about projects or policies.
- Smallholder farmers may be wary of engaging with authorities depending on their land tenure status.

Women

- Women may not feel comfortable speaking in front of men due to power dynamics and cultural norms. Instead of interviewing mixed gender groups, assessors can interview women's groups separately. These should be interviewed by a woman assessor.
- Women may have household/homestead, caring or other responsibilities that make it difficult to attend certain meeting times or formats. Facilitators need to consider meeting at an appropriate time and place and avoid late evening hours.
- Women and other excluded groups may have specific considerations around personal safety and accessibility of meeting sites. Consulting relevant local civil society groups may help to ensure assessment is undertaken in an accessible manner.

E.3 Facilitation and Communication Skills

Assessors shall carry out interviews and/or focus group discussions with local stakeholders (section 5.7), and facilitating these effectively requires some good communication skills.

When communicating, assessors shall:

- Be open-minded and ready to modify preconceptions
- Speak clearly and slowly, using the language most commonly used by the stakeholder group
- Smile and make eye contact
- Have open body language (e.g., do not have crossed arms)
- Ask non-leading questions, listen to answers, and seek confirmation and clarification as required

Facilitating group discussions

When assessors are engaging with groups of stakeholders (for example, during a focus group discussion), they shall make sure that as far as possible everyone gets an opportunity to participate and contribute while respecting existing hierarchies. Assessors shall also steer discussions to obtain the types of information and ideas needed for assessment. Often, in larger groups, people may start to depend on a spokesperson and may become unwilling to express their own ideas. In some social groups and cultures having a spokesperson is normal, and people are confident enough to add their ideas or opinions when they feel they have not been articulated well by others.

Working with subgroups

To assess the impact of a project on different local stakeholder groups, assessors can divide stakeholders into subgroups. For example, for focus groups, assessors might want to have women's and men's subgroups or groups based around tribes/castes, or occupation, e.g., farmer/non-farmer. This is a good technique to empower and give voice to socially disadvantaged groups and to compare the information from different groups.

Timing and seasonal aspects

When conducting assessments, assessors should be aware that certain seasons or certain times of day may be more suitable than others. For example, it is usually best to avoid certain agricultural seasons because people may be too busy to participate in meetings. During the daytime some people may be working in their fields; during evenings women may be busy with household tasks. Often, early morning is the best time to engage with local communities but check with local people first to find out what would be best for them. Avoid taking up too much of busy people's time. Assessors should always adjust your plans accordingly rather than expecting people to fit in with your own schedule.

Preparations for marginalised or vulnerable groups

In some contexts, attending a meeting can mean a person abandoning a whole day's activities and can thus act as a major barrier to participation of women or more vulnerable individuals or families, e.g., daily paid labourers. In other cases, people may have to travel some distance to attend. Make preparations appropriate to the local context and culture, and ensure equitable practices are applied between individuals, groups and villages.

E.4 Semi-structured Interview[13]

Semi-structured interviews are an effective information-gathering tool for assessing social aspects of restoration projects.

E.4.1 When to Use this Tool

Semi-structured interviews are very useful during TGBS assessments when the assessor needs to interact with a particular stakeholder group (particularly an identified disadvantaged group), or with a knowledgeable person, but would like to do this away from other stakeholders or the project team because of the need to discuss sensitive issues in private.

E.4.2 What Is the Purpose of a Semi-structured Interview?

Semi-structured interviews:

- Seek in-depth information and ideas from knowledgeable local persons or small groups of people
- Obtain expert advice and suggestions from key informants
- Check how certain critical stakeholder groups are being affected by a project (e.g., to see if equity issues and safeguards are being properly addressed)

E.4.3 Why Is this Tool Useful?

A semi-structured Interview is a flexible tool that can be used for many different purposes, both with individuals and small groups (see also section E.5). It is a way to get beyond a simple questionnaire by adding depth to existing information or to find out more and get a better understanding of a particular topic. It is also a useful tool for checking information that has already been provided or obtained from elsewhere (triangulation) and is therefore a useful tool for project assessment.

The important feature of a semi-structured interview is that it enables interviewees to explain and describe things in their own words rather than giving answers to specific predetermined questions. This allows them to become more confident, especially if the individual or group is normally unable to speak out in public.

E.4.4 Who Should Participate?

Interviewees are normally selected according to the requirements of the interviewer. Usually, this is because a particular stakeholder group has been identified about which more detailed information is needed or because a particularly knowledgeable individual has been suggested as being a potentially useful informant. During assessment, a particular individual or group might request an interview because they have a sensitive issue which they want to discuss (this may form part of a safeguarding procedure). If a semi-structured interview is being conducted with a group of people, it is important to ensure that the group is small (less than five people) and that they have a common attribute, e.g., single gender, or a single ethnic background. In this way they will be empowered to speak out with greater confidence than if they were in a larger mixed group.

E.4.5 How to Use this Tool

1. Start by preparing an outline or checklist of the topics to cover during the semi-structured interview. Usually, a few formal questions are included at the start, e.g., for interviewees to explain who they are and where they come from. This will help to put them at ease from the start. The rest of the topics are simply listed – not necessarily in the form of questions.
2. Identify and inform the individuals to be interviewed. This will depend on the purposes for which the semi-structured interview is being used. Make sure that those persons chosen can communicate with the interviewer in a common language (or arrange for an interpreter if necessary).
3. Select a suitable place and time for the interview. Often, an informal setting will help to put participants at ease – so a semi-structured interview can be conducted in a cafe or other quiet place, but make sure that there will be no disturbances and that the interview can be carried out in confidence. If there is a small group attending, make sure that seating arrangements are suitable (don't use a desk, but sit around a table or in a circle on the ground). Normally a semi-structured interview shall not take more than about 30 minutes. For reasons of safeguarding, the interviewers should work in pairs: one person can take notes and the other to guide the dialogue.
4. Begin by explaining the purpose of the semi-structured interview to the person or group participating. Explain that, if necessary, all information provided will be treated confidentially. If you wish to record the discussion (this is not usually recommended), then make sure you have everyone's permission to do so.
5. Ask a few prepared formal introductory questions (see point 1 above). Make sure that in a group everyone has spoken – if only to introduce themselves.
6. Work through the checklist you prepared earlier by asking relevant questions and carefully listening to the answers. Questions should be short, simple and 'open', i.e., questions should not be answerable with a simple 'yes' or 'no' or with a single word. Avoid asking 'leading questions', e.g., where you are suggesting what the answer might be in your question (see examples below). Don't rush participants' answers, and if necessary, let them speak at length. The aim of a semi-structured interview is to allow participants to speak as much as possible and for you to listen in a non-judgemental way.
7. After participants have spoken, follow up by asking other related follow-up questions based on the answers they have given. This helps to ensure that you have understood their answer properly and allows you to explore it in a bit more depth (this is called 'probing'). Avoid jumping from topic to topic.
8. In a small group – follow up on one participant's answer by asking another person what they think (about the same topic or about the other person's answer).
9. Maintain eye contact with participants and don't try to take notes at the same time. If necessary, another person can take notes.
10. If the line of discussion goes too far off-topic, then use your checklist to bring it back on track – but don't be too rigid because participants may have things they wish to discuss that you didn't include in your checklist.
11. In a small group, give every person a chance to participate and speak. If someone is unwilling to speak, then ask them questions personally, rather than to the whole group, e.g., 'So, what do you think about that person's answer'? But don't embarrass people if they don't want to speak out.
12. Before finishing, ask the participants if they have any questions they would like to ask you and answer them accordingly.
13. At the end of the interview, remember to thank everyone for their contributions.
14. If you have taken notes, or if you want to keep a record of the interview, then do this as soon as possible, so that answers are still fresh in your mind. If you can remember particular quotes that a person has said, this will help to convey the quality of the discussions you have had.

A semi-structured interview with stakeholders in São Paulo, Brazil. (Jardim Botânico Araribá)

E.4.6 Examples of Closed/Open and Leading Questions for Semi-structured Interviews

Don't ask:

'Is the project going well?' or 'Are there any problems with the project?' or 'Have you benefited from the project?'

Do ask:

'How do you feel about the project so far?' then, based on the answer given, ask follow-up questions to get more detail.

Don't ask:

'Do you collect medicinal plants from the forest?'

Do ask:

'What sort of resources do you collect from the forest?' then follow up (probe more deeply) by asking about each different plant that has been mentioned in turn, e.g., 'What is it being collected for?', 'Who collects it?', 'How abundant is it?' etc.

Don't ask:

'Is the forest now more degraded than it used to be?'
Or 'Is there any illegal logging taking place in the forest?'

Do ask:

'How does the condition of the forest now compare with what it used to be?' then follow up (probe) by asking: 'What do you think are the causes of the changes in forest condition?'

E.5 Focus Group Discussion[14]

Focus group discussions are another effective information-gathering tool for assessing social aspects of restoration projects.

E.5.1 What Is the Purpose of a Focus Group Discussion?

A focus group discussion is a way to bring together several members of a group having a common interest or common identity. The purpose of a focus group is to understand in greater depth a particular topic or issue that is relevant to the project. It differs from a wider group because of the focus group's make-up that ensures that everyone participating has something relevant to contribute to the discussion.

E.5.2 Why Is this Tool Useful?

A focus group discussion is a useful tool to engage with a disadvantaged group (e.g., women, minority ethnic groups, children) as they may find it less intimidating to discuss things in a closed group of known people.

Group discussions are a useful way to obtain several perspectives about a project, activity or other topic. Unlike one-to-one interviews, members in a group can build on each other's responses and come up with ideas that they may not have thought of by themselves. Group discussions are particularly beneficial for bringing together a range of people or stakeholders (e.g., staff, students, local authorities, communities, local businesses).

E.5.3 Who Should Participate?

Ideally 8-10 participants and a facilitator and a note taker. It can be useful to have separate focus groups so each one can accommodate participants of a similar social or other background.

E.5.4 How to Use this Tool

Before starting, prepare a topic guide, which is a rough list of questions divided into sub-set categories (or themes). The purpose of this is to loosely structure the focus group discussion and to guide the group's discussion (as naturally as possible) through the topics. It is good practice to record the focus groups (but remember to get participants' consent if doing this), so that the discussions can be transcribed word for word. This allows for easier analysis and serves as a written record of the session. Questions for the group shall be qualitative, unbiased and open.

1. At the start of the focus group discussion, welcome the group and introduce yourself and your team. Check that all participants understand the confidentiality policy and risks. Cover any housekeeping notes and then begin by explaining the purpose of the focus group discussion and the objective for the session (be careful not to give too much away as it could bias the responses). At this point it is generally a good idea to pause for any questions that the group may have. Think about how best the group should be seated so as to promote equality.

2. Set out some basic ground rules and remind participants that:
   - You are interested in their responses and experiences
   - They should speak one at a time (for the audio recorder or note taker)
   - You want to hear everyone's views
   - They should listen to each other and respect each other's views
   - You might ask them to move on to a question or revisit a question depending on the time available
   - Any views or opinions expressed during the focus group will be confidential and anonymised
3. Begin with an icebreaker to get participants comfortable with speaking, and establish the moderator as the leader of the group (allow approximately 10 minutes for this).
4. During the discussion, encourage the conversation (through prompts) and allow the group to lead their own discussion. If the dynamics of the group work well, you will be able to do and say less, keep listening and let the group naturally interact over the topic. In these circumstances, keep an eye on the clock and only intervene when you have heard suitable responses and would like to move on.
5. Occasionally, the group's dynamics can be unhelpful for the stimulation of a discussion, particularly where there are breakaway conversations among two or more individuals or where there is tension in the group. In these circumstances there are a number of things you can do to get the group back on track:
   - Challenge and close down dominant characters (politely at first)
   - If a participant makes persistent negative remarks, remind participants of the house rules to respect one another and of the fact that this is a safe space
   - Give quieter participants a chance to contribute (look out for signs that they have something to say but avoid putting them on the spot)
   - Diffuse conflicts by moving the topic on (or parking an issue)
   - Move into a more creative mode (for example, get the group up and ask them to engage in an exercise before sitting down in different seats)
   - Introduce an activity to the group that requires them to work among themselves (this can also give the moderator a break)
6. At the end of the focus group, summarise the important things you have learned from the focus group and reflect on some of the emerging issues. Remember to thank the participants for their time and participation, and to let them know that you appreciate their contributions. Explain to them the next steps and share how the information from the focus group discussion will be used.
7. After the discussion, analyse and summarise the findings. Generally, you are looking for the consensus position among all the groups, but it may also be important to highlight outliers or areas of disagreement.

E.5.5 Example Questions for Focus Groups Discussions[15]

The questions posed during focus groups serve as the agenda for the group discussion. A good question will stimulate good interaction among group participants. Some questions have the potential to exclude certain points of view through false assumptions or narrow, inappropriately phrased and poorly designed questions, which can affect the quality of the information provided.

To understand who benefits from the project, and how, the following questions may be asked:

- How did a particular project intervention or policy impact you?
- Did it lead to a change in income and/or employment opportunities?
- Who was mainly employed (male or female participants, lower class, migrant workers, labourers)?
- What differences did you notice in the surrounding environment?
- Did you notice changes in water quality, soil fertility, emergence of butterflies, etc.?
- How was income from the project used within the family?
- Were you able to access health and educational benefits with increased income?
- Is there anything you'd like to ask me?
- Is there anything I haven't asked that you think I should have?

A focal group discussion about conservation planning with local people at Ankafobe, Madagascar. (Missouri Botanical Garden Madagascar)

Notes

[11] https://www.un.org/en/fight-racism/vulnerable-groups/indigenous-peoples

[12] https://www.fao.org/indigenous-peoples/our-pillars/fpic/en/

[13] Plan Vivo Foundation, 2023. Participatory tools for use in PV climate projects.

[14] Plan Vivo Foundation, 2023. Participatory tools for use in PV climate projects.

[15] FAO (2009) Bridging the Gap: FAO's programme for gender equality in agriculture and rural development. Rome: FAO.

Appendix F: Ecosystem Integrity Five-star System

Adapted from the Society for Ecological Restoration Five-star Recovery System (Gann et al. 2019; Standards Reference Group SERA 2021, and Young et al. 2022, with additional contributions by Tein McDonald and Kingsley Dixon)[16].

Ref.	Attribute	Sub-attribute	Zero stars	One star	Two stars	Three stars	Four stars	Five stars
a)	Absence of threats	Contamination	High number and degrees of direct contamination drivers present, posing a high risk to the environment. Mitigation efforts are inadequate or non-existent.	Some direct drivers of contamination (e.g., use of toxic herbicides, legal or illegal dumping) are absent but others remain high in number and degree (residual contamination, chemical control of pests or weeds, leakage from adjacent sites).	Direct contamination drivers intermediate in number and degree.	Number of direct contamination drivers is low, but some may remain intermediate in degree.	Direct contamination drivers, both external and on site, low in number and degree.	Known threats from contamination managed or mitigated to high extent.
b)	Absence of threats	Invasive species	Direct invasive species drivers present at high levels (e.g., high invasive loads in propagule bank or reproductive invasive animals on site, reproductive individuals on adjacent sites or within dispersal zone, >50% relative cover of reproductive invasive plants on site). No or inadequate management or mitigation measures in place.	Some invasive species drivers (e.g., planting or release of invasive species, contaminated equipment or supplies) are absent but others remain high in number and degree (e.g., >25% relative cover of reproductive invasive plants on site).	Direct invasive species drivers intermediate in number and degree (e.g., >10% relative cover of reproductive invasive plants).	Number of direct invasive species drivers is low, but some may remain intermediate in degree (e.g., >2% relative cover of reproductive invasive species).	Threats from direct invasive species drivers, both external and on site, very low in number and degree (e.g., <2% relative cover of reproductive invasive species).	All threats from invasive species managed or mitigated to a very high extent.
c)	Absence of threats	Over-utilisation	Protection status not secured; multiple over-utilisation drivers present (e.g., over-harvesting, illegal logging or harvesting, mining, overgrazing, over-hunting, infrastructure development) present and high in number and degree.	Protection status secured; some over-utilisation drivers (e.g., over-harvesting, illegal logging or harvesting, mining) absent but others remain high in number and degree (e.g., overgrazing, over-hunting, infrastructure development).	Direct over-utilisation drivers (overgrazing, over-hunting) intermediate in number and degree.	Number of direct over-utilisation drivers is low, but some may remain intermediate in degree.	Direct over-utilisation drivers, both external and on site, low in number and degree.	All threats from over-utilisation managed or mitigated to a high extent.

Ref.	Attribute	Sub-attribute	Zero stars	One star	Two stars	Three stars	Four stars	Five stars
d)	Absence of threats	Other degradation drivers	Direct degradation drivers present at high levels (e.g., inappropriate fire regimes including severe and harmful wildfires, inappropriate hydrology including severe and harmful flooding, absence of any appropriate natural disturbance regimes). No or inadequate management or mitigation measures in place.	Some direct degradation drivers remain high in number and degree.	Direct degradation drivers intermediate in number and degree.	Number of direct degradation drivers is low, but some may remain intermediate in degree.	Direct degradation drivers, both external and on site, low in number and degree.	Threats from direct degradation drivers are minimal or effectively absent.
e)	Physical conditions	Substrate physical conditions (both abiotic and biotic components), including topography	Physical properties of the substrates (e.g., soil structure and layers, landforms and topography, erosion, compaction, temperature) are highly dissimilar to those of the reference, making them incapable of supporting the growth and development of native biota.	Most physical properties of the site's substrates are still highly dissimilar to the reference but some (e.g., topography) showing improved similarity.	Physical properties of substrates remain at low similarity levels relative to the reference but capable of supporting some characteristic native biota.	Physical properties of substrates stabilised within the intermediate range of the reference and capable of supporting growth and development of many characteristic native biota.	Physical conditions of substrates within a high range of the reference and suitable for ongoing growth and recruitment of most characteristic native biota.	Physical conditions of substrates are highly similar to that of the reference with evidence they can indefinitely sustain all characteristic species and processes.
f)	Physical conditions	Substrate chemical conditions	Chemical properties of the substrates (e.g., pH, nutrients, salinity) are highly dissimilar (e.g., too high or too low) to the reference, unable to support native biota growth and development.	Most chemical properties of the site's substrates still highly dissimilar to the reference but some showing improved similarity.	Chemical properties of substrates remain at low similarity levels relative to the reference but capable of supporting some characteristic native biota.	Chemical properties of substrates stabilised within the intermediate range of the reference and capable of supporting growth and development of many characteristic native biota.	Chemical conditions of substrates within a high range of the reference and suitable for ongoing growth and recruitment of most characteristic native biota.	Chemical conditions of substrates are highly similar to that of the reference with evidence they can indefinitely sustain all characteristic species and processes.
g)	Physical conditions	Water chemo-physical conditions	Physical and chemical properties of the site's hydrology (e.g., pH, nutrients, hydrological conditions, water table depth) are highly dissimilar to those of the reference resulting in an inability to support the growth and development of native biota.	Most physical and chemical properties of the site's hydrology are still highly dissimilar to the reference but some showing improved similarity.	Physical and chemical properties of hydrology remain at low similarity levels relative to the reference but capable of supporting some characteristic native biota.	Physical and chemical properties of hydrology stabilised within the intermediate range of the reference and capable of supporting growth and development of many characteristic native biota.	Physical and chemical conditions of hydrology within a high range of the reference and suitable for ongoing growth and recruitment of most characteristic native biota.	Physical and chemical conditions of hydrology highly similar to that of the reference with evidence they can indefinitely sustain all characteristic species and processes.
h)	Species composition	Desirable plants, fungi and lichens	No native plant, fungi and lichen species are present or their presence is negligible.	Some colonising native plant, fungi and lichen species are present (e.g., >5% richness and evenness of the reference).	A small subset of characteristic native plant, fungi and lichen species present (e.g., >25% richness and evenness of the reference) across the site.	A subset of key native plant, fungi and lichen species present (e.g., >50% richness and evenness of the reference) over substantial proportions of the site.	Substantial diversity of characteristic native plant, fungi and lichen species and genes present (e.g., >75% richness and evenness of the reference) across the site and representing a wide diversity of functional groups.	High diversity of characteristic native plant, fungi and lichen species and genes present (e.g., >95% richness and evenness of the reference or a somewhat lower % if high likelihood for further colonisation of all other main native species over time), with very high similarity to the reference.

Ref.	Attribute	Sub-attribute	Zero stars	One star	Two stars	Three stars	Four stars	Five stars
i)	Species composition	Desirable animals	No native animal species are present or their presence is negligible or transitory.	Some colonising native species present (e.g., >5% richness and evenness of the reference) with some evidence of residency at site.	A small subset of characteristic native species present (e.g., >25% richness and evenness of the reference) across site with low levels of residency compared to the reference.	A subset of key native species present (e.g., >50% richness and evenness of the reference) over substantial proportions of the site with moderate levels of residency compared to the reference.	Substantial diversity of characteristic native species and genes present (e.g., >75% richness and evenness of the reference) across the site and representing a wide diversity of functional groups with demonstrated high levels of residency compared to the reference.	High diversity of characteristic native species and genes present (e.g., >95% richness and evenness of the reference or a somewhat lower % if high likelihood for further colonisation of all other main native species over time), with very high similarity to the reference.
j)	Species composition	Rare and threatened species	No rare or threatened species are present or their presence is negligible.	Some colonising rare and threatened species present (e.g., >5% richness and evenness of rare and threatened species of the reference).	A small subset of characteristic rare and threatened species present (e.g., >25% richness and evenness of rare and threatened species of the reference) across the site.	A subset of key rare and threatened species present (e.g., >50% richness and evenness of rare and threatened species of the reference) over substantial proportions of the site.	Substantial diversity of characteristic rare and threatened species and genes present (e.g., >75% richness and evenness of rare and threatened species of the reference) across the site and representing a wide diversity of functional groups.	Appropriately high diversity of characteristic rare and threatened species and their genes present (e.g., >95% richness and evenness of rare and threatened species of the reference), with high similarity to the reference and high potential for colonisation of more native species over time.
k)	Species composition	No undesirable species	Extremely high levels of non-native, invasive or other undesirable plants (e.g., >75% relative species richness, abundance or cover) or non-native or undesirable animals (e.g., harmful livestock or over-abundant native species).	Very high levels of non-native, invasive or other undesirable plants (e.g., >50% relative species richness, abundance or cover) or non-native or undesirable animals.	High to intermediate levels of non-native, invasive or other undesirable plants (e.g., >25% relative species richness, abundance or cover) or non-native or undesirable animals.	Intermediate to low levels of non-native, invasive or other undesirable plants (e.g., <25% relative species richness, abundance or cover) or non-native or undesirable animals.	Low to very low levels of non-native, invasive or other undesirable plants (e.g., <5% relative species richness, abundance or cover) or non-native or undesirable animals.	Very low to nil non-native, invasive or other undesirable plants or non-native animals and no overabundant native species.
l)	Species composition	Provenance, genetic diversity and genetic resilience	Provenance of material is inappropriate for the site with inadequate genetic diversity or resilience for native species and little to no presence of native species with appropriate provenance and genetic diversity.	Provenance of material appropriate to site and adequate genetic diversity and resilience for a very low proportion of native species (e.g., >5% of the reference) are present.	Adequate genetic diversity and resilience for a very low to low proportion of native species (e.g., >25% of the reference) are present.	Adequate genetic diversity and resilience for a low to intermediate proportion of native species (e.g., >50% of the reference) are present.	Adequate genetic diversity and resilience for an intermediate to high proportion of native species (e.g., >75% of the reference) across the site.	High genetic diversity and resilience of characteristic native species (e.g., >95% of the reference), with high similarity to the reference.
m)	Structural diversity	All vegetation strata	No stratum of the reference present, with little to no resemblance in terms of the number, structure, growth form and complexity of strata present.	At least one stratum of the reference present throughout the site (e.g., canopy, ground cover) but is dissimilar to the reference.	Multiple strata of the reference present and remain at low similarity levels relative to the reference but capable of supporting some biota of the reference.	>50% of the strata of the reference present within the intermediate range of the reference and capable of supporting growth and development of many characteristic native biota.	All strata of the reference present, within a high range of the reference and suitable for ongoing growth and recruitment of most characteristic native biota.	All strata of the reference present and highly similar to that of the reference. Further complexity able to self-organise to highly resemble the reference. No inappropriate strata unrelated to the reference present.

Ref.	Attribute	Sub-attribute	Zero stars	One star	Two stars	Three stars	Four stars	Five stars
n)	Structural diversity	All trophic levelsl	Community trophic complexity is highly dissimilar to the reference with little to no resemblance in terms of primary producers, primary consumers, secondary consumers, tertiary consumers, apex predators and decomposers. Soil microbiome highly dissimilar to the reference.	Community trophic complexity is still largely dissimilar to the reference with some evidence of primary producers, primary consumers and secondary consumers.	Some similarity of trophic complexity, relative to reference in terms of primary producers, primary consumers and secondary consumers.	Intermediate similarity of trophic complexity relative to reference in terms of primary producers, primary consumers, secondary consumers, and tertiary consumers and decomposers.	Substantial similarity of trophic complexity relative to reference in terms of primary producers, primary consumers, secondary consumers, tertiary consumers, decomposers and apex predators and decomposers.	All trophic complexity present with high similarity to the reference. Further trophic complexity is able to self-organise to highly resemble the reference.
o)	Structural diversity	Spatial mosaic	Spatial distribution of features (e.g., vegetation, animal populations, habitats) is highly dissimilar to the reference. There is little to no resemblance to the reference in terms of the arrangement and distribution of species, habitats and habitat features.	Spatial patterning is still largely dissimilar to the reference, but some spatial distribution of features is present.	Some similarity of spatial distribution of features relative to reference throughout most of the site.	Intermediate similarity of spatial distribution of features relative to reference throughout most of the site.	Substantial similarity of spatial distribution of features relative to reference throughout the site.	All spatial distribution of features present with high similarity to the reference. Further spatial distribution of features is able to self-organise to highly resemble the reference.
p)	Ecosystem function	Productivity/ cycling	Physical and biological processes and functions (e.g., photosynthesis and growth, water and nutrient cycling) are either completely absent, compromised or severely diminished when compared to the reference.	Physical and biological processes and functions are at a very foundational stage only, compared to the reference.	Low numbers and levels of physical and biological processes and functions, relative to the reference are present.	Intermediate numbers and levels of physical and biological processes and functions, relative to the reference.	Substantial levels of physical and biological processes and functions, relative to the reference are present.	All processes and functions are present with a high similarity to the reference and show evidence of being sustained.
q)	Ecosystem function	Habitat & interactions	Habitat provision is absent or severely limited in its presence and functions when compared to the reference.	Habitat provision at a very foundational stage only, compared to the reference.	Low numbers and levels of habitat provision relative to the reference are present.	Intermediate numbers of habitat provision relative to the reference are present.	Substantial levels of habitat provision relative to the reference are present.	Habitat provisions are present with a high similarity to the reference and show evidence of being sustained.
r)	Ecosystem function	Resilience & recruitment	Little to no resilience or recruitment compared to the reference. The ecosystem is not able to recover from natural disturbances or maintain species population through reproduction.	Resilience and recruitment are at a very foundational stage compared to the reference.	Low levels of resilience and recruitment relative to the reference (including return of appropriate disturbance regimes) are present.	Intermediate levels of resilience and recruitment relative to the reference (including return of appropriate disturbance regimes) are present.	Substantial levels of resilience and recruitment relative to the reference (including return of appropriate disturbance regimes) are present.	Resilience and recruitment (including appropriate disturbance regimes) operating with high similarity to the reference and show evidence of being sustained.
s)	External exchanges	Landscape flows	No or very limited positive exchanges or flows with the surrounding environment (e.g., of species, water, fire) for any species or processes.	Positive exchanges and flows with the surrounding environment in place for only very low numbers of species and processes (e.g., >10% of the reference).	Positive exchanges and flows with the surrounding environment in place for a few characteristic species and processes (e.g., >25% of the reference).	Positive exchanges and flows between site and surrounding environment in place for intermediate levels of characteristic species and processes (e.g., >50% of the reference).	Positive exchanges and flows with the surrounding environment in place for most characteristic species and processes (e.g., >75% of the reference) and likely to be sustained.	Evidence that exchanges and flows with the surrounding environment are highly similar to the reference for all species and processes and likely to be sustained.

Ref.	Attribute	Sub -attribute	Zero stars	One star	Two stars	Three stars	Four stars	Five stars
t)	External exchanges	Intraspecific gene flows	No or very limited positive genetic flow between the site and its surroundings for any species.	Positive genetic flow with the surrounding environment in place for only very low numbers of species (e.g., >10% of the reference).	Positive genetic flow with the surrounding environment in place for a few characteristic species (e.g., >25% of the reference).	Positive genetic flow between site and surrounding environment in place for intermediate levels of characteristic species (e.g., >50% of the reference).	Positive genetic flow with the surrounding environment in place for most characteristic species (e.g., >75% of the reference) and likely to be sustained.	Evidence that genetic flow with the surrounding environment is highly similar to the reference for nearly all species (e.g., >95% of the reference) and likely to be sustained.
u)	External exchanges	Habitat links	No to very limited positive habitat links with the surrounding environment in place for any species, indicating the site is highly isolated from its surroundings.	Positive habitat links with the surrounding environment in place for only a very low number of species (e.g., >10% of the reference).	Positive habitat links with the surrounding environment in place for a few characteristic species (e.g., >25% of the reference).	Positive habitat links between site and surrounding environment in place for intermediate levels of characteristic species (e.g., >50% of the reference).	Positive habitat links with the surrounding environment in place for most characteristic species (e.g., >75% of the reference) and likely to be sustained.	Evidence that habitat links with the surrounding environment are highly similar to the reference for nearly all species (e.g., >95% of the reference) and likely to be sustained.

Assessment of a restoration site in Soraypampa, Peru. (Huarango Nature)

Notes

[16] Gann GD, McDonald T, Walder B, Aronson L, Nelson CR, Jonson L, Hallett JG, Eisenberg C, Guariguata MR, Liu J, Hua F, Echeveria C, Gonzales E, Shaw N, Decleer K, Dixon KW (2019) International principles and standards for the practice of ecological restoration. Second edition. *Restoration Ecology* 27:S1-S46

Appendix G: Level of Protection Five-star ratings

Category	Description	Source	Star rating	Legal protection for biodiversity	Percentage of management activities sufficient for long-term sustainable conservation objectives
Strict nature reserve	Strictly protected for biodiversity and possibly geological/geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values.	IUCN Cat. 1a	5 stars	Yes	100%
Wilderness area	Usually large, unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition.	IUCN Cat. 1b	5 stars	Yes	100%
National park	Large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.	IUCN Cat. II	5 stars	Yes	100%
Natural monument or feature	Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove.	IUCN Cat. III	5 stars	Yes	100%
Habitat/ species management area	Areas to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category.	IUCN Cat. IV	5 stars	Yes	100%
Protected landscape/ seascape	Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value; and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.	IUCN Cat. V	5 stars	Yes	100%

Category	Description	Source	Star rating	Legal protection for biodiversity	Percentage of management activities sufficient for long-term sustainable conservation objectives
Protected area with sustainable use of natural resources	Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims.	IUCN Cat. VI	5 stars	Yes	100%
Area with near sustainable use of natural resources	Legally protected but despite management efforts to conserve the ecosystem and maintain associated cultural values, only 75-99% of management activities are consistent with sustainable long-term conservation objectives.		4 stars	Yes	75-99%
Primary conservation	Areas meeting the IUCN definition of a protected area, but where the governance authority (e.g., community, indigenous peoples' group, religious group, private landowner) does not wish the area reported as a protected area.	OECM definition	4 stars	No	100%
Area with partial sustainable use of natural resources	Legally protected but despite management efforts to conserve the ecosystem and maintain associated cultural values, only 50-74% of management activities are consistent with sustainable long-term conservation objectives.		3 stars	Yes	50-74%
Informal area of conservation	Land is managed as if it is a protected area but has no formal status. Biodiversity is an objective of the management of the site. ≥75% of management activities are consistent with sustainable long-term conservation objectives.		3 stars	No	≥75%
Concerned park	Legally protected but despite management efforts to conserve the ecosystem and maintain associated cultural values, only 25-49% of management activities are consistent with sustainable long-term conservation objectives.		2 stars	Yes	25-49%

Category	Description	Source	Star rating	Legal protection for biodiversity	Percentage of management activities sufficient for long-term sustainable conservation objectives
Secondary conservation	Active conservation of an area where biodiversity outcomes are only a secondary management objective, but in situ conservation is delivered (e.g., some conservation corridors).	Modified from OECM definition	2 stars	No	≥50%
Ancillary conservation	Areas delivering in situ conservation as a by-product of management, even though biodiversity conservation is not an objective (e.g., some military training grounds, protected marine war graves and freshwater protection zones).	OECM definition	2 stars	No	≥50%
Paper park	A legally established protected area where experts believe current protection activities are insufficient to halt degradation. 0-24% of management activities are consistent with sustainable long-term conservation objectives.		1 star	Yes	<25%
Conflicted	Despite management efforts to conserve the ecosystem and maintain associated cultural values, only 25-49% of management activities are consistent with sustainable long-term conservation objectives.		1 star	No	25-49%
Concerned	Conservation objectives are stated but not implemented or met, with only 25-49% of management activities consistent with sustainable long-term conservation objectives.	Inspired by IUCN RLE	1 star	No	25-49%
Threatened	Lack of management that causes ecosystem alteration (e.g., invasions of destructive flora or fauna, fire suppression or unnatural fire). 0-24% of management activities are consistent with sustainable long-term conservation objectives.	Inspired by IUCN RLE	0 stars	No	<25%
Vulnerable	Observed or inferred threatening processes (e.g., illegal hunting, grazing, over-exploitation) that are likely to cause continuing declines in geographic distribution, environmental quality or biotic interactions and considered to be at a high risk of collapse.	Adapted from IUCN RLE	0 stars	No	<25%
Collapse	Biotic or abiotic features are lost, and the characteristic native biota are no longer sustained (e.g., illegal occupation of protected area, deforestation, mining).	Modified from IUCN RLE	0 stars	No	<25%

Appendix H: Stakeholder Engagement and Social Benefits Ratings

Contents

H.1 Stakeholder Engagement

A maximum of 4 points is available for scoring criterion 3 attribute 1: stakeholder engagement.

+1 point: Awarded for stakeholders being identified and made aware of the project and rationale. This can be evidenced through the project having completed a stakeholder analysis or mapping exercise, and the applicant creating awareness of the project through distributing flyers, holding community meetings, and establishing and communicating feedback and grievance mechanisms.

+1 point: Awarded when the applicant shows that a grievance mechanism exists and is accessible to stakeholders. This can be evidenced through documentation, and through confirming with stakeholders that they are aware of the grievance process.

+1 point: Awarded when the applicant shows that primary stakeholders are involved and support the project.
Involvement should increase from the start of implementation.

+1 point: Awarded when the applicant shows that secondary stakeholders are involved and support the project.
Involvement should increase from the start of implementation.

For medium to large projects (>500 ha), it would be expected that the project demonstrates a high level of involvement of primary and secondary stakeholders to earn the respective points.

Significant involvement of stakeholders in project activities could involve stakeholders taking part in several activities, stakeholders having ongoing involvement in project activities rather than a one-off (e.g., ongoing project monitoring rather than a one-off tree planting day) or significant involvement in one activity (e.g., stakeholders carrying out participatory mapping, and the resulting map being used to establish formal access and use rights for stakeholders).

Local communities can benefit from employment in native tree nurseries, such as this one in Agnalazaha Forest, Madagascar. (Missouri Botanical Garden Madagascar)

Table H1: *Ratings and examples of evidence for scoring projects under criterion 3, attribute 1.*

1 point	1 point	1 point	1 point
Stakeholders identified and made aware of the project and rationale.	Stakeholders identified and made aware of the project and rationale. Grievance mechanism exists and is accessible to stakeholders.	Primary stakeholders are involved* and support the project throughout its development. Involvement increases from the start of implementation.	Secondary stakeholders are involved and support the project throughout its development. Involvement increases from the start of implementation.
Evidence: • Stakeholder analysis and mapping completed, e.g. stakeholder map, list, plan • Stakeholders being made aware of the project Examples of awareness: • Flyers • Community meetings • Feedback mechanism established	Evidence: • Grievance mechanism established Examples: • Formal or informal grievance mechanism • Evidence of how grievances can be submitted and are dealt with • Evidence of flow chart for dealing with different grievances and how they are escalated	Evidence: • Interviews or focus groups with primary stakeholders to show they are involved/support the project • Evidence of involvement in project activities Examples of involvement: • Community tree planting days • Other sensitisation or engagement activities • Participatory monitoring strategy in place • Project considered local priorities in terms of species selection • Community engagement plan in place OR political engagement strategy in place • Clear community/stakeholder engagement plan established and/or in place	Evidence: • Interviews or focus groups with primary stakeholders to show they are involved/support the project • Evidence of involvement in project activities Examples of involvement: • Community tree planting days • Other sensitisation or engagement activities • Participatory monitoring strategy in place • Project considered local priorities in terms of species selection • Community engagement plan in place OR political engagement strategy in place • Clear community/stakeholder engagement plan established and/or in place

**Guidance: For medium to large projects (>500 ha), it would be expected that the project demonstrates a high level of involvement of primary and secondary stakeholders to earn the respective points, i.e., multiple activities conducted to include the relevant stakeholders.*

H.2 Benefits Distribution

A maximum of 3 points is available for scoring criterion 3 attribute 2: benefits distribution.

+1 point: Awarded when the applicant demonstrates that benefits have been distributed to stakeholders through capacity building demonstrated through knowledge uptake and use and/or skills development.

+1 point: Awarded when the applicant demonstrates that benefits have been distributed to stakeholders equitably, for example, through having a project-wide equal opportunity policy, employment of local people, gender balance of employees.

+1 point: Awarded when the applicant demonstrates that benefits have improved community well-being. This may include, although not limited to, improvements to local infrastructure, increased food, increased water security, tenure or use rights.

Table H2: *Ratings and examples for scoring projects under criterion 3, attribute 2.*

1 point	1 point	1 point
Capacity increased/building (at least one of the below bullet points or similar).	Benefits/opportunities equitably distributed (at least two of the bullet points or similar).	Improved community well-being (at least two of the bullet points or similar).
Evidence of capacity increased: • Knowledge uptake and use • Skills development	Evidence of benefits/opportunities equitably distributed: • Equal opportunities policy • Balance of local people employed • Gender balance of employees • Employment of minority groups • Stakeholders feel benefits are equally distributed (assessed through interviews or focus groups) • Education of younger generations	Evidence of improved community well-being: *The project directly supports community well-being through initiatives or activities.* • Biological control of disease vectors • Food security • Fuel security • Gender equality, beyond improving gender balance of employees • Health • Improved local infrastructure • Recreation value (access to green space) • Reduced human-wildlife conflict • Reduced disaster risk • Reduced rural migration • Spiritual value • Tenure or use rights clarity and enforcement • Community water security/water supporting systems/infrastructure

H.3 Knowledge Enrichment

A maximum of 1.5 points is available for scoring criterion 3 attribute 3: knowledge enrichment.

+0.5 points: Awarded when local or indigenous knowledge has been incorporated into project development. This could be through knowledge being included in species selection decisions, in decisions around the management plan or other relevant areas.

+0.5 points: Awarded when scientific or conservation best practice has been incorporated into project development. This could be through appropriate species selection, choice of monitoring techniques, or other relevant areas.

+0.5 points: Awarded when the project contributes to knowledge production or an increase in scientific knowledge. This could be through improved GBIF records, papers or reports published, or new species being discovered through the project, for example.

Table H3: *Ratings and examples for scoring projects under criterion 3, attribute 3.*

0.5 points	0.5 points	0.5 points
Inclusion of local or indigenous knowledge in project development.	Inclusion of scientific/conservation best practice in project development.	Project contributes to the scientific community/ wider knowledge.
Indigenous knowledge could be incorporated through: • Species selection • Species conservation management plan • Seasonality and climate understanding • Long-term project development strategy and management	Scientific/conservation best practice could be incorporated through: • Species selection • Species conservation management plan • Monitoring techniques • Long-term project development strategy and management	Example evidence: • GBIF records • Papers/reports published • Discovery of new species • Recording of germination protocols

H.4 Sustainable Economies

+0.5 points: Awarded in the first instance for the creation of increased employment through the project, which is evidenced by data on the number of employees prior to and following the project intervention. In deciding whether to award points for increased employment, the significance of the employment generated in the context of the overall scale of the project can be considered.

+0.5 points: Awarded to projects where there is evidence that there has also been improvement to local supply chains and the local economy.

+0.5 points: Awarded to projects where there is a sustainable business plan for the project, which is demonstrating strong success in terms of sustainable business and employment generation. Assessment shall therefore include examination of the project's financial plan and operating budget, to see whether the project is likely to be sustainable in the longer term, and to identify the financial contribution of the project to employment generation and sourcing from local supply chains and businesses.

Table H4: *Ratings and examples for scoring projects under criterion 3, attribute 4..*

0.5 points	0.5 points	0.5 points
Increased employment.	Improvement to local supply chains/local economy.	Inclusion of sustainable business and employment models.
Example: • Number of employees	Example: • Local ecotourism business supported • Local tree nursery supported through purchase of seedlings • Regular purchase of local materials, e.g., compost, tools, machinery rental	Example: • Project has a sustainable business plan to ensure long-term livelihoods of employees and communities • Skill uptake and trainings mean that individuals have opportunities to start their own businesses (e.g., start new nurseries, projects)

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