Biodiversity Indicator Guidance: Hectares Under Ecological Restoration as a Result of Funding

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Summary

This report provides guidance on the implementation of a proposed biodiversity indicator to estimate the impacts on biodiversity of a funding portfolio. It was selected in the context of, and is presented in the format of, an ICF (International Climate Finance) KPI (Key Performance Indicator). Further development and stakeholder consultation may be required to consider suitability for specific implementation.

Biodiversity is often overlooked within funding portfolios, and is not yet included within the ICF KPIs, leaving an important gap in monitoring. The guidance in this report presents an option for filling this gap. One of the biggest threats to biodiversity currently is the loss and degradation of natural ecosystems. Therefore, one of the most beneficial actions funding portfolios can take to improve biodiversity is restoring ecosystems. This indicator therefore makes use of the hectares of area under ecological restoration as a result of funding. It is based on the Society for Ecological Restoration's definition of ecological restoration. The report is aimed as a user guide, explaining how funding portfolios such as ICF could implement this indicator, including the data and additional information that projects would need to submit to funding programmes, and how the effects of multiple projects and programmes can be aggregated to give results at the portfolio level.

A second and separate proposed biodiversity indicator that could be used within the same context is presented in 'Biodiversity Indicator Guidance: Improvement in Status of Threatened Species as a Result of Funding'. Both indicators were selected following reviews of existing biodiversity frameworks and indicators.

Contents

1 Rationale

This indicator aims to measure the spatial extent of activities benefiting biodiversity as a result of a funding portfolio. The area in which ecosystems are being transformed towards a reference conservation state (and thereby improving in terms of their intactness and quality) is used to represent this.

Biodiversity is declining rapidly: The Living Planet Index estimates that across vertebrate species monitored, on average, populations have declined by 68% since 1970 (WWF, 2020), whilst the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) Global Assessment estimates a million species are threatened with extinction (IPBES, 2019). Addressing this issue is recognised as a crucial policy priority both internationally and within the UK. For example, the Sustainable Development Goals aim to "reverse degradation and halt biodiversity loss," the Convention on Biological Diversity (CBD) has an overarching objective of "the conservation of biological diversity" and the UK Government's 25 Year Environment Plan includes a policy on "protecting and improving international biodiversity."

Recent biodiversity loss is almost exclusively due to pressures that humans are putting on the environment, most notably, land use change (40% of terrestrial land surface is now agricultural or urban; IPBES, 2019) and the degradation of marine, freshwater and terrestrial ecosystems as a result of human activity (e.g. through overexploitation and the introduction of harmful pollutants). This degradation changes the species present, disrupts ecosystem processes, and alters habitat structure away from that found in more intact natural ecosystems. Therefore, mitigating the impacts from these pressures and restoring ecosystems to a more natural state will be key to biodiversity recovery.

For most ecosystem types, full recovery will take many years or decades to achieve, and in some instances, may not be possible. Whilst it is important to continue monitoring and interventions at the project scale for as long as necessary, this indicator aims to be usable at an early stage in a project's lifespan, to allow for annual reporting and aggregation at the level of a funding portfolio. The scope of this indicator therefore only considers whether projects are on track to achieve recovery, rather than whether recovery has actually been achieved. For the purposes of aggregation, whilst each hectare counted against the indicator must pass a defined level of restoration for inclusion, differences in restoration quality beyond this also fall out of scope and are not considered. Whilst every effort has been made to keep this indicator accessible to as wide a range of practitioners as possible, it does assume a base level of local ecological understanding on the part of project teams, without which it would not be possible to plan and monitor a project aiming to improve biodiversity.

This indicator has some overlap with several of the current ICF KPIs. ICF KPI 8 considers 'Hectares of deforestation and degradation avoided through ICF support,' including 'the number of hectares where afforestation or reforestation has taken place.' ICF KPI 10 measures the 'Value of ecosystem services generated / protected as a result of ICF support,' which includes area of afforestation (referred to as restoration at some points within the document) as an input to their calculations of ecosystem service values. ICF KPI 17 quantifies the 'Hectares of land that have received sustainable land management practices as a result of ICF,' which includes hectares of restoration of several key ecosystem types. However, the indicator described here is different in that the focus is on ecological restoration (i.e. restoration for the purpose of biodiversity), the restoration of all ecosystem types is included, and restoration must be on track to meet defined ecological criteria. This therefore only includes areas where activities result in notable improvements in biodiversity, something which is not an inevitable consequence of many forms of sustainable land management.

2 Indicator summary

- **Units:** Number of hectares
- **Disaggregation summary**: Ecosystem type restored
- **Headline data to be reported:** Annual increase and cumulative net increase of hectares under ecological restoration as a result of funding
- **Timing issues:** Reporting should take place annually
- **Links to ICF KPI portfolio**: This indicator is distinct from but has some overlap with ICF KPIs 8, 10 and 17. This means that:
  - Some hectares of restoration will be included in this indicator that are not included in any current ICF KPIs (i.e. restoration of ecosystem types beyond those explicitly mentioned in KPIs 8 or 17)
  - Some hectares of restoration will be included in current ICF KPIs that are not included in this indicator, where the standards outlined in this document on the contribution of the restoration to biodiversity are not met (e.g. monoculture afforestation which may improve services such as reducing soil erosion but will contribute little to biodiversity)
  - Some hectares of restoration will be counted both within the indicator described here and within current ICF KPIs

  Links to other (non-ICF) indicators relating to restoration are presented in Appendix 1.

3 Technical definition

This indicator makes use of the Society for Ecological Restoration's (SER) definition of ecological restoration: "the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed" (Gann *et al*., 2019). This definition is also used by the International Union for the Conservation of Nature (IUCN). Ecosystems are compared to a reference model, ideally based on a similar ecosystem that has not undergone local degradation (see Appendix 2), which acts as a target for the restoration process. Restoration under this indicator can include both improvements in the ecological condition of a degraded natural or semi-natural ecosystem (e.g. forests impacted by logging) and the creation of appropriate natural or semi-natural ecosystems in areas previously used for anthropogenic purposes (urban, agriculture). SER make use of a five-star scale describing different levels of recovery (Appendix 2, Table 4). For the purposes of this indicator, only areas aiming to reach near complete or complete recovery (four or five stars on the scale) should be counted. Further details on the definition and its underpinning principles can be found in SER's International Principles & Standards for the Practice of Ecological Restoration document (Gann *et al*., 2019).

In order to count towards the indicator, projects must demonstrate:

- An understanding of ecological condition at both the project site pre-intervention and the reference model
- A plan outlining the project's intervention logic – how the project will restore the site condition towards that of the reference model
- Proposed monitoring procedures against each of the actions described in the project plan
- Confirmation that the planned restoration activities have taken place

To provide a better understanding of the breakdown of restoration types taking place across the funding portfolio, projects should also report the ecosystem type that the project is aiming to restore (i.e. the reference model). To improve alignment with the CBD, these should match the ecosystem types with specific associated CBD targets. For the Aichi targets (2010-2020), these are listed in Figure 1, with an additional 'other' category. These groupings will require review following agreement of the post-2020 targets. Definitions should match those within CBD documentation.

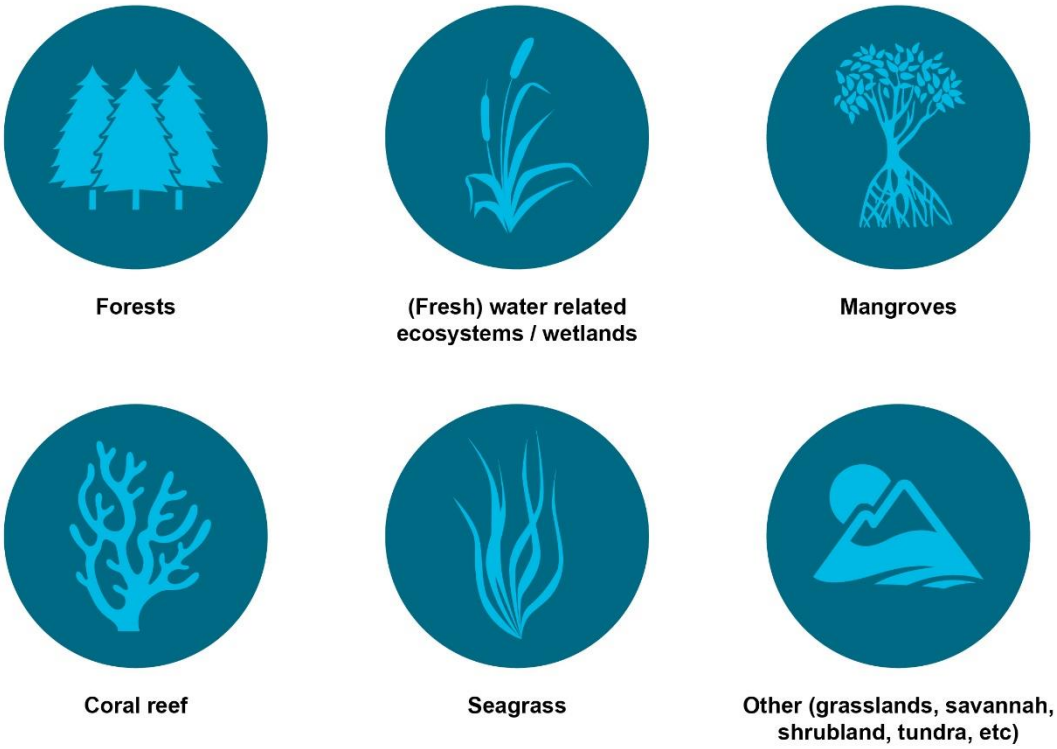

Figure 1. Ecosystem types into which restoration activities should be disaggregated

4 Methodological summary

Figure 2 shows a step-by-step guide of how to report on this indicator. Further detail on the criteria and steps to be followed can be found in the Methodology section below.

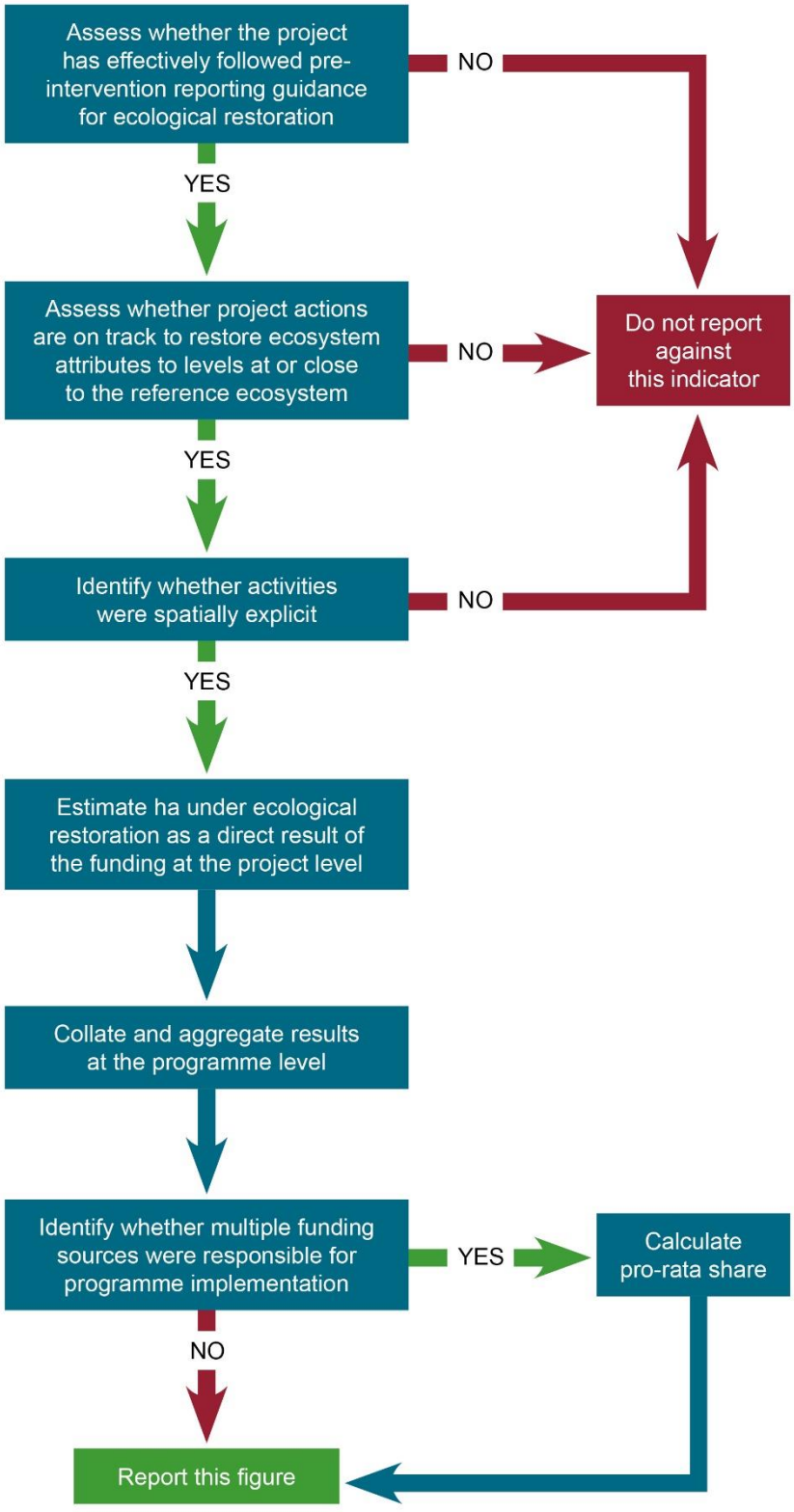

Figure 2. A summary of the steps that must be undertaken in order to report on this indicator at the portfolio level. Further detail on each step can be found in the Methodology section below.

5 Methodology

5.1 Assess whether this project has effectively followed pre-intervention reporting guidance for ecological restoration (Appendix 2)

Prior to the start of a project, an effective ecological restoration plan must have been carried out. This must include a description of a reference ecosystem (the conservation aim for the project), a description of the ecological status of the project area pre-intervention, and a list of planned actions that should bring the project to a state close to that of the reference ecosystem. The actions must be associated with appropriate indicators to measure implementation, and appropriate planned maintenance actions to ensure that the action will achieve ecological recovery in the long term. Detailed guidance for projects to carry out this process can be found in Appendix 2, with specific descriptions outlining the state project activities must plan to achieve in Table 4 (Appendix 2). Programme managers must check that this plan has been put in place in line with this guidance. Areas for which such a plan was not completed will not count towards this indicator.

5.2 Assess whether project actions are on track to restore ecosystem attributes to levels at or close to the reference ecosystem.

Projects are considered to be on track to restore ecosystem attributes to levels at or close to the reference ecosystem once the planned restoration activities have been carried out, so long as the plan created in the previous step has provided a clear logic link showing how the activity will lead to the appropriate level of ecological recovery as described in Table 4 (Appendix 2), and how this state will be maintained. For example, in a forest restoration project, the area of seedlings planted could count towards the hectares under restoration, but only if there is also a management plan in place to ensure their survival to a mature and independent forest.

Restoration activities that are unlikely to lead to an appropriate level of recovery from a biodiversity perspective should not be reported. For example, if transplantation of just one species of native coral was carried out as part of a coral reef restoration project, this would not be considered restoration of an appropriate level to meet the criteria set out in Table 4 (Appendix 2) and would have little impact on biodiversity. To successfully meet the standards described in the Society for Ecological Restoration's five-star recovery scale, a mix of native coral species with enough variation to support a substantial diversity of characteristic native species, including at different trophic levels, would be required.

All key ecosystem attributes that were considered relevant for the project in its pre-intervention planning must be on track to reach the appropriate level of recovery as described in the project plan before a hectare can be counted. For example, if a wetland under restoration has benefited from NbS that have restored appropriate water flows and functions, and reintroduced a range of native species, but the area still suffers from the threats of significant invasive species and contamination problems which have not yet been addressed through the project's actions, the hectares could not count towards the indicator until these other problems are also on track to be mitigated.

Although this indicator captures areas returning to a high-level of natural functioning, this does not preclude ecosystems also used for human activities, and multi-functional land,

wetlands or sea can be included as long as the minimum level of recovery, as defined in Table 4 (Appendix 2), is an achievable standard of the restoration. Justification for this must be well documented for auditing purposes.

5.3 Identify whether activities were spatially explicit.

For aggregation purposes, all measurements must be reported in hectares. It may be that some actions described cannot be reported in this format. For example, a reduction in air pollution represents the decrease of a potentially significant threat, but is not something that can be measured in spatially explicit terms. Whilst important that projects take into account non-spatially explicit considerations for the purposes of good practice and ensuring that all biodiversity impacts are considered, it will not be possible to report on this at the level of a Key Performance Indicator for aggregation. In cases where projects have reported on both spatially explicit and non-spatially explicit restoration actions, programmes should only aggregate the spatially explicit aspects.

5.4 Estimate hectares under ecological restoration as a direct result of the funding at the project level.

From the previous two steps, it should be possible to estimate the area in hectares that is considered to be under ecological restoration as a direct result of funding at the project level. Both the annual increase (the additional hectares that have come under ecological restoration within the latest reporting year) and the cumulative net increase (the total hectares under ecological restoration since the start of the project) should be reported.

The ecosystem types being restored as a result of the funding must also be reported and disaggregated. In cases where projects report against more than one reference ecosystem (e.g. if one part of the project area is being restored as seagrass meadow and another part is being restored as coral reef), the areas should be spatially distinct meaning there is no risk of double counting.

Appendix 4 presents a reporting template for the indicator.

5.5 Collate and aggregate results at the programme level

Total hectares estimated to be under ecological restoration as a direct result of the funding across all projects within the programme should be summed. Restoration for each ecosystem type should also be summed separately to give disaggregated totals and annual increases.

5.6 Identify whether multiple funding sources were responsible for programme implementation and calculate pro-rata share

If ICF is the only funding source for a programme, results can be entirely attributed to it. If co-financed by other funding sources, the proportion of total spend the portfolio was responsible for should be calculated, and only that proportion of total hectares calculated should be reported.

6 Worked example

A fictitious project is aiming to use replanting as a NbS to restore a Miombo woodland ecosystem in an area that has become degraded over the last 20-30 years, largely due to

fuel wood collection. The project is currently reporting results in its fifth year. The project area covers 1000 ha.

6.1 Assess whether this project has effectively followed pre-intervention reporting guidance for biodiversity (Appendix 2)

The project submitted descriptions of the ecological conditions of the reference site and the project area pre-intervention (Appendix 3). From these, the project created a restoration plan with the actions, indicators and maintenance steps described in Table 1. The programme manager considered these to be adequately in line with the reporting guidance in Appendix 2 for actions within the site to be counted towards the indicator.

Table 1. Actions planned by the fictitious project.

Action	**Indicator that will be used to measure progress against planned actions**	**Maintenance required beyond the action to ensure complete or near complete recovery will be reached**
500 ha of the project area will be replanted with a variety of native plant species (100 ha per year for the first 5 years of the project). This covers half of the project site; the other half has been assessed to have sufficient natural vegetation cover to grow back naturally once other threats are removed.	Area of native mixed seedlings planted.	Survival rates will be monitored, with additional replanting taking place in cases of mortality. Threats (e.g. fuel wood collection) will be monitored and mitigated.
The invasive plant species *Lantana camara* will be removed across the whole project site.	Area across which removal efforts have taken place.	The area will be monitored for re-establishment and any new plants removed again each year of the project.
Community engagement sessions will be run to educate on alternative fuel sources (e.g. manure fire bricks) and the reasons for not sourcing firewood from the area under restoration. Provision of bio-burners.	Attendance at engagement sessions. Uptake of bio-burners in the community.	Regular engagement sessions to continue until ingrained into community practices.

6.2 Assess whether project actions are on track to restore each ecosystem attribute to levels at or close to the reference ecosystem;

6.3 Identify whether outcomes were spatially explicit, and;

6.4 Estimate hectares under ecological restoration as a direct result of the funding at the project level

The project has planted and maintained 100 ha of seedlings per year for the first five years. Therefore, the annual increase in this fifth year of reporting is 100 ha, but the cumulative net increase since the project start is 500 ha (Table 2). This is a spatially explicit indicator, so can be counted towards the aggregated total. The project has also now completed the removal of *Lantana camara* across the whole project site, with plans in place to prevent its re-establishment. This gives a cumulative net increase of 1000 ha, of which 250 ha was completed in this reporting year (Table 2). However, this area overlaps with the area of seedlings that were replanted – some hectares this year received both interventions. These areas cannot be counted twice. The removal of *Lantana camara* covered a larger area than the area in which seedlings were planted. However, this is because the project only planned to replant a smaller area due to the assessment made that the vegetation quality in parts of the project site were already sufficiently similar to the reference state, not because the project failed to fully deliver the restoration planned for those 150 ha. Therefore, the larger of these two figures (250 ha) can be taken as the annual increase. Likewise, the 500 ha completely overlaps with the 1000 ha under restoration since the start of the project, giving a cumulative net increase of 1000 ha (Table 2).

The indicators against the actions aimed at preventing further degradation through preventing the collection of firewood in the project area are not spatially explicit. They can therefore not be aggregated to form part of the key performance indicator at a programme level. However, they are essential to the success of the project and so must have succeeded for the other indicators to count. If the threat that caused the ecosystem to degrade in the first place is not removed, then replanting the vegetation will have little long-term effect; the area will simply become degraded once again in the near future.

All funding for the project was provided by a single source.

Table 2. Project reporting against each restoration action planned.

Indicator	Annual Increase	Cumulative Net Increase	Spatially Explicit?	Maintenance in place as planned
Area of native mixed seedlings planted	100 ha	500 ha	Yes	Yes
Area across which removal efforts of *Lantana camara* have taken place	250 ha	1000 ha	Yes	Yes
Attendance at engagement sessions. Uptake of	50 attendees, 5 new households	250 attendees, 25 households in the	No	Yes

Indicator	Annual Increase	Cumulative Net Increase	Spatially Explicit?	Maintenance in place as planned
bio-burners in the community	now using bio-burners	community now using bio-burners		
Total (correcting to ensure no double counting has taken place)	250 ha	1000 ha	N/a	N/a

7 Data management

7.1 Data sources

Data can be obtained from a wide range of sources. Much of the information required for reporting on this indicator will be known to project teams without any additional research or collation of data sources (e.g. the area over which a particular action is planned and has been carried out). To describe the reference ecosystem, ideally a reference site (selected as described above and in the SER documentation) should be visited and surveyed. However, this information can be supplemented with descriptions from reliable literature or replaced with this where visiting a reference site is not possible (see Appendix 2 for more detailed explanation of how to describe reference sites).

7.2 Data issues, risks and challenges

One significant risk associated with restoration projects is the possibility of displacement. This occurs where the positive effects of project intervention directly or indirectly lead to negative effects elsewhere. For example, if a project restores an area of agricultural land to tropical rainforest, it is possible that the demand for the food produced within the agricultural land will lead to the clearing of nearby primary rainforest to continue to meet demand. Similarly, if a project aiming to minimise the threat of overgrazing does so by importing livestock feed that has been grown elsewhere, the imported feed will impact the environment wherever it is grown, potentially causing other impacts such as water stress and nitrogen pollution. Projects must identify in their planning any potential risks of displacement that could be caused and what they have done to mitigate them.

The long-term nature of ecological restoration and biodiversity change leads to a particular risk with this indicator on the permanence of any effects measured. This is an issue with any time-limited project, but may be more significant in the context of this indicator than others. This is one of the reasons that the action carried out by the project is not enough and that an area must be considered ‘on track’ to recover to a 4 or 5 star level longer term before it can be counted, with planned maintenance. However, this does not prove that the recovery outcome has taken place, or that it will persist once it has reached its recovered state; future pressures may degrade the habitat once more. This should be noted as a risk for the interpretation of this indicator, with long term legacy management encouraged wherever possible. In cases where a hectare counted has since been degraded again, the hectare should be removed from that year’s results and the totals updated.

The indicator, by necessity to allow flexibility across the wide range of potential biodiversity interventions that are possible and the wide range of ecosystem types found within eligible

countries, has some degree of subjectivity. Project teams must use their best judgement to interpret the guidance in the document in the most sensible way for the project's unique context. This will require a base level of ecological understanding. However, any project aiming to improve biodiversity should have this level of expertise anyway in order to carry out the project, so it should not involve significant additional cost or consultation.

As with any indicator, there is a risk of double counting, both within and across projects. Projects should ensure to follow guidance above and only count a hectare within a project once all relevant attributes are considered on track to reach complete or near complete recovery (see Appendix 2). Projects should not count a hectare for each hectare of action completed in cases where multiple actions are required on the same hectare; this hectare should only be counted once, after all planned actions are completed and this hectare is on track to reach complete or near complete recovery (see Appendix 2).

Another issue with making use of total hectares as the metric to be used for aggregation, is that it risks missing the effect of fragmentation. For example, it may be possible to create a large area of disjointed small patches of ecosystem under restoration, which do not connect. This is likely to have a far smaller effect on biodiversity than a large area that is well connected to other relevant ecosystems nearby. It is hoped that the required assessment of "external exchanges" (see Table 4, Appendix 2) would pick up on any issues around fragmentation, particularly where this occurs within the project area. However, in many cases, projects will not be in control of areas beyond their project borders, leading to a risk that an area is restored with very little connectivity to other similar ecosystems and therefore a low rate of recolonisation.

Not accounting for any actions that would prevent degradation in the first place is another limitation of this indicator due to the focus on restoration. In many cases preventing degradation would be a cheaper and more effective method of preserving biodiversity than restoring areas that are already degraded. This is out of scope for the indicator described within this document, but should be recognised as also important for biodiversity.

7.3 Quality assurance

Projects and programmes should have appropriate quality assurance processes in place. Plans for this should be submitted alongside the project plan and a record of its implementation should be submitted alongside annual reports. Programmes should independently check both projects' plans and their results for accuracy and should at times audit selected projects with a site visit to check that actions stated as being completed and persisting actually are. This should include checking whether projects have comprehensively considered all possible negative or displacing impacts their activities could have, the logic linking activities and management practices to expected recovery, and cross-checking the descriptions given for the reference site with other sources describing that ecosystem where possible.

7.4 Counterfactual baseline

As described in Appendix 2, projects must establish a counterfactual baseline pre-intervention in order to prove that any improvements recorded are due to actions completed by the project rather than changes that would have taken place in the area anyway, for instance through other programmes working in the region.

In cases where the programme is unable to estimate a counterfactual, an 'adjustment factor' should be used. This should depend on the programme's certainty in the additionality of the project – for example it may be 95% if confidence is high, but 50% if confidence is low.

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Appendix 1: Comparability and synergies with other indicators

A1.1 IUCN STAR

The Species Threat Abatement Restoration metric (STAR) uses data from the IUCN Red List of Threatened Species to estimate the potential reduction in species extinction risk that could be or has been achieved, for example, across a corporate footprint, within a country or on a project site. It is a modelled state indicator based on using pressures as inputs. See also the 'Biodiversity Indicator Guidance: Improvement in Status of Threatened Species as a Result of Funding' document, which gives guidance on the use of STAR as a separate proposed biodiversity indicator that could be implemented as an ICF KPI.

A1.2 Global Ecosystem Restoration Index

The Global Ecosystem Restoration Index uses a different definition of restoration to the indicator presented here, based on three datasets addressing different aspects of land restoration: change in land productivity (calculated as the ratio between net primary productivity and precipitation), change in energy balance (evapotranspiration, which a functional ecosystem should optimise) and identity transitions in land cover (to act as the structural aspect of restoration and to put the other two aspects into context). It is calculated globally on a 1 km2 grid, but data is not yet publicly available.

A1.3 Landscale Assessment Framework

The Landscale Assessment Framework has also produced several indicators relating to the area under restoration:

- Total area (ha) under restoration, disaggregated by ecosystem type and restoration type A plan outlining the project's intervention logic – how the project will restore the site condition towards that of the reference model
- Rate of increase (ha/yr) in total area under restoration disaggregated by ecosystem type and restoration type
- Area (ha) and percentage (%) of land under restoration within areas identified as important for biodiversity

For these indicators, "area under restoration" is defined as the "significant presence of restoration activities or restored land in the landscape, including: a) Areas where restoration has been completed; and / or b) Areas where restoration activities are underway or are expected to be initiated by the time of the assessment report publication." This definition is largely consistent with that used in the indicator described within the current document, so there would be strong alignment.

Appendix 2: Pre-intervention reporting guidance for projects

A2.1 Describe the reference ecosystem for the project area.

Prior to the start of the project, the reference ecosystem should be identified and described. This should be carried out using the processes and guidance more fully described under Principle 3 in the Society for Ecological Restoration's 'International Principles and Standards for the Practice of Ecological Restoration' (Gann *et al*., 2019).

In brief, the reference ecosystem should be based on a real-world ecosystem (e.g. boreal forest, coral reef) that represents how the site may have been if it had not been degraded (e.g. a nearby protected area), adjusting for changes in environmental conditions (e.g. adaptation with climate change). Using a nearby protected area could be challenging in some cases, particularly in the marine environment as condition is largely location-specific due to complex biological and environmental relationships. However, the reference system is to be used as a guideline rather than a perfect representation. Where protected areas are lacking, the reference ecosystem can be inferred, for example by combining information from the least-disturbed areas of that ecosystem type that it is possible to find in the scientific literature with historical data or modelling. The reference ecosystem should be described against SER's six key ecosystem attributes (Table 3). These attributes are not prescriptive, in order to allow for inclusion of the wide range of different types of ecosystems requiring restoration. Descriptions should contain as much detail as possible, but do not need to be comprehensive. For example, native species characteristic of the ecosystem must be known, but understanding every single species that may occur there and their population breakdowns is not necessary, unless this information is easily accessible.

It is important to note that simply turning one ecosystem into another does not count as ecological restoration; the focus should be on restoring degraded ecosystems. There may be cases where this involves transforming one ecosystem into another that should be there in its place, but changing, for example, savannah into forest (perhaps for the purposes of the ecosystem services this could bring) should not be considered beneficial to biodiversity if forest would not have naturally occurred in that location in a non-degraded state.

Table 3. SER's key ecosystem attributes. Reproduced from the Society for Ecological Restoration's 'International Principles and Standards for the Practice of Ecological Restoration' (Gann *et al*., 2019).

Attribute	**Description**
Absence of threats	Direct threats to the ecosystem such as overutilization, contamination, or invasive species are absent.
Physical conditions	Environmental conditions (including the physical and chemical conditions of soil and water, and topography) required to sustain the target ecosystem are present.
Species composition	Native species characteristic of the appropriate reference ecosystem are present, whereas undesirable species are absent.
Structural diversity	Appropriate diversity of key structural components, including demographic stages, trophic levels, vegetation strata and spatial habitat diversity are present.
Ecosystem function	Appropriate levels of growth and productivity, nutrient cycling, decomposition, species interactions, and rates of disturbance.
External exchanges	The ecosystem is appropriately integrated into its larger landscape or aquatic context through abiotic and biotic flows and exchanges.

A2.2 Describe the project area pre-intervention.

The starting conditions of the project area should be recorded against the same attributes used to describe the reference ecosystem. Table 4 can be used as a framework to assess

how similar the project area is to the reference model. The table contains generic indicators which may need adapting to suit specific ecosystems of interest.

The project should also establish a counterfactual baseline to predict what change would take place in the project area in the absence of the project. For example, if the project area contains abandoned agricultural land that is starting to be colonised by native species independently then it may be the case that restoration-like improvements would take place over the following years even if no interventions were made. This should not count towards the reporting total. All projects must qualitatively determine that any direct restoration undertaken by the project has a more significant effect on the ecosystem condition than this counterfactual baseline. For example, if a project area covering 100 ha of disused agricultural land actively restores 25 ha of ecosystem towards its reference state but leaves the other 75 ha untouched, only the 25 ha should count towards the reporting total. Counterfactual baselines could be established by comparisons to similar sites nearby that have not undergone the intervention or by making predictions based on regional environmental change patterns.

Table 4. Five-star recovery scale (1 star = low quality and very dissimilar to the reference ecosystem, 5 stars = high quality and very similar to the reference ecosystem). Reproduced from the Society for Ecological Restoration's 'International Principles and Standards for the Practice of Ecological Restoration' (Gann *et al*., 2019).

Attribute	One-star	Two-star	Three-star	Four-star	Five-star
Absence of threats	Further deterioration discontinued, and site has tenure and management secured.	Threats from adjacent areas beginning to be managed or mitigated.	All adjacent threats managed or mitigated to a low extent.	All adjacent threats managed or mitigated to an intermediate extent.	All threats managed or mitigated to a high extent.
Physical conditions	Gross physical and chemical problems remediated (e.g. excess nitrogen, altered pH, high salinity, contamination or other damage to soil or water).	Substrate chemical and physical properties on track.	Substrate stabilized within natural range and supporting growth of characteristic native biota.	Substrate securely maintaining conditions suitable for ongoing growth and recruitment of characteristic native biota.	Substrate exhibiting physical and chemical characteristics highly similar to that of the reference ecosystem with evidence they can indefinitely sustain species and processes.
Species composition	Some colonizing native species present (e.g. ~2% of species in the reference	A small subset of characteristic native species establishing (e.g. ~10% of reference).	A subset of key native species (e.g. ~25% of reference) establishing over substantial	Substantial diversity of characteristic native biota (e.g. ~60% of reference) present across the	High diversity of characteristic native species present (e.g. >80% of reference), with high

Attribute	One-star	Two-star	Three-star	Four-star	Five-star
	ecosystem). Moderate onsite threat from nonnative invasive or undesirable species. Regeneration niches available.	Low to moderate onsite threat from nonnative invasive or undesirable species.	proportions of the site. Very low onsite threat from nonnative invasive or undesirable species.	site and representing a wide diversity of species groups. Very low onsite threat from nonnative invasive or undesirable species.	similarity to the reference ecosystem; improved potential for colonization of more native species over time. No known onsite threat from undesirable species.
Structural diversity	One or fewer biological strata present and no spatial patterning or community trophic complexity relative to reference ecosystem.	More strata present but low spatial pattering and trophic complexity, relative to reference ecosystem.	Most strata present and some spatial patterning and trophic complexity relative to reference site.	All strata present. Spatial patterning evident and substantial trophic complexity developing relative to the reference ecosystem.	All strata present and spatial patterning and trophic complexity high. Further complexity and spatial patterning able to self-organize to highly resemble reference ecosystem.
Ecosystem function	Substrates and hydrology are at a foundational stage only, capable of future development of functions similar to the reference.	Substrates and hydrology show increased potential for a wider range of functions including nutrient cycling, and provision of habitats and resources for other species.	Evidence of functions commencing (e.g. nutrient cycling, water filtration, and provision of habitat and resources for a range of species).	Substantial evidence of key functions and processes commencing including reproduction, dispersal, and recruitment of native species.	Considerable evidence of functions and processes on a secure trajectory towards that of the reference and evidence of ecosystem resilience, tested by reinstatement of appropriate disturbance regimes.
External exchanges	Potential for exchanges (e.g. of species, genes, water,	Connectivity for enhanced positive (and minimized negative	Positive exchanges between site and external environment	High level of positive exchanges with other native	Evidence that external exchanges are highly similar to reference,

Attribute	One-star	Two-star	Three-star	Four-star	Five-star
	fire) with surrounding landscape or aquatic environment identified.	exchanges) arranged through cooperation with stakeholders. Linkages being reinstated.	becoming evident (e.g. more species, gene flows, etc.)	ecosystems established; control of undesirable species and disturbances.	and long-term integrated management arrangements with broader landscape in place and operative.

A2.3 Create a plan of actions to be carried out within the project that will leave the area on track to achieve a minimum of four stars based on Table 4, and indicators for each to assess whether they are on track. State how this plan would address each ecosystem attribute (excluding any that are irrelevant within the context of that project).

Project plans should detail the intervention logic describing the actions that will be undertaken to restore the site's condition towards that of the reference model. Projects should record how the planned interventions should help with the site's ecological recovery, against each attribute from Table 4 that is of relevance to the project.

Projects should aim for substantial recovery. For the purposes of this indicator, substantial recovery is considered to be reaching four or five stars against all relevant attributes as described in Table 4. If the starting condition is four stars, the project must aim for five stars. If the starting condition is less than four stars, projects should aim for five stars where this is possible, but may also count hectares undergoing partial restoration to four stars where it is not. Attribute descriptions for one to three stars may be helpful for projects to consider from a planning perspective, but hectares in which restoration is not planned to be on track to achieve higher than this by the end of the project should not be considered within this indicator. Table 4 contains broad, generic indicators and associated definitions and thresholds, which may need adapting to suit specific ecosystems of interest, contexts, aims or interventions. Projects should state within their planning specific indicators they intend to use against the actions they have planned.

It may be the case that not all six attributes are relevant in a particular context. In these cases, projects are not required to report against every attribute. In particular, external exchanges are likely to be out of the control of projects, unless, for example, the project is explicitly aiming to improve connectivity. In cases where an attribute is not considered, justification for its exclusion should be recorded at the project planning phase.

A project's plan should also outline how the project will make sure that the actions undertaken will not lead to displacement (i.e. the positive effects of the project are not leading to potential negative effects elsewhere).

Appendix 3: Worked example of pre-intervention reporting

A fictitious project is using replanting as a NbS to restore a Miombo woodland ecosystem in an area that has become degraded over the last 20-30 years, largely due to fuel wood collection. The project area covers 1000 ha.

A3.1 Describe the reference ecosystem for the project area.

The Miombo woodland ecosystem is well described in scientific literature and a well protected area of Miombo woodland can be found in a nearby national park, which the project team visited to better understand the ecosystem they are aiming for through their conservation efforts. From these sources of information, descriptions in Table 5 were established for each attribute.

Table 5. A description of the reference ecosystem for the project area (WWF, n.d.).

Attribute	**Description**
Absence of threats	Whilst the Miombo woodland ecosystem in general suffers from conversion to agricultural land, overgrazing, illegal hunting, fuelwood collection and a higher than natural rate of fire occurrence (with many of these threats stemming from recent population expansions in these areas), reference sites in protected areas have alleviated these threats to the greatest extent possible.
Physical conditions	Soils are acidic, nutrient poor and well-drained. Climate is typical of tropical savannah, with average temperatures of 9-27°C and very seasonal precipitation patterns (including a 4-7-month drought).
Species composition	The dominant plant species are *Caesalpiniaceae, Brachystegia* and *Julbernardia* species (especially *B. spiciformis* and *J. globiflora*). *Uapaca kirkiana, B. boehmii, Monotes glaber, Faurea saligna, F. speciosa, Combretum molle, Albizia antunesiana, Strychnos spinosa, S. cocculoides, Flacourtia indica*, and *Vangueria infausta* are also common. Notable mammal species include the near-endemic roan antelope (*Hippotragus equinus*), the critically endangered black rhino (*Diceros bicornis*) and the endangered elephant (*Loxodonta africana*). Other typical mammal species include sable (*H. niger*), Lichtenstein's hartebeest (*Signoceros lichtensteinii*), southern reedbuck (*Redunca arundium*), greater kudu (*Tragelaphus strepsiceros*), eland (*Taurotragus oryx*), buffalo (*Synerus caffer*), lion (*Panthera leo*), leopard (*P. pardus*), cheetah (*Acinonyx jubatus*), spotted hyena (*Crocuta crocuta*), African wild dog (*Lycaon pictus*), caracal (*Felica caracal*), and side-striped jackal (*Canis adustus*). Around 500 species of bird can be found in Miombo woodland. Miombo woodland contains around 30 species of endemic reptiles, including the regal girdled lizard (*Cordylus regius*), dwarf wolf snake (*Cryptolycus nanus*), ocellated flat lizard (*Platysaurus ocellatus*), and *Platysaurus oshaughnessyi*.

Attribute	Description
Structural diversity	Tree and shrub species are common, but there is usually little grass cover. In protected reference sites, all trophic levels can be found, including apex predators such as lions, leopards and cheetahs.
Ecosystem function	The naturally nutrient poor soil and extended drought periods lead to relatively low productivity for most of the year.
External exchanges	External exchanges with other ecosystem types are common and key, particularly with many species of fauna at least seasonally dependant on Miombo woodland and seasonally dependant on food, shelter or water in non-Miombo areas.

A3.2 Describe the project area pre-intervention.

The project team have recorded descriptions of the ecological condition of the project site before the project's start against each ecosystem attribute (Table 6). They have used the criteria in Table 4 to assign a current star rating to each ecosystem attribute.

Table 6. A description of the project area's ecological condition pre-intervention.

Attribute	Description	Star rating
Absence of threats	Fuel wood collection by locals is a significant threat to the ecosystem.	0
Physical conditions	Soil acidity levels are as expected, but soil compaction is an issue in some areas due to footfall and the lack of root network in bare ground areas. Although soil in the reference ecosystem is nutrient poor, soil in the project area is even more so due to the removal of plant matter.	0
Species composition	Whilst some plant species characteristic of the reference ecosystem are present, their density and diversity is significantly lower, with substantial patches of bare ground. The invasive plant species *Lantana camara* have also become established across much of the project area. A range of the typical ungulate and bird species listed in the reference ecosystem have been seen in the project area (or have left identified prints/scat), although at significantly lower frequencies than would be expected. No carnivorous or endangered mammals have been seen (and no prints/scat has been found) at the site for at least 20 years.	1
Structural diversity	Plant structural diversity is largely as expected, except with larger areas of bare ground. In terms of fauna, the highest trophic level (carnivorous mammals) is not present.	2

Attribute	Description	Star rating
Ecosystem function	Habitat and resources for a range of native species are present but in poor quality.	2
External exchanges	Project area is connected on three sides to other degraded Miombo woodland and related ecosystems, providing a low-quality but existent corridor for fauna to move through. On one side, extensive agricultural areas prevent exchanges for many species.	1

Counterfactual baseline: Human populations in the area are expanding. Without the project, there is no reason that fuel wood collection would stop, leading to continued degradation of the area. Any restoration can therefore be safely attributed to project activities.

A3.3 Create a plan of actions to be carried out within the project that will leave the area on track to achieve a minimum of four stars based on Table 4, and indicators for each to assess whether they are on track. State how this plan would address each ecosystem attribute (excluding any that are irrelevant within the context of that project).

Based on the pre-intervention assessment, the project proposed a restoration plan for the area, including descriptions of the actions to be undertaken, the indicators to measure against these actions and the planned maintenance to ensure long-term recovery, as listed in Table 1 (Section 6.1).

The project also recorded justifications against each ecosystem attribute to explain how their plan will address each relevant one.

- **Absence of threats:** The community engagement sessions will stop locals harvesting material for firewood from the restoration area, which will remove the threat identified within the pre-intervention assessment.
- **Physical conditions:** Replanting and preventing firewood collection will reduce footfall and therefore soil compaction, and reinstate natural nutrient cycling.
- **Species composition:** Replanting a variety of native plant species will help move the plant species composition back towards that of the reference model, and should attract a variety of other species that can make use of the habitat. Removal of *Lantana camara* will lead to very low / no known onsite threat from invasive species.
- **Structural diversity:** Replanting will reduce unnatural patches of bare ground and improve the likelihood of organisms of higher trophic levels making use of the habitat (although unlikely in this context for apex predators to return due to the degraded habitat surrounding the project site).
- **Ecosystem function:** Replanting and the prevention of overgrazing will improve the quality of the habitat and resources available for a wide range of species.
- **External exchanges:** Not relevant, as the project will have no control over areas external to the project site

As part of this planning, the project recognised the risk of displacement through the possibility of community members relocating their firewood collection activities to other nearby areas and causing further degradation there. However, they stated that this would be addressed in the engagement and education sessions, with community members strongly encouraged to make use of alternative fuels such as manure blocks rather than shifting their sourcing to other Miombo woodland areas.

Appendix 4: Reporting Template

A reporting template for the indicator can be found in Table 7.

Table 7. Indicator reporting template.

	Forest	**Wetland**	**Mangrove**	**Coral**	**Seagrass**	**Other (grassland, savannah, tundra, etc)**	**Total**
Annual Increase of Hectares of ecological restoration as a result of the funding							
Cumulative Net Increase of hectares of ecological restoration as a result of the funding							

Appendix 5: Acronyms

CBD – Convention on Biological Diversity

ICF – International Climate Finance

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IUCN – International Union for the Conservation of Nature

KPI – Key Performance Indicator

NbS – Nature Based Solutions

SER – Society for Ecological Restoration