# Landscape & Seascape Restoration Monitoring Framework

## Guidance for Applicants

Endangered Landscapes & Seascapes Programme

Cambridge Conservation Initiative

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# 1. Why monitoring is important

There is a lack of evidence describing the outcomes of large-scale open-ended ecosystem restoration projects. Reasons for this include the relative novelty of some of the approaches, the time needed to see change, and a lack of investment and prioritisation of monitoring in restoration at the scales required. However, the ELSP sees it as a priority to collect data to understand and document the changes taking place in landscapes and seascapes as a result of the restoration that we fund. Such monitoring data is important for a number of purposes:

- To demonstrate that projects have achieved, or are making progress towards achieving, their stated outcomes. Projects with well-designed and effectively implemented monitoring plans are more transparent and can account for their actions and expenditure to funders, local communities and other stakeholders.
- To understand the effects of restoration actions as they are carried out, in order to inform adaptive management. Assessing the changes that take place in your landscape or seascape using a carefully designed monitoring scheme can tell you whether your project is on track or whether adaptations to management actions are required to achieve the desired outcome.
- To add to the wider evidence base. Evidence for what does and doesn't work is still scarce for many actions undertaken as part of landscape and seascape restoration. Sharing the findings of your monitoring will allow others in the wider restoration community to use them in decision making, enabling successful results to be replicated and ineffective interventions avoided.
- To understand, measure and communicate the changes taking place across a landscape or seascape more widely. The data produced from scientifically robust monitoring can be an enormous asset when sharing stories about the benefits of large-scale restoration to audiences ranging from policy makers to other landowners and the general public. Such science-based communications can encourage scaling up, via informing policies that enable and incentivise restoration, building support among local communities to sustain restored landscapes in the long term, and encouraging replication and extension by other landowners and funders.

However, monitoring requires resources that otherwise might be allocated to restoration interventions on the ground. Therefore, it is critical that careful thought goes into the selection of an appropriate number of informative indicators for which data can be collected using practical and efficient methods that are appropriate and sustainable over the spatial scales and timeframes needed. It is also important that the intended audience for the results of each of your indicators and the channels by which they can be reached are considered at the planning stage: who are data being collected for and how will the information be used?

Image credit: Maxim Yakovlev

# 2. Who is monitoring for?

Although all indicators monitored as part of your ELSP project need to assess the impacts of your restoration activities and measure progress towards your project outcomes and landscape or seascape vision, indicator data may additionally be used to foster learning, reflection and adaptation, and empower relevant actors. There is ample evidence of the benefits of consulting the people who live and work in a landscape or seascape about the value of restoration to them. Understanding what is important to these stakeholders, and using this to inform the selection of indicators, can ensure that the monitoring carried out is relevant to and valued by the wider community. Initiating these conversations early in the project planning process, before decisions have been made and when there is still space for flexibility in terms of the indicators selected, is key for genuine co-design.

If one of the major audiences for an indicator is external to your project partnership, we encourage you to consider engaging relevant stakeholders from this audience in a participatory process asking what is important to them and how it could be monitored (e.g. Fraser et al. 2006). For example, if one of your logical framework outcomes is to increase the ecosystem services provided by your landscape or seascape, a consultation with local communities will help understand which of these services are most valued – perhaps recreational benefits or improved water quality - and hence inform the data that you collect. Involving stakeholders in the selection of these indicators can raise awareness of the benefits and build support for the restoration work that a project is delivering. Where appropriate, it could also provide a starting point for engaging communities in monitoring, for example via voluntary citizen science initiatives or other participatory monitoring (McKinley et al. 2017; Sigouin et al. 2025). Building relationships and trust with communities can be slow and it is important to ensure that sufficient time and resources are dedicated to achieving this successfully.

The practical process for achieving such engagement will vary depending on your context and circumstances. If a community forum or regular community meetings are already in place, these may be suitable spaces to ask for people's views. Alternatively, organizing a facilitated community event or speaking to a range of individuals can also be ways to gather ideas (e.g. Leisher et al. 2021). It is important to ensure that during this process the scope and capacity of the project is made clear, to reduce the chance of raising unrealistic expectations about both monitoring and wider project outcomes.

If you identify indicators that are of interest to specific stakeholder groups, you will need to consider the channels and formats that will be used to ensure the monitoring data and results are fed back to these audiences. As your project gets underway and information starts to be collected, it is important to re-visit your initial plans, to ensure that information from monitoring is being used as envisaged, whether in communications with specific stakeholders or to inform decision making about future actions.

Please include information about the relevant stakeholder audiences for each indicator in the relevant section (*How will the data be used? Who is the expected audience?*) of your Monitoring Plan.

Image credit: Madalin Mocanu

# 3. Monitoring in the ELSP

The aim of this monitoring framework is to support projects to identify and develop indicators that will meet the range of purposes outlined in Section 1. It is designed to be flexible, to allow projects to select indicators that inform progress towards their desired objectives and to use sustainable and replicable methods appropriate to their context. At the same time, the structure of the framework aims to ensure that all ELSP-funded projects are monitoring indicators that measure responses over the range of time scales and thematic dimensions that are relevant to ecosystem restoration but also fit the needs of grant management cycles. It is perhaps not surprising that several types of indicator are needed to meet this diversity of requirements.

The ELSP asks projects that we fund to monitor the progress of their project and the difference it is making to the landscape or seascape using four different types of indicators:

1. **Output (or implementation) Indicators**, which directly track the implementation of project activities; information on these indicators is usually collected as part of project management and should not require significant extra work.
2. **Project Outcome Indicators**, measuring changes as a result of restoration actions within your landscape or seascape that are expected to take place within the ELSP funding period. Project Outcome Indicators will often require additional data collection, collation and/or analysis.
3. **Long-term Indicators**, measuring changes as a result of restoration actions within your landscape or seascape that are expected to be seen after the ELSP funding period. They too will often require additional data collection, collation and/or analysis.
4. **Key Performance Indicators (KPIs)**, which are defined at programme level and enable the ELSP to measure its impact against relevant Global Biodiversity Framework targets. KPIs are reported annually by projects and the data to inform them should be easily collated from other sources. Note that there may be overlaps between KPIs and Output Indicators. For example, the area of land or sea under restoration or protection is often reported as both an Output Indicator and as part of a KPI.

The main characteristics of each type of indicator are given in Table 1. The rest of this document (and your ELSP monitoring plan) will relate to selecting and designing Project Outcome and Long-term Indicators, which should be developed together. Figure 1 shows the steps for identifying and designing these indicators.

## 3.1 Monitoring Outcomes

Project outcome and Long-term Indicators are used to measure change in your landscape or seascape as a result of your restoration actions. Therefore, an initial longlist of possible indicators can be based on the outcomes in your logical framework. For each outcome, consider how progress towards and achievement of that outcome could be assessed using one or more indicators. You do not need to (but may choose to) monitor an indicator for every outcome in your logical framework. Note that these indicators should measure the target of the restoration activities (so the impact on biodiversity, natural processes, people's behaviour, institutions and economies) rather than the progress of delivering these activities (which will measured by your Output Indicators).

**Table 1.** Characteristics of the four types of indicators used by the ELSP.

| Type of indicator | Description | Scope / scale | Examples | Planning process | Reporting | Further information |
|---|---|---|---|---|---|---|
| **1. Output (implementation) Indicators** | Measure the progress of project activities and outputs. Directly linked to outputs in a project's logical framework. Measurement is often already embedded into project management and implementation. | Direct data on progress of restoration activities at project sites within ELSP funding period. | Area of land purchased<br>Number of stakeholder meetings held<br>Creation of management plan | As part of development of logical framework | Reported as needed to show delivery of planned outputs during ELSP period.<br>Reported as part of ELSP annual report. | N/A |
| **2. Project Outcome Indicators** | Measure progress towards outcomes in project's logical framework that are expected to be achieved within ELSP funding timescale. Project Outcome Indicators focus on responses to restoration actions, rather than the actions themselves. | Data measuring changes in targets of project actions within a 3-5 year period. Indicators may apply at site or landscape level. | Survival of small mammals translocated into landscape<br>Increase in native fish biomass<br>Change in water level after peatland restoration<br>Public attitudes towards a more natural landscape<br>Number of livestock killed annually by wild carnivores<br>Number of recommendations incorporated into a protected area management plan | ELSP monitoring plan | Baseline data, describing pre-restoration status, submitted within 18 months of project start. Final data, showing change over project period, submitted by project end date. Intermediate data reported as appropriate. ELSP templates should be used for all reporting. | This document |
| **3. Long-term Indicators** | Measure progress towards outcomes in project's logical framework where change is only expected after the ELSP-funding period. Long-term Indicators measure change towards a more natural and resilient land-or seascape, with functioning ecosystem processes, as a result of restoration actions. | Indicators should reflect recovery of natural processes and/or benefits to people at landscape scale. Change may be slow and may not be seen during ELSP funding period. | Population of predators such as seals, wolves or eagles.<br>Habitat extent, connectivity or heterogeneity<br>Change in fire or flood resilience<br>Improved farm or fisher incomes based on sustainable practices | ELSP monitoring plan | Baseline data, describing pre-restoration status, submitted during ELSP period (usually within 18 months of project start). Change data submitted as agreed with ELSP Science Team. ELSP templates should be used for all reporting. | This document |
| **4. Key Performance Indicators** | High level indicators of project progress that measure the programme's contribution to selected post-2020 Global Biodiversity Framework targets of the Convention on Biological Diversity. | Desk-based data collection on direct and indirect effects of project activities across a land- or seascape. | New area under protection<br>Number of communities benefitting from project<br>Amount of new funding secured for ecosystem restoration | None needed – standardised set. | With ELSP annual report using template provided. | KPI guidance document |

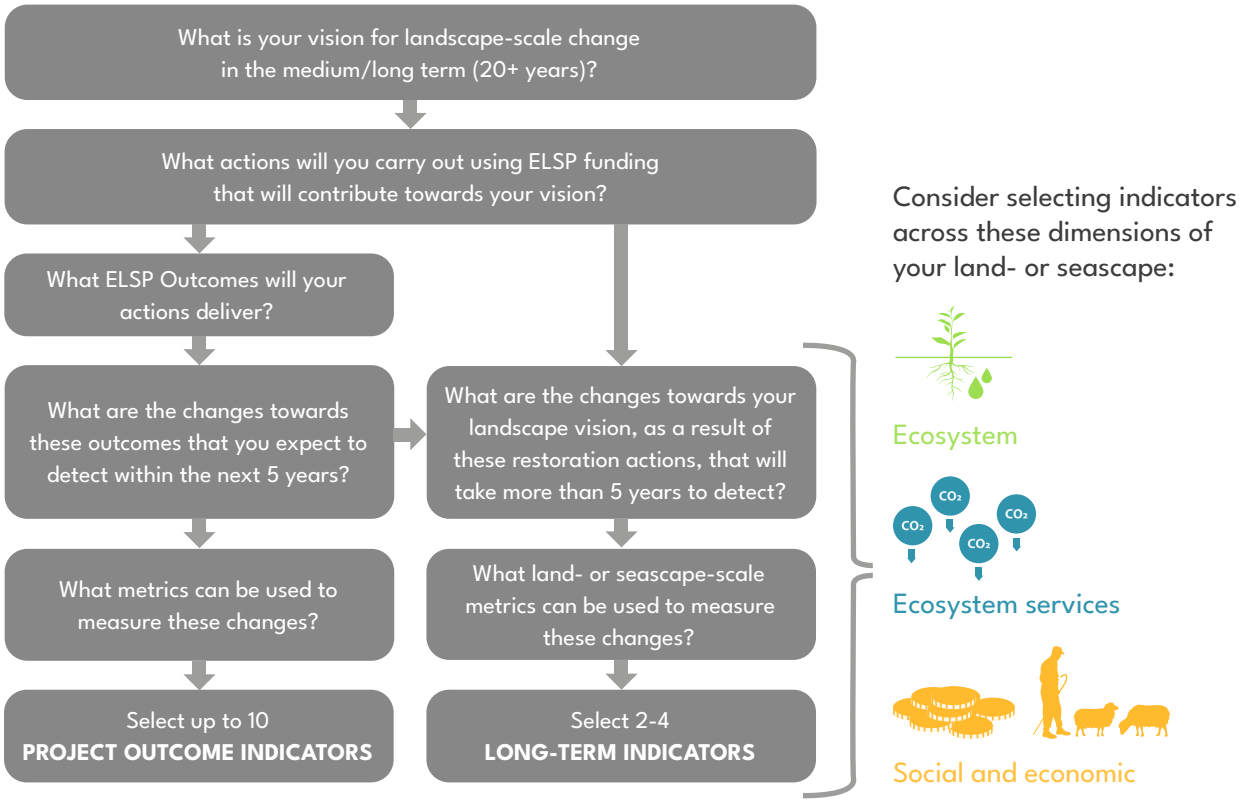



Figure 1a. Stages in identifying indicators for monitoring change in large-scale ecosystem restoration projects. The left-hand pathway shows the steps in selecting Project Outcome Indicators, that measure progress towards your ELSP objectives, while the right-hand pathway shows steps in selecting Long-term Indicators, that measure changes across your landscape or seascape as a result of your restoration actions that will not be seen within the ELSP funding period.

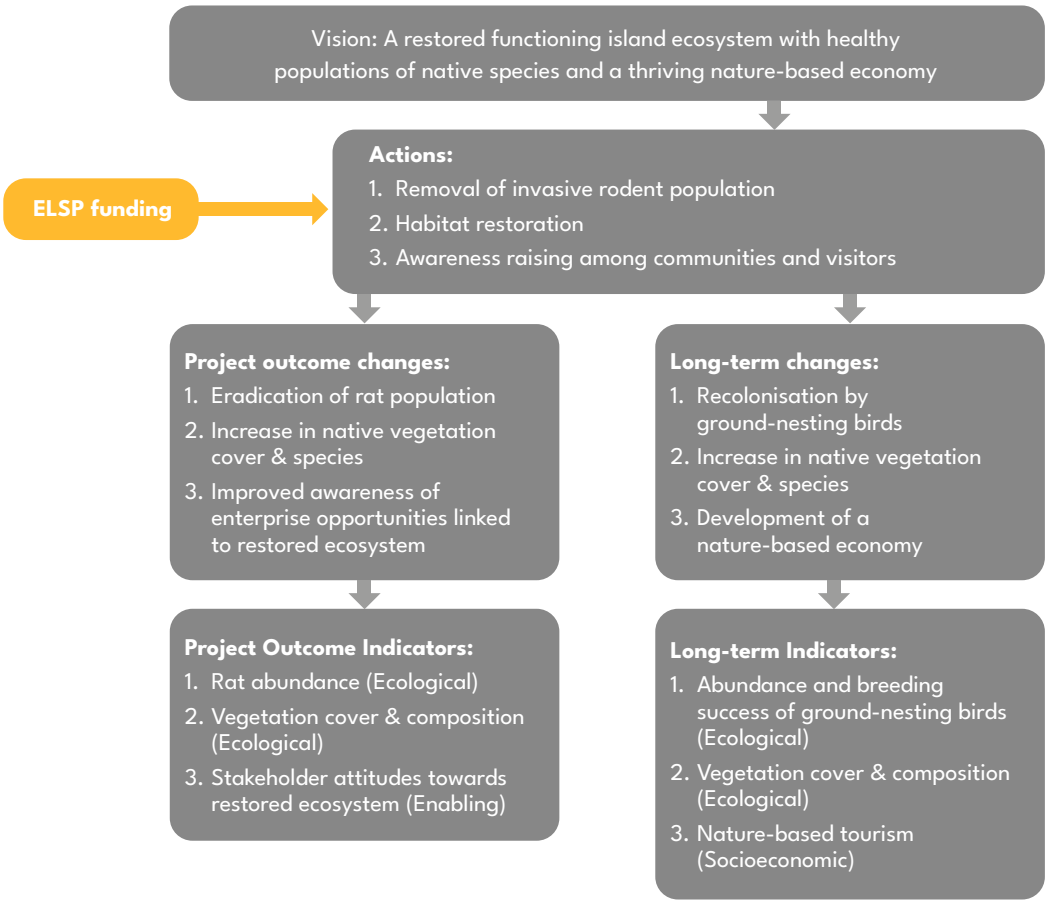



Figure 1b. An example showing how the pathway could be used to identify Project Outcome and Long-term Indicators for a simplified project working on island ecosystem restoration.

## 3.2 Multiple dimensions of landscapes and seascapes

Large-scale restoration projects often aspire to catalyse change across a range of aspects of a landscape or seascape. In order to ensure that your set of indicators captures this diversity of changes, the Monitoring Framework provides a set of themes and sub-themes to consider (Figure 2).

These encompass the following common objectives for restoration projects:

- an improvement in the abundance, distribution, movement or diversity of key species or species' communities;
- an increase in the quantity or quality of natural habitat;
- enhanced natural functioning of ecosystem processes;
- improved resilience to short- and longer-term pressures (including climate change);
- improved services to people, including food and resources, water quantity or quality, carbon sequestration, or flood or fire mitigation;
- the provision of economic benefits to local communities;
- the provision of sustainable cultural, social and wellbeing benefits to people;
- improved institutional, legal, governance or economic conditions that enable restoration to be sustained or scaled up.

We encourage you to think about how you expect the landscape or seascape to change across these different dimensions as a result of your restoration actions and how these changes can best be demonstrated, by selecting Long-term and Project Outcome Indicators from across the range of themes and sub-themes shown in Figure 2. Examples of indicators from each of these themes are given in Table 2.

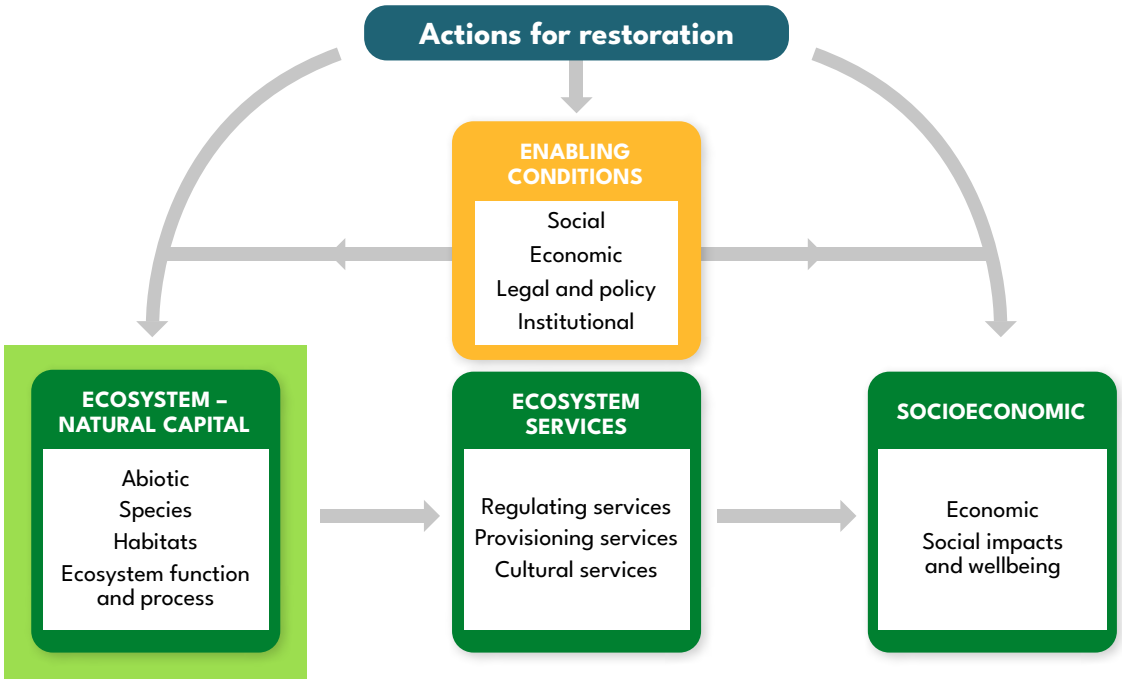



Figure 2. Themes, and the sub-themes within them, to consider when selecting Long-term and Project Outcome Indicators. Restoration actions may directly target the ultimate outcomes of restoration (green boxes) or may operate via improving enabling conditions (orange box), which then facilitate enhancement in ecosystem or socioeconomic dimensions of landscapes. Restoration actions may be targeted at components of the ecosystem (species, habitats, function and processes, abiotic factors), with increased ecosystem services and socioeconomic benefits to people then flowing from the restored ecosystem. Actions may also aim to directly enhance socioeconomic factors. Note that the first green box, representing ecosystems/ natural capital indicators, is highlighted, as this is the primary focus of ecosystem restoration across the ELSP. We recommend selecting indicators from at least two of the green boxes and across multiple subthemes, to ensure you are capturing the diversity of outcomes of landscape and seascape restoration.

## 3.3 Project Outcome Indicators

Project Outcome Indicators assess progress towards achieving the outcomes for your ELSP project and are expected to show changes over the five-year funding period. These indicators should cover the range of outcomes described in your project's logical framework and be spread across the breadth of land- or seascape dimensions (Section 3.2, Figure 2).

Some Project Outcome Indicators will measure change in the ultimate targets of your restoration actions (green boxes in Figure 2). Others may assess progress towards intermediate stages on the journey to the ultimate landscape vision, such as the reduction of threats (e.g. distribution or abundance of non-native species, levels of pollution, incidences of poaching) or the removal of limiting societal barriers (e.g. laws or change in the ownership of land). Indicators of these types of outcome will often fall within the 'Enabling conditions' theme (Orange box in Figure 2). Where ELSP outcomes, and hence Project Outcome Indicators, describe an intermediate enabling stage, it may be useful to include an additional Long-term Indicator to monitor the ultimate target of the restoration action (e.g. recovery of native plant communities, enhanced fish populations, increase in abundance of large mammals in the landscape).

## 3.4 Long-term indicators

The inclusion of Long-term Indicators in your ELSP Monitoring Plan provides an opportunity to assess changes in the ultimate targets of your restoration actions (green boxes in Figure 2), even if these changes are unlikely to be seen during the ELSP funding period. Long-term indicators should assess progress towards the vision described in the Vision/Impact Section at the top of your Logical Framework, as a result of activities carried out with ELSP funding. They can be used to demonstrate the transition of your landscape or seascape towards a more natural, resilient and self-sustaining ecosystem that delivers sustainable benefits to people.

Long-term indicators will usually measure ecological or socioeconomic change at a land- or seascape scale rather than at individual sites and should measure change in the ultimate targets of your restoration rather than enabling factors. Examples could include an increase in forest cover, recovery of carnivore populations, functioning of natural hydrological processes or transformation of local economies.

The timescale for seeing changes in Long-term Indicators will depend on the type and history of your ecosystem, as well as the current pressures acting on it and the surrounding context, but it may take decades or even centuries for degraded ecosystems to recover (see box Timeframes and Long-term Indicators below). When selecting your Long-term Indicators, it is again important that you consider changes across the breadth of land- or seascape dimensions (see section 3.2, Figure 2).

### Timeframes and Long-term Indicators

The likely timeframes over which responses are expected to be seen in large-scale ecosystem restoration present a challenge. Many of the ultimate outcomes of your restoration actions may require decades to be achieved (Figure 3). In addition, the time period needed to see change may be poorly known and vary with context. We suggest you consult the scientific literature and use your own experience and that of colleagues and experts to make a judgement on the expected rate of change for each indicator and thus the frequency of data collection, or monitoring interval, required. There is no requirement to show change in your Long-term Indicators before the end of your ELSP funding period; data collected during this time may often only provide a pre-restoration baseline against which to assess future changes.

When selecting indicators for assessing long-term change, it is important to consider what will be feasible to monitor beyond the duration of ELSP funding, in terms of the capacity, expertise and costs required. **Measuring change in your Long-term Indicators should be a core priority for organisations and partnerships, to demonstrate that they are moving towards their ultimate goals, so we expect projects to be committed to maintaining data collection for these indicators at appropriate frequencies over the medium-long term.**

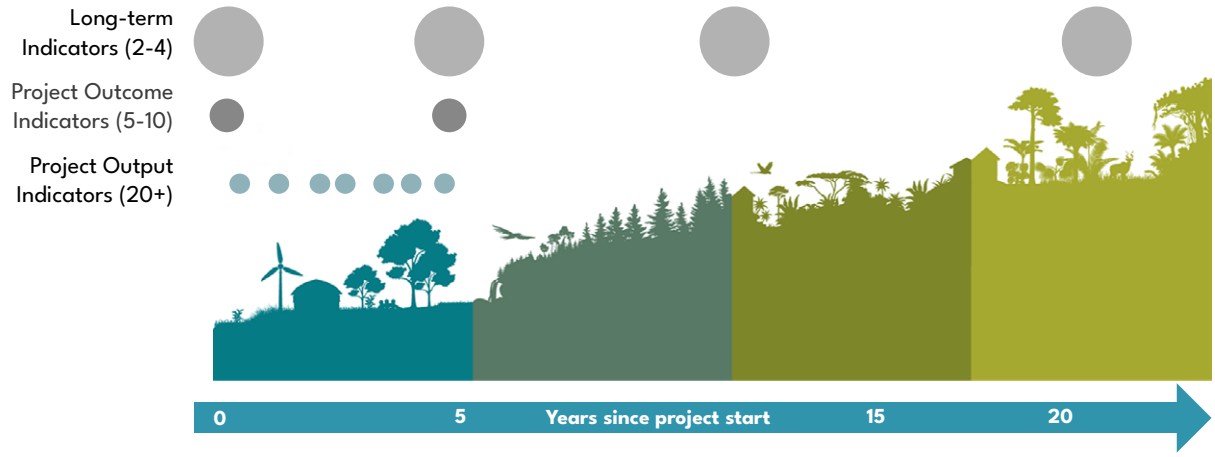



Figure 3. The approximate frequency of data collection and reporting for the different indicator types in the ELSP. Size of circles represents the relative likely effort and resources required for data collection. Please note that the exact number of data collection events and their frequency will vary depending on the type of indicator and its expected rate of change. Numbers in brackets are the recommended number of indicators of each type. Further details of each type of Indicator are provided in Table 1. Figure based on The Restorative Continuum, from SER's International Principles & Standards for the Practice of Ecological Restoration (https://www.ser.org/page/SERStandards).

## 3.5 Selecting a set of Project Outcome and Long-term Indicators

Once you have a longlist of potential indicators, consider which of these will be most useful and important to monitor change in the targets of your restoration across your landscape or seascape. It is critical to work with partners to identify a set of indicators that will provide valuable information for your project and partners - we don't want you to collect data simply to report to ELSP. This may involve participatory processes in the selection of some indicators (see Section 2). It may be useful to ask questions such as

- What are the key changes that tell you whether your management is having the desired effects and allow you to adjust your interventions if things are not on track?
- What are the changes that, if demonstrated clearly, would aid your advocacy of restoration and protection to national or regional agencies and authorities?
- What results would help persuade others that you are providing benefits to people and nature, and thus increase support and/or funding for the project?

If indicators will be useful in answering these types of questions, then it is likely that they should be included in your monitoring plan.

Other factors to consider include:

- The overall diversity and complementarity of the suite of Long-term and Project Outcome Indicators selected, to ensure that the different goals of the partnership and the different dimensions of large-scale restoration are adequately covered (section 3.2).
- Availability of necessary skills, equipment and capacity to design, implement, analyse and write up the monitoring plan and its results.
- Practicality of sustaining data collection, processing and dissemination over the timescales required.

Note that some indicators will function as both Long-term and Project Outcome Indicators (see example in Figure 1b). These indicators will be expected to show change towards ELSP project outcomes within your ELSP funding period, but will also be monitored in the longer term as key metrics of progress towards the ultimate vision for your ecosystem. These indicators can be marked as both Long-term and Project Outcome Indicators in your Monitoring Plan and the frequency of data collection should reflect their purpose and expected rate of change.

Examples of Long-term and Project Outcome Indicators being used by current ELSP projects are available on the Measuring Impact Hub on our website.

## 3.6 Existing monitoring schemes

Early on in the project planning process it is useful to review any data that is already being collected in your project area, by partners on the ELSP project, other local organisations, or as part of existing national or regional monitoring schemes (for example, national monitoring of birds or butterflies, ongoing water temperature or water quality monitoring, existing social or economic indices) and consider whether they could provide data and/or methods to inform any of your indicators. This may have benefits of lower costs and likely long-term sustainability and may also provide useful comparative data within and outside your focal restoration area. However, please check the spatial and temporal resolution of these datasets, to ensure they are likely to be sufficient to detect change at the scale of your landscape or seascape.

## 3.7 Indicator requirements of the Landscape & Seascape Restoration Monitoring Framework

The ELSP has no minimum requirement for the number of indicators you select to monitor. We encourage you to select a small number of high-quality indicators that have been carefully thought through and are sustainable in the long term rather than a large number of indicators that you may struggle to manage and sustain. In general, this often equates to approximately 2-4 Long-term Indicators and 5-10 Project Outcome Indicators, spread across the themes and sub-themes shown in Figure 2. Project Outcome indicators should relate to a range of outcomes from your log frame, with a well-described rationale for the importance of each. All selected indicators should be described in detail in your monitoring plan, using the template provided.

Please note that, for projects given in-principle approval, support and advice from ELSP is available to help with selection of indicators and methodology for data collection.

Image credit: Sabuko

Image credit: FCC

# 4. Designing Long-term and Project Outcome Indicators

## 4.1 Appropriate methodologies

- The methodology for each indicator should be robust, consistent and systematic. Data collection approaches should be appropriate to the size of area or population being monitored and the expected rate of change. It is vital that the same methodology is used for each monitoring round, to ensure data are comparable through time. Methods should be well documented and written in sufficient detail that they could be replicated by the reader.
- Practical aspects to consider include the resources (time, equipment, etc.) and expertise required to collect data for an indicator. For indicators that require information from control sites (outside the project area or in other areas where no intervention is undertaken), please remember to include capacity and resources for monitoring these areas.
- Consider the type of data that are collected and reported. This will often be quantitative, but qualitative and narrative-type indicators may be more appropriate in some circumstances.
- Sampling strategies – for indicators where it is not possible to measure the entire 'population', it is important to spend some time designing an appropriate sampling regime, to ensure that results are robust and conclusions can be drawn about the wider population (see 4.4 below).
- Think about how the results will be analysed at the outset of the project, to ensure that the data you collect will be appropriate to answer the question that you are asking.
- Monitoring methods for Long-term Indicators need to be feasible to sustain in the long term, given the expected timescale to achieve the vision of most landscape and seascape restoration projects. Suggesting an appropriate monitoring frequency should help to ensure this is achievable.
- New approaches and technologies may be helpful in addressing the challenges of large spatial and temporal scales. For example, remotely sensed images from drones or satellites or passive methods such as acoustic sampling may enable assessment of habitats and species across large areas.
- If your organisation lacks experience in a particular area or approach (for example, hydrology or assessing social indicators), consider consulting or collaborating with other individuals, organisations or institutions with expertise in these topics. Partnerships with local universities can often be helpful in designing and implementing more complex indicators. If there is an area where you feel your project particularly lacks capacity please talk to the ELSP Management Team as soon as possible.

## 4.2 Indicator targets

There is a section in the Monitoring Plan template asking about the target value for each indicator. It may be difficult to set a target for some indicators in process-led open-ended restoration projects, where the response of a particular species, community or habitat may be dynamic or uncertain. However, please provide some information about the desired direction of travel in this section, even if it allows some flexibility. For example:

- We will double the area of wetland and improve habitat quality, so therefore expect the abundance of most wetland bird species to show significant increases.
- Increased abundance of fish as distance between habitat patches decreases.
- Creation of at least 10 new jobs and two nature-based enterprises by Year 5 of the project.

## 4.3 Attribution

As described in Section 1, one of the main purposes of monitoring is to understand the effect that your restoration activities have had on ecosystems and local communities. However, the status of Long-term or Project Outcome Indicators may be affected by factors which are outside the project's control, such as climate. We therefore encourage you to include controls or comparisons for some key outcome indicators where this is possible, to allow you to demonstrate a link between your project actions and changes in target indicators. The most rigorous way to do this is by monitoring an appropriate number of matched but 'untreated' comparison sites to those where the interventions are taking place, allowing you to measure any changes that would have been expected in the project area in the absence of your restoration activities. Including a control, in addition to collecting a pre-restoration baseline, will result in a before-after-control-impact (BACI) study design, which is one of the most powerful ways to be able to attribute any changes observed in your indicator to the restoration activities undertaken (Christie et al. 2019).

However, it can be challenging to identify suitable comparison sites and monitoring them may be expensive and/or impractical in a landscape or seascape context. Using remotely sensed data from satellites or drones to assess change at one or more comparison sites may be one possible solution. Another option may be to compare the changes (in species populations, habitat cover or socioeconomic variables) observed in your landscape or seascape with equivalent data describing national or regional trends.

Alternatively or in addition, it may be useful to collect data on external factors, that are outside your control but that you think may have important effects on your target indicator. This could include environmental variables (such as precipitation, air temperature, sea surface temperature or pH), ecological factors (such as abundance or distribution of problematic non-native species) or socio-economic metrics (such as population density or inflation). These data may already be being collected by others. Taking account of key factors in the wider environment may you help to understand unexpected changes in your indicators, improve your understanding of the effects of your project actions, and, if necessary, allow you to adapt your restoration activities accordingly.

Other potential approaches to increasing confidence in the causal link between your actions and changes in indicator values include interviewing local experts about the causes of change or checking results against expectations based on a detailed theory of change. Staggering restoration interventions and using 'controls in time' (in which areas that are currently being restored are compared with those that are scheduled for restoration at an earlier or later date) is another option that can be considered.

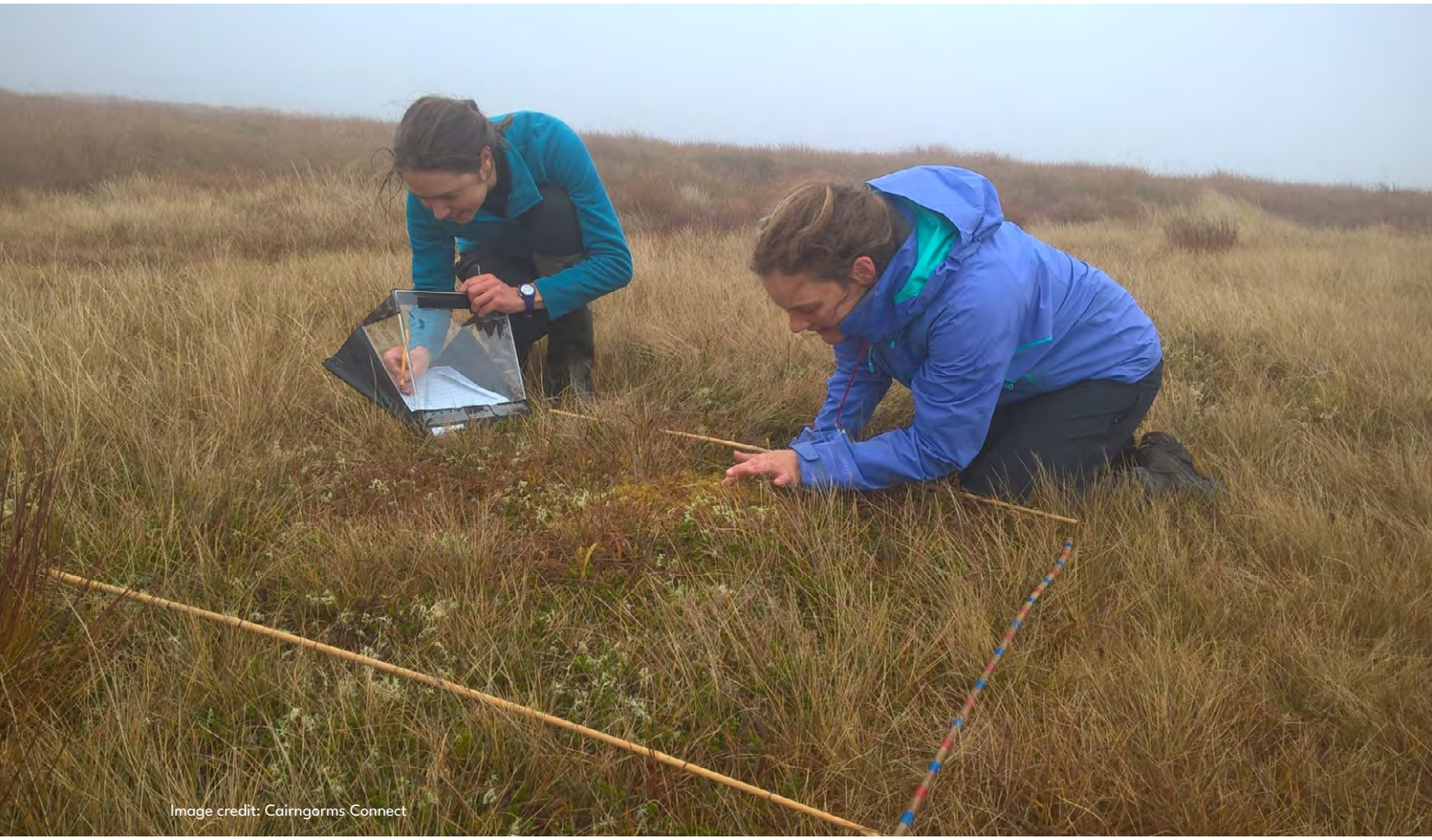
Any additional work undertaken to assess the link between restoration actions and changes in Long-term or Project Outcome Indicators should be described in the 'Attribution' sections of your monitoring plan. You do not need to show attribution for all your indicators; instead, we suggest you identify a subset of indicators for which it is important to assess whether any observed changes are a result of your restoration activities. Please note that it may not be necessary to separate the effects of 'ELSP-funded activities' from the impacts of other actions taken as part of your wider programme of work.

## 4.4 Dealing with large spatial scales

The large areas involved in landscape and seascape restoration projects have implications for the selection of indicators and the methodology used to collect data. Some indicators, such as those based on data from remote sensing, may effectively measure change across a whole landscape or seascape. Other indicators may focus on only a part of the whole project area, for example a specific habitat where active restoration is planned.

Many indicators will require a robust sampling strategy, in which data collected at a representative subset of plots or sites can be used to monitor change across the wider landscape or seascape. It is important that the number and choice of replicate samples where data are collected are carefully thought out, and expert advice is sought where necessary. Samples may be randomly selected, but in many cases where sites or populations are heterogenous, a stratified sampling regime may be preferable.

Power analyses are a formal statistical approach that can be used to determine the number of replicate samples needed to detect a given change in a parameter and may be a useful step in the design process for some monitoring indicators (please see our short guidance for how to conduct a power analysis here). However, frequently in restoration ecology there is not enough information available (on the variability of the system and/or the expected rate of change) to carry out a power analysis. Therefore, the ELSP does not require power analyses to be carried out, but instead we encourage robust design of data collection, such as increasing the replication of both treatments and samples and including BACI designs where possible and appropriate.



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# 5. Long-term and Project Outcome Indicator data storage and reporting

## 5.1 Data storage

Because of the timespan over which Long-term Indicator data will be collected and the fact that monitoring is often carried out by several different organisations across a restoration project partnership, it is vital that you have a robust system in place for storing your results. Thinking about how data will be structured, shared and analysed across partners, and ensuring the system is resilient to organisational change and staff turnover, is a key part of planning[1]. It is important that your results and associated metadata are stored in a way that is easy to understand and allows data to be revisited and reanalysed for new purposes in the future, including by new staff. Thought should be given to who holds and has access to the databases that are being produced. Using an open access repository can be one solution to these issues.

## 5.2 Making your data open access

One of the key aims of Arcadia, the ELSP's funder, is to promote open access to information. This allows others to see and learn from the monitoring data you have collected, including performing new analyses and combining your results with other datasets. Therefore, you must ensure there is a plan for making the data from each of your Long-term and Project Outcome Indicators **freely and publicly available**. We encourage you, where appropriate, to publish results in an open-access peer-reviewed scientific journal[2]. However, for other data a publicly available data repository may be more suitable. Appropriate repositories will provide your dataset with a DOI and allow your data to be available open access. The re3 database of repositories allows you to filter by theme and location to find those that are relevant to you. Repositories that have earned the CoreTrustSeal certificate are recommended. Some examples include Movebank and Seabird Tracking database (for animal tracking data), and KNB repository (particularly suitable for sensitive data e.g. protected species geolocations) and Zenodo (a reliable general data repository).

**We generally expect data from ELSP-funded projects to be available in an open access format within one year of the project end date.**

## 5.3 Data confidentiality

Data for some of your indicators may involve sensitive or confidential data (such as personal information about survey respondents or the location of threatened species). If you will be storing confidential data, it is important to ensure that you have appropriate plans for its storage, who can access it, and what will happen to it in the long term. These plans need to adhere to national legal requirements as well as any ethical standards associated with the data collection.

1. An ELSP webinar, where two projects share examples of the data management processes, is available
2. A webinar to provide help with this is available, with the Open Access section starting at 36 minutes

### 5.4 Reporting to the ELSP

The aim of monitoring outcomes is to understand the changes taking place in a landscape or seascape as a result of the restoration activities that have been implemented. Baseline monitoring provides a vital assessment of the landscape or seascape prior to the start of restoration activities, and is key to demonstrating any type of change. Subsequent data collection and reporting needs to be appropriate to the expected time to see substantive change in the indicator.

**Long-term Indicators:** The grantee and ELSP will agree reporting timings and frequency for each Long-term Indicator, tailored to the type of data and expected rate of change. Baseline status for these indicators should be collected and reported to the ELSP using the Baseline Reporting Template as soon as possible and normally within 18 months of the project start date.

**Project Outcome Indicators:** Projects are required to submit a baseline status report for each Project Outcome Indicator to the ELSP within 18 months of their start date using the Baseline Reporting Template provided. Interim reports may then be submitted during the five-year funding period as relevant, depending on indicators' monitoring frequency. A final report for each Project Outcome Indicator, showing change over the project period, must be submitted at or before the end of the ELSP project period.

# 6. Selected references and resources

Please ask the ELSP Science Manager if you have difficult accessing these or any other reference materials.


Christie A.P., Amano T., Martin P.A., Shackelford G.E., Simmons B.I. & Sutherland W.J. (2019) Simple study designs in ecology produce inaccurate estimates of biodiversity responses. *Journal of Applied Ecology*, 56, 2742-2754. https://doi.org/10.1111/1365-2664.13499

De Bell S., Graham H., & White P.C. (2020) Evaluating dual ecological and well-being benefits from an urban restoration project. *Sustainability*, 12, 695. https://doi.org/10.3390/su12020695

EU Water Framework Directive (WFD) (2000) The EU's Water Framework Directive provides a standardised list of indicators for assessing change in water quality.

Fraser E.D., Dougill A.J., Mabee W.E., Reed M. & McAlpine P. (2006) Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. *Journal of Environmental Management*, 78, 114-127. https://doi.org/10.1016/j.jenvman.2005.04.009

Hughes F.M.R., Adams W.M., Butchart S.H.M., Field R.H., Peh K.S.-H. & Warrington S. (2016) The challenges of integrating biodiversity and ecosystem services monitoring and evaluation at a landscape-scale wetland restoration project in the UK. *Ecology and Society*, 21, 10 http://dx.doi.org/10.5751/ES-08616-210310 ***Provides a practical description of long-term monitoring of ecosystem services at a UK wetland restoration site, including descriptions of the indicators used and valuations for each ecosystem service.***

Leisher C., Hess S., Dempsey K., Payne Wynne M.L. & Royte J. (2022) Measuring the social changes from river restoration and dam removal. *Restoration Ecology*, e13500. https://doi.org/10.1111/rec.13500

Marsh P., Auckland S., Dudley T., Kendal D. & Flies E. (2023) A mountain of health benefits? Impacts of ecological restoration activities on human wellbeing. *Wellbeing, Space and Society*, 4, 100132. https://doi.org/10.1016/j.wss.2023.100132

McKinley, D.C., Miller-Rushing, A.J., Ballard, H.L., et al. (2017) Citizen science can improve conservation science, natural resource management, and environmental protection. *Biological Conservation*, 208, 15-28. https://doi.org/10.1016/j.biocon.2016.05.015

Pettorelli, N., Schulte to Bühne, H., Tulloch, A., et al. (2018) Satellite remote sensing of ecosystem functions: opportunities, challenges and way forward. *Remote Sensing in Ecology and Conservation*, 4, 71-93. https://doi.org/10.1002/rse2.59 ***Provides definitions of ecosystem processes, functions and services and a list of which remote sensing datasets could be used to assess each one.***

Sigouin A., Porzecanski A..L.., Betley E., Gazit N., Lichtenthal P., Cheng S.H., Pacheco P. & Mahajan S.L. (2025) Enabling participatory monitoring and evaluation: Insights for conservation practitioners and organizations. *Conservation Science and Practice*, 7, e70032. https://www.doi.org/10.1111/csp2.70032

TESSA toolkit, including guidance on using stakeholder engagement to identify key ecosystem services in a landscape and the beneficiaries of these. TESSA also provides simple assessment protocols for pollination, flooding, water quality and use, nature-based recreation, above ground live biomass carbon (M3 & M4), soil organic carbon (M7). The toolkit and approach are described in: Peh, K.S.H., Balmford, A., Bradbury, R.B., et al. (2013) TESSA: A toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. *Ecosystem Services*, 5, 51-57. https://doi.org/10.1016/j.ecoser.2013.06.003.

Tinsley-Marshall P.J., Rigg A., Skilbeck A., Ball L. & Still R. (2021) Nature's Sure Connected: A practical framework and guidance for evidencing landscape-scale outcomes of landscape-scale conservation.***This report includes descriptions of a citizen science approach to assessing terrestrial invertebrate abundance as a measure of ecosystem function, and using plants and invertebrates to assess functional connectivity of an ecosystem.***

**Table 2.** Examples of Long-term and Project Outcome Indicators across each theme and sub-theme of the Landscape & Seascape Restoration Monitoring Framework. Note that some indicators can fit in more than one theme and sub-theme.

| **Theme**<br>*Sub-theme* | **Description** | **Indicator type** | **Examples** |
|---|---|---|---|
| **Ecosystem**<br>*Abiotic* | Change in physical or chemical attributes of the landscape or seascape | Project | Change in water depth at restored peatland<br>Change in water quality parameters of restored rivers and estuaries |
| | | Long-term | Changes in dynamism of hydrology across landscape or catchment<br>Restoration of natural flood regimes along a river |
| **Ecosystem**<br>*Species* | Change in the distribution, abundance, demography or diversity of species or communities | Project | Abundance or productivity of target species<br>Genetic variability of key species<br>Use of landscape by a species through dispersal or other movements<br>Species richness or diversity of a community |
| | | Long-term | Change in abundance or distribution of keystone species or ecosystem engineers, such as carnivores, large herbivores or scavengers, across a landscape. |
| **Ecosystem**<br>*Habitats* | Change in the amount or quality of habitat | Project | Area of habitat in good quality (e.g. % tree cover, absence of invasive species, area of saltmarsh in good condition, adult kelp densities)<br>Habitat structure (e.g. from field, in-water or LIDAR surveys) |
| | | Long-term | Habitat heterogeneity<br>Habitat structural connectivity (e.g. length of riparian habitats in good ecological condition, distance between patches of target habitat)<br>Extent of restored native habitat at landscape or seascape scale (beyond direct impacts of the project e.g. due to natural regeneration) |
| **Ecosystem**<br>*Ecosystem functions and processes* | Change in ecological function, including measures of ecological connectivity, ecological integrity and resilience | Project | Measures of ecological integrity e.g. amount of deadwood in forest, aquatic invertebrate communities, soil microbe community, diversity and biomass of juvenile fish, habitat use by mobile fauna (fish & transient molluscs /crustaceans) |
| | | Long-term | Assessment of trophic chains (number of predators and diversity of their diet)<br>Landscape-scale measures of functional connectivity (e.g. changes in animal movements or gene flow, arrival of species that have used a new corridor e.g. Hughes et al. 2016, Tinsley-Marshall et al. 2021). |
| **Ecosystem services**<br>*Regulating services* | Change in the benefits humans gain from the regulation of ecosystem processes, including climate, water, soil and air quality, pollination or disease. | Project or Long-term, depending on scope | Amount of carbon sequestered by ecosystems, either from field measurements or modelled estimations (e.g. TESSA provides simple methodologies for assessing above- and below-ground carbon stocks)<br>Measures of resilience to drought or fire (e.g. abundance of flammable species, vegetation biomass)<br>Measures or models of the flood risk (e.g. number of households affected by flood events, flood occurrence from daily standing water extent based on satellite data, Pettorelli et al. 2018), water storage capacity of the landscape (e.g. Hughes et al. 2016) or coastal protection.<br>Measures of water quality reflecting pollutants, nutrients or dissolved organic carbon (aquatic invertebrates or plants can be used as indicators of water quality (e.g. Hughes et al. 2016). Eutrophication may be measured using satellite data (e.g. Pettorelli et al. 2018))<br>Measures or models of the rate of soil erosion<br>Pollination services measured by the rate of pollinator visits or pollination success |

| | | | | |
|---|---|---|---|---|
| | **Ecosystem services** *Provisioning services*[1] | Change in the yield of products from ecosystems | Project or Long-term, depending on scope | Yield of wild or cultivated food production (e.g. from agriculture, fisheries, forestry)<br>Amount or quality of fresh water available for human use<br>Availability of products for fuel or fibre, such as wood |
| | **Ecosystem services** *Cultural services* | Change in the cultural benefits that people gain from ecosystems, including cultural or spiritual enrichment, aesthetic experiences and recreation. | Project | Number of public events linking people with the landscape or seascape (not directly organised by project)<br>Rate of creative outputs related to the landscape or seascape (e.g. number of pieces of art created)<br>Amount of money or time spent by visitors to visit a landscape or seascape, as a reflection of value |
| | **Socio-economic** *Economic* | Change in economic status or other measures of livelihood of stakeholders | Project or Long-term, depending on scope | Contribution of the project to local or regional economies, such as number of nature-based jobs or businesses created<br>Levels of effective place-based marketing or access to markets<br>Measures of nature-based livelihoods among relevant stakeholders, such as income from sustainable harvesting of non-woody forest products |
| | **Socio-economic** *Social impacts and wellbeing* | Change in physical or mental health as a results of ecosystem restoration | Project or Long-term, depending on scope | Direct measures of physical or mental health and wellbeing as a result of awareness of and/or time spent in nature (e.g. De Bell et al. 2020)<br>Measures of self-motivated engagement (e.g. volunteering) related to the project and associated changes in perceived health or job satisfaction (e.g. Marsh et al. 2023)<br>Measures of negative impacts such as displacement or access restrictions[1] |
| | **Enabling conditions** *Social* | Change in social aspects of a landscape, including attitudes and empowerment, that facilitates and supports ecosystem restoration | Project | Attitudes among stakeholders towards ecological restoration<br>Measures of the strength of local networks including the number of public, stakeholder or volunteer events and participants (not organised directly by the project)<br>Measures of community empowerment (e.g. the number of local forums or community discussions, levels of participation by target stakeholders, the number and distribution of leadership roles established) |
| | **Enabling conditions** *Economic* | Change in economic conditions that supports large-scale ecosystem restoration | Project | Amount of grant funding for future restoration leveraged by project<br>Levels of effective place-based marketing or access to markets<br>Funds raised via sale of credits/ certificates or other forms of payment for ecosystem services |
| | **Enabling conditions** *Legal and policy* | Change in policy, legislation or other enabling conditions that facilitates and incentivizes ecosystem restoration | Project | Changes in national, regional or local policy or law to support or incentivize restoration<br>Changes in national, regional or local policy or law that aim to reduce practices that degrade ecosystems |
| | **Enabling conditions** *Institutional* | Change in institutions, collaborations, and governance mechanisms that enables more effective large-scale ecosystem restoration | Project | Measures of institutional sustainability or effectiveness, such as the number and type of partnerships established or the sustainability of relevant institutions<br>Measures of the quality of relationships or levels of trust and engagement, either between partner organisations or between the project and external stakeholders |

**1.** It is important to note that restoration may have unwanted impacts on some people, for example by reducing access to land or limiting offtake of resources. If this is a risk then it is important to also monitor such negative consequences and explore, if appropriate, any mitigation measures with those affected. Therefore such indicators can usefully be included in your monitoring plan.

Image credit: Taras Kazantsev

Endangered Landscapes & Seascapes Programme

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