

Ecosystem Restoration Camps Monitoring and Evaluation Framework

A How to Guide

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1. Why do we need to monitor and evaluate?

The purpose of this guide is to share our monitoring and evaluation framework with you so that you can collect data at your camp. This data is evidence of the impact of the ecological and social transformation taking place at your camp. Once we have evidence of how transformational ecosystem restoration camps are, we can then share these stories with the world which will increase our legitimacy, credibility and increase our support base and income.

2. What is the difference between monitoring and evaluation?

Monitoring is the continuous collection of data within a fixed time period. For example, a standard time frame for monitoring is one year, with baseline data collected at the beginning of the year, before any of the projects activities have been implemented. Then a 'midline' monitoring exercise is done, where data is collected 6 months later, with the results compared to those collected during the baseline. The final assessment takes place at the end of the year, with the results compared to the midline and the baseline to show progress achieved throughout the year.

Evaluation is the analysis of the data collected during the monitoring period. Once all of the data has been received, it is time to compare the results from the beginning of the period to the midline, to the final. You should see a difference in the results and be able to generate some conclusions from them about how the camp is developing. You then write the results and the analysis and subsequent conclusions into a report and send it to the Foundation.

3. Our Framework

We have created our framework together with input from various members of our team. The framework is split into two sections which define our work, ecological and social.

The first column describes the outcomes that we want the camp's activities to produce. The second describes the indicators which are signs that the outcomes are being met. The third, 'means of verification,' refers to the tests used to measure the outcomes.

Outcomes	Indicators	Means of Verification
SOIL		
Increased soil carbon (at sites with reachable laboratories)	Soil carbon is higher than baseline level	Lab test
Increased water retention capacity of the soil	Water holding capacity higher than baseline	Water Holding Capacity Test
Increased total photosynthesis	Increase in amount of leaf cover (vegetation) within the landscape	Leaf area index test, satellite imaging
Increased biodiversity	Insect biodiversity increased from baseline	Insect traps
Increased soil health (water, organic matter, biology)	The cloth has decomposed more than comparison site	Underwear test
SOUL		
Campers feel a sense of personal transformation	#People passing through camps/taking courses	Count
Campers knowledge and skills of ecosystem restoration increased	# people reporting positive life transformation	Survey/interview
Increased levels of hope, purpose and inspiration felt by campers	# people reporting an increase in feelings of hope, purpose and inspiration	Survey/interview Story of significant change
SOCIETY		
Community networks are built and strengthened	People report feeling a greater sense of community	Survey
Livelihoods are created and strengthened	# of new enterprises created (direct and indirect) by the camp	Count
	People have reported an increase in skills and knowledge that help them in their career	Survey/interview
Cross cultural learning and collaboration takes place	# of events where cultural sharing takes place	Count
	# of cultural backgrounds present in and around the camps	Story of significant change

4. Outcomes (Ecological)

This section of the guide will take a closer look at the outcomes and break them down clearly so that you understand them, in order of appearance from top to bottom.

Increased soil carbon (only at specific sites)

This outcome is essential for the camps to achieve, to prove that this is a solution to mitigate climate change. An increase of carbon in the soil has multiple benefits such as better drought resilience and less erosion, quicker-growing and more robust crops and plants, and lower levels of atmospheric carbon dioxide. If we can successfully show that our camps are sequestering carbon into the soil, we are likely to receive more funding and attention as a climate change mitigation solution.

Increased water retention capacity of the soil

The more water that the soil can hold means that there will be more available for the soil food web and the plants growing there. Soil with a high water holding capacity makes the landscape more resilient to droughts and floods.

Increased total photosynthesis

Increased total photosynthesis refers to the amount of leaf cover that the land contains. The more leaves, the greater the photosynthesis. Increasing vegetation cover is an essential part of ecosystem restoration as it provides cover for the soil to decrease erosion, fix carbon and nitrogen, hold water and moisture, and provide habitat and food for a multitude of creatures.

Increased biodiversity

Biodiversity of flora and fauna are essential for the creation and maintenance of healthy ecosystems. Ecosystem restoration is a recipe for increased biodiversity, and measuring these increases help to increase support for this work at a time when biodiversity is in swift decline.

Increased soil health (water, organic matter, biology)

The foundation of a healthy ecosystem is healthy soil. Across the world, industrial agriculture is destroying soil biology that underpins food and water security and a stable climate for us all. Ecosystem restoration rehabilitates degraded soils, so proving the efficacy of this is vital to the legitimacy of our solution.

5. Outcomes (Social)

These outcomes relate to the social impact that we hope the camps will achieve in regards to improving human societies and economies that are often degraded due to the degraded nature of the ecosystems around them.

Campers feel a sense of personal transformation

Personal transformation refers to a positive change in mindset, emotion and intention for the direction and outlook of one's life as a result of the time spent at the camp. This is something that we're hoping to see happen and would like to measure.

Campers knowledge and skills of ecosystem restoration increased

One of the main aims of ecosystem restoration camps is to increase the knowledge and skills of ecosystem restoration across the human population, globally. Therefore it is essential to measure whether or not this is happening, and by how much.

Increased levels of hope, purpose and inspiration felt by campers

Ecosystem restoration is an incredibly hopeful solution to climate breakdown, and this is something that we want to invoke in people that visit and take part in our camps.

Community networks are built and strengthened

Community networks refer to existing communities, such as those living around the camps, and the communities that are created at the camps and as a result of them.

Livelihoods are created and strengthened

Livelihoods refer to the means of supporting ones existence both financially and vocationally. It is our ambition for the camps to generate opportunities for people both working within and outside of them to create new livelihoods and strengthen existing ones.

Cross cultural learning and collaboration takes place

This outcome refers to the learning about other cultures that will take place at the camps, as a result of the coming together of people from all over the world. We hope to see collaborations take place between people from different cultures to foster a more tolerant and diverse future for humanity.

6. Indicators and Means of Verification (Ecological)

Indicators are signs that the outcomes are being achieved. The Means of Verification is the test that is used to assess whether the indicators exist, which in turn shows us whether the outcomes are being achieved. Below are the tests that you will need to carry out to collect the data.

Indicator: Soil carbon is higher than baseline level

Means of Verification: Lab test

This is the indicator that shows that more carbon is being sequestered into the soil than it was before the camp was in place and the ecosystem restoration activities had begun. This is measured in the following way:

Collect soil samples

The Why

Increasing carbon in the soil is one of the central reasons why ecosystem restoration is such a powerful answer to climate breakdown. Therefore, proving that carbon is being sequestered into the soil is a powerful sign to the world that this is a solution worth investing in.

Materials you will need:

- 1 spade
- 1 clean bucket
- 1 clean Ziploc bag to hold the sample

Method

1. Determine and prepare locations of subsamples you will take: At least five to ten locations should be chosen that represent the area of interest, for example from the top, middle, and bottom of a slope; or scattered locations in a field, pasture, or garden bed. Avoid sampling in irregular and border areas.
2. At each of the selected locations, take two soil subsamples 5m apart, and mix the subsamples together into one sample.
 - a. Remove any residue or plant material above the soil surface.
 - b. Use the spade to dig a small hole in the center of the prepared area, about 8 inches deep. From the side of the hole take a vertical,

rectangular slice of soil, aim for 6 inches deep and 2 inches thick. Remove any extra soil so that you have a more or less uniform “slice of soil” that is 6 inches deep, 2 inches thick and the width of the spade. Try to ensure that the slice represents the top 6 inches with equal representation across the depth of the sample. Place the slice of soil into the clean bucket.

- c. Repeat the sampling procedure at each location that you chose for this area, and combine the soil in the bucket. Break up the soil and thoroughly mix the subsamples in the bucket.
- d. Once the soil is sufficiently mixed, take an amount needed by the lab for analysis and transfer into the clean ziplock bag to transfer to the lab (0.7 litres of soil should be sufficient).

The Results

Once you have received your results back from the lab, you will be given a percentage of soil carbon found in the sample that you sent off. Healthy soils have around 6% organic carbon content. Degraded soils have 1-2%.

Indicator: Water holding capacity higher than baseline

Means of Verification: Water Holding Capacity Test

This is the indicator that shows that there is more water being held in the soil than there was before the camp began work. The means of verifying this is called the Water Holding Capacity Test, with the instructions below:

The Why

Healthy soils hold water, unhealthy soils don't. Water holding capacity indicates organic matter and carbon content. More soil moisture equals more life. Measure the water holding capacity before, during and after the restoration process to track changes.

Materials you will need:

- 1 watering can and water (a hose and spray nozzle can also be used)
- 3 or 4 trash bags, small tarps, or pieces of thin sheet plastic
- 1 small scale (mass balance)
- 1 spade
- 1 clean bucket
- 1 clean Ziploc bag, glass jar, or container to hold the sample

- 1 kitchen sieve or screen material with ~2 mm holes
- Mortar and pestle or other way to grind/break up soil
- 1 Kitchen oven or toaster oven set to 105°C
- A glass, metal, or ceramic dish/container to hold soil in oven (withstand 105°C)

The Method

1. Select and mark out at least three sites across the area that you are restoring
2. Free a 1x1 m area of soil from vegetation and soak it slowly and for several hours with water until saturated (ideally after a substantial rainfall event with clear forecast for the next three days)
3. Avoid pooling and runoff
4. Cover with plastic sheet, pin it down and wait for 48-72 hours, the sheet will prevent evaporation
5. Remove the plastic sheet, take sharp spade and cut a soil sample (15cm deep, 5cm thick and the width of the spade), make sure that the slice represents the entire top 15cm of the soil), repeat this for all sample sites
6. Mix samples together and omit any roots or stones
7. Take about 3 to 6 cups of the mixed sample and put it on a pan or another high-temperature container
8. Zero the scale, weigh the soil and record its weight
9. Bake the soil in an oven at 105°C for 24 hours until the water has evaporated, let it cool
10. Grind the sample with a mortar and sieve it through a 2 mm mesh, sift out all remaining stones and roots
11. Weigh the now dry soil sample and record weight
12. Weight the empty clean pan and record weight
13. Calculate the water holding capacity (WHC) of the soil sample using the equation $WHC = (PSw - PSd) / (PSd - P - RR)$
 - a. PSw = weight of pan and wet soil together
 - b. PSd = weight of pan and dry soil together
 - c. P = weight of pan
 - d. RR = weight of rocks and roots
14. Units for WHC are reported as kg H₂O / kg soil and can be converted to a percent (multiplying WHC by 100)
15. When repeating the test make sure to use the same procedure in order to get meaningful results

The Results

1. A small water holding capacity indicates a high soil compaction and/or a small percentage of soil organic matter
2. We therefore gain a better understanding of the soil health as well as insight on which strategies to prioritise

3. Repeating the test throughout the restoration process shows if restoration efforts are successful

Indicator: Increase in amount of leaf cover (vegetation) within the landscape

Means of Verification: Leaf Area Index Test

The Why

One of the main aims of ecosystem restoration is to increase vegetative cover within the landscape in question. Having increased vegetation is beneficial for several reasons, namely the increased photosynthesis created by the increase in plant life, which absorbs carbon, creates oxygen, prevents evaporation from the soil which increases the amount of water available to plants and animals, and provides habitats. Therefore showing that the vegetative cover has been increased is an effective way of proving the legitimacy of our work.

Leaf Area Index (LAI) is a measure for the total area of leaves per unit ground area. LAI is directly related to the amount of light that can be intercepted by plants, and is an important variable used to predict photosynthetic primary production and evapotranspiration. It is also used in carbon flux studies and global carbon cycle research. Values of LAI range from 0 (bare ground) to over 10 (dense conifer forests).

Materials You Will Need (The Options)

1. Cheapest and easiest option: use a smartphone app like *PocketLAI* (Cassandra Labs from University of Milan) or *LAIsmart*.
2. Better quality measurements: use the industry standard sensors Licor LAI-2000 or LAI-2200 (\$500 used on ebay), or alternatively AccuPAR (Decagon Devices).
3. More technically difficult option: Digital Hemispheric photography (DHP) with a high-resolution camera and an extreme angle fisheye lens and a leveling system. Use a freeware image processing software such as CAN-EYE, GLA, or CIMES to estimate LAI.

The Method

LAI should be measured at the ground surface at least twice each year: during peak foliage and also during minimum foliage. LAI should be measured separately in each area that is being restored, for example: annual cropland, perennial pasture, orchard, forest. LAI measurements should be taken within each restoration area at points on a regular grid that is appropriately sized to the restoration area so that at least 30 LAI measurements are made. Corrective adjustments must be applied to LAI measurements taken on ground sloping more than 30°.

[Click here for a video tutorial on how to conduct the leaf area index test.](#)

References

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Indicator: Increase in Insect Species Diversity and Biomass

Means of Verification: Insect Traps

The Why

Measuring the total insect biomass and insect species diversity on a site gives an indication of biodiversity that are present. Biodiversity reflects the overall health and resilience. This test should be done before, during and after restoration takes place.

Materials Needed

1. 3 open yellow containers per site
2. 8 parts water
3. 1 part molasses
4. 1 part powdered soap or detergent
5. (adjust the quantities of trapping solution to size and number of containers)
6. Tweezers
7. 1 kitchen oven or toaster oven set to 105°C

The Method

1. Mix the water, molasses and laundry soap together in the bowl
2. Place the bowls in different parts of the land so that they represent the site of interest
3. Replace evaporated water
4. Collect the insects after at least three days
5. Clean the insects from any remaining trapping solution (e.g. using a sieve, soaking, etc.)
6. Count the number of different insect species as well as the total number within each species in the bowl and record the numbers
7. Dry the insects for a few hours at 105°C
8. Weigh the insects and record the weight (total insect biomass)

9. When repeating the test, make sure to use exactly the same number and size of traps, to locate them at the same spots and to leave them for the same amount of time. This allows you to directly compare the results over time

The Results

1. Assessing the number of diversity of insect on a given site reflect its biodiversity which in turn represents the overall health and resilience of the land
2. Repeating the test throughout the restoration process is a possibility to measure if the restoration efforts are successful.

Timelines

These tests need to be conducted, as mentioned earlier in the guide, at the baseline, midline and endline periods of the camp project. This means, before the restoration activities are carried out (baseline), at a fixed point during the implementation of the activities (midline), and at the end of the restoration project. It is up to you how regularly you conduct these tests and collect this data, but we recommend that it happens once a year to once every two years.

If your camp has already started its restoration activities, then the best thing to do is to select a piece of land that is still being managed in the same way as your camp plot/restoration site was being managed before your restoration work began. Take data from that plot to use as your baseline data.

Indicators and Means of Verification (Social)

This section of the guide covers the indicators and means of verification for the social outcomes hoped to be achieved as a result of the presence of a camp. Ecosystem Restoration Camps isn't just about restoring ecosystems, it's about restoring what else is degraded alongside it, namely communities and economies. The top line social outcomes that camps should aim to achieve are:

- 1) Community networks are built and strengthened
- 2) Livelihoods are created and strengthened
- 3) Cross cultural learning and collaboration takes place

This section of the guide will take you through each of the indicators and means of verification that show whether these outcomes are being achieved.

Indicator: People report feeling a greater sense of community

Means of Verification: Camper Survey

The Why

Restoring and rebuilding community is essential for humanity to live sustainably and happily on planet earth. When communities are intact, everything works better. Support structures of many kinds alleviate feelings of depression, loneliness, anger, trauma, and fear, which lead to overconsumption, which leads to the degradation of the earth's resources, which causes climate change.

The Method

1. Use/create a camper database with the names and email addresses of everyone who has experienced the camp
2. Send them the [Camper Survey #1](#) to collect their thoughts on the topic of community building as a result of the camp

The Results

We are hoping that the surveys come back with a positive response in relation to the community building aspect of ecosystem restoration camps, with campers reporting that their sense of community has increased.

Indicator: # of enterprises created/enhanced (direct and indirect) by the camp

Means of Verification: Wider Community Survey

The Why

Restored landscapes provide the resources and hope needed to restore economies and create regenerative livelihoods for people living within healthy ecosystems.

The Method

1. Keep a database of all of the people within your network using either a simple spreadsheet or a CRM tool such as Monday.com
2. If they have spent time at the camp and are therefore considered a camper, send them the [Camper Survey #1](#) soon after they have left the camp, and send the [Camper Survey #2](#) a year later.

3. Send those who haven't been actively involved at the camp but are a part of the wider community [the wider community survey](#) to ascertain whether the camp has helped them with their livelihood.

The Results

We are hoping that the surveys come back with a positive response in relation to the improvement/creation of livelihoods aspect of ecosystem restoration camps, with an increase in people reporting that their livelihoods have improved.

Indicator: People have reported an increase in skills and knowledge that help them in their career

Means of Verification: Campers Survey

The Why

Ecosystem Restoration Camps are learning centres where skills and knowledge can be transferred that can then be used to restore ecosystems around the world. That is why we want to measure the quality and quantity of learning that has taken place at the camps, and whether or not this knowledge and these skills have helped them in their career.

The Method

1. Send [campers survey #1](#) to all those who have spent time learning at the camp, soon after their departure
2. Send [camper survey #2](#) to campers one year after their departure, to assess if the camp has had a longer term effect on their lives.

The Results

What we hope to see is that people are reporting an increase in their skills and knowledge as a result of spending time at a camp.

Before and After Photos

One of the quickest and easiest ways to demonstrate the impact that your camp is having is by taking before and after photos of the areas that you are restoring. The best before and after images are taken with drones.

Method:

- 1) Mark out specific points on your site with markers, and then take a photo of the site with a drone.
- 2) Keep the markers in place, and take another photo from the same location one year later.
- 3) Store these photographs and

Evaluating the results

Once all of the data has been collected, it is time to evaluate the results. Evaluation is taking the data from the collection exercise and looking at it to assess the trends. Evaluations often take the form of reports, which we can share with donors to prove the efficacy of our work.

Our recommendation is that you write a baseline report, after you have collected the initial ecological data, which summarises your findings and how they are going to inform how you restore your land.

The next time you collect data should be one year later, and this should include ecological and social data collected, with a summary of what you found and an analysis of what it means. Here is [a report template document](#) to give you an idea of the headings needing to be covered.

Once the report is complete, send it to ashleigh@ecosystemrestorationcamps.org, and feel free to send any questions about the framework to this address as well.

Conclusion

We hope that this guide provides you with the information and tools that you need to collect data according to the Ecosystem Restoration Camps framework. It is our ambition to be able to collect data from all of our camps so that we can show the world how effective they are at sequestering carbon, increasing biodiversity, increasing water holding in the soil, building community, strengthening livelihoods and increasing skills and knowledge.

Let's restore the earth together. The time is now.

