Guiding Principles for Measuring and Monitoring Progress on Forest and Landscape Restoration in Africa

AFR100 WORKING PAPER SERIES

Contents

1. Introduction

There is growing awareness regarding the potential for forest and landscape restoration to generate numerous benefits for people and support progress toward multiple national development goals, such as food security, poverty reduction, and climate resilience. Within this context, dozens of national governments have made commitments to restore deforested and degraded lands as part of global and regional restoration initiatives, including the New York Declaration on Forests, the Bonn Challenge, Initiative 20x20, and AFR100. The Bonn Challenge targets the restoration of 150 million hectares by 2020 and 350 million hectares by 2030, which is supported by AFR100, the Africa-wide initiative to place 100 million hectares of land under restoration by 2030. Meeting these targets and commitments requires a holistic approach to sustainable land use management and planning. A system to track and document progress supports a sustainable restoration strategy and encourages adaptive management practices.

2. How to create a restoration strategy?

Restoration strategies need to evaluate the effectiveness of different interventions at the landscape scale to understand the best intervention and the best place to pursue restoration. A restoration strategy should be created before investing in a monitoring system.

There are a wide variety of tools available to assist in creating a restoration strategy. A few tools and methods that are commonly used in forest and landscape restoration assessments are highlighted here. The

Restoration Opportunities Assessment Methodology (ROAM) provides a flexible and affordable method for countries to rapidly identify and analyze areas that are best suited for forest and landscape restoration and to identify specific priority areas at a national or sub-national level. INVEST is a suite of free, open-source software models used to map and value the goods and services from nature that sustain and fulfill human life. Rapid Rural Appraisal is a way for multi-disciplinary teams to learn via visual methods and semi-structured interviews from local people about their land use as well as their socio-economic realities and challenges. The Food and Agriculture Organization of the United Nations (FAO) has also compiled a database of resources related to forest and landscape restoration, including monitoring resources.

3. Why is monitoring restoration different from monitoring deforestation?

Many countries have experience with monitoring and many countries are already restoring lands. However, monitoring restoration is a different process than monitoring deforestation.

Many countries and organizations have years of experience in measuring and monitoring deforestation as part of REDD+ and other initiatives. Although many of the same techniques used in monitoring deforestation can be used for monitoring restoration—including satellite remote sensing, inventories, national statistics, and community-based surveys, there are important differences that need to be taken into consideration to ensure that monitoring of restoration is efficient and useful. The key differences are related to time and area.

First, while deforestation is a near-instantaneous event and wider landscape degradation often takes place at a much faster rate, restoration typically occurs over much longer time spans, usually on the order of years or decades. Measuring progress from seedlings to saplings and from young trees to mature trees requires a monitoring system that is based on a long-term time horizon. Therefore, it is important to determine what can be detected within the proposed timeframe and with what metrics when choosing which indicators to monitor. A monitoring framework based on the simple presence or absence of trees—which works for deforestation monitoring—does not capture the nuances of measuring progress on restoration, especially since it may involve restoration of croplands and other non-forested areas.

Second, deforestation is often measured in thousands of hectares and is characterized by relatively wide swaths of dramatic change in land cover. Restoration, on the other hand, usually occurs over smaller, more dispersed plots of land measured in a few hectares or hundreds of hectares. Thus, the scale of the two monitoring efforts are quite different, which and needs to be reflect in the approach to monitoring. To monitor restoration, high- to very high-resolution satellite images need to be used to detect these small, dispersed, and subtle changes in the landscape and then measure overall change. Since higher resolution imagery covers a smaller total area per image, tens of thousands of images are usually needed to cover even a modest monitoring area. Therefore, cost, volume of data, and time for visual interpretation are important considerations for setting the scale for the biophysical dimension of the monitoring initiative. Tools like Collect Earth and the Tree Cover Mapping Tool are based on a sampling approach that utilizes freely available imagery from Google Earth, thus providing a solution to some of the issues associated with cost and time constraints.

4. Principals of monitoring

4.1. Purpose

Monitoring restoration is critical to the continuation of restoration at scale and serves at least five important purposes:

1. Communicate results and outcomes to encourage positive momentum, inspire replication, and allow for transferable results;
2. Guide and support implementation of restoration and provide feedback, including continuous and collective learning for adaptive management;
3. Ensure transparency and provide evidence of progress, achievements, and impact in relation to specific goals and objectives, including periodic assessments of who benefits and how from restoration interventions (pay for performance);
4. Support sharing of evidence to restoration investors to enhance trust and foster additional investments and scaling up; and
5. Support robust monitoring of the restoration impacts, and regular reporting on progress in achieving national, regional, and international commitments.

4.2. Stages

Restoration is conducted to achieve a variety of distinct but interrelated goals—to increase crop yields, to increase the quality of water, to enhance biodiversity, to mitigate climate change, or to reduce soil erosion, among many others. Identifying the primary drivers of degradation and how restoration can address these drivers and restore lost ecosystem services while addressing the needs and aspirations of rural communities and enabling behavior change and investments at the grassroots are critical steps in implementing restoration. To understand if restoration activities are achieving progress toward the intended goals, it is useful to think of four stages:

- **Commitment:** measuring commitment helps countries see whether they are meeting their national AFR100 pledges.

- **Level of Effort:** this helps show how countries are contributing to their intended restoration strategies. To measure level of effort on land use goals, satellite tools such as Collect Earth can be especially useful.

- **Enabling Conditions:** this includes the legal and regulatory environment, and finance for restoration, and will be supported by the International Union for Conservation of Nature (IUCN)'s Barometer of Progress (see Annex).

- **Impacts:** the impacts of restoration can be varied, and often depend on the intended goal for restoration. FAO and the World Resources Institute (WRI) produced a guide on Monitoring Progress to support the selection of indicators for measuring impact (see Annex). The IUCN Barometer of

Progress will also analyze results and benefits, focusing among others on number of hectares under restoration, carbon sequestered, jobs created, and biodiversity impacts.

4.3. Indicators

Monitoring should be focused on progress toward specific goals and objectives that the restoration effort plans to achieve. Indicators help measure how much progress has been achieved.

It is important to note that there is no "one-size-fits-all" approach to monitoring. A monitoring system must be tailored to suit the unique needs and circumstances of each country and situation. Some monitoring systems will be based on commitments made at the national scale and others will be focused more on the landscape scale.

When talking about monitoring, the conversation often revolves around increase in vegetation cover or the development of terraces, both clear features visible from a satellite. These biophysical indicators are a key part of restoration monitoring, but a strong restoration monitoring system needs to include other elements as well.

A holistic monitoring system should include indicators that draw on the following:

- **Socioeconomic.** Assessing the health and well-being of people within the context of restoration goals (e.g., food security, access to clean water) can indicate whether the restoration program has achieved success in restoring targeted ecosystem services.[1]
- **Political.** Political will and favorable policy conditions—in the form of new or modified laws that enable restoration or simply visible support from politicians—can signify progress and sustained commitment to restoration success.
- **Financial.** Understanding the flow and/or sum of investments in restoration activities and financing of restoration initiatives by donors, governments, private sector, and other sources can indicate focus and commitment to restoration.
- **Biophysical.** Assessing the physical change in land use and land cover over time is the most straightforward indicator of whether restoration is effectively taking hold.

To set up a restoration monitoring system, it is recommended that stakeholders follow the steps below that guide them through a uniform and efficient approach. These three steps can be used at whatever scale is desired.

1. **At what scale?** The scale of the restoration effort to be monitored—whether it is national, subnational, local or some other geographic extent—is critical context for making all other decisions regarding the monitoring system.

[1] It is important to note that correlation does not guarantee causation. The cost and technical challenge of certifying causation depends on the chosen indicators and metrics.

2. **Use the framework to help select indicators based on goals.** Given the scope and large range of ecosystem types for which restoration will be needed, each restoration effort's specificities need to be carefully considered. Site-specific attributes should be identified at the early planning stage.

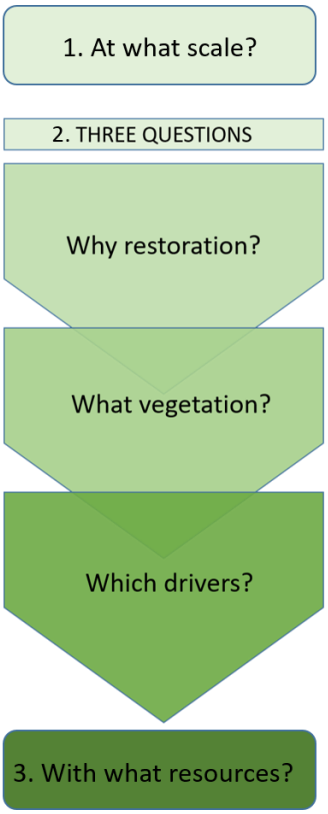

Figure 1: Three Steps for Choosing Indicators

- **Why restoration?** Identify the main goals of the restoration effort to be monitored. Consult with local communities and key stakeholders to identify what the restoration interventions are aiming to achieve. These goals are the basis for developing indicators and metrics against which to measure success. For example, if some types of restoration interventions are aimed at increasing food security, relevant indicators may be those related to soil fertility or crop yields. Typically, a suite of restoration interventions is implemented in support of integrated landscape management and designed to achieve multiple, interrelated goals.
- **What vegetation**? Identify in which type of landscape the change is happening. Change in land-use cover remains a common factor that needs to be measured, regardless of the restoration goal. In many types of restoration efforts land-use cover is increased by a combination of trees, and other vegetation like shrubs, grasses, bamboo, or some type of agroforest system. Different indicators will be needed depending on whether canopy cover or other types of cover are being monitored.
- **Which drivers?** Identify the drivers of degradation in the restoration area. Focusing on drivers of degradation helps identify how to mitigate and adapt to restoration challenges to ensure sustainability of the restoration effort.

3. **With what resources?** Take stock of existing monitoring efforts. Reach out across sectors and ministries to learn about any existing monitoring initiatives already taking place. Leveraging existing monitoring frameworks and/or data already collected will streamline the process. This process should also identify compatibility with other commitments and reporting requirements. Other regional and international agreements such as the Sustainable Development Goals, Aichi Targets, Paris Climate Agreement, and UNCCD Land Degradation Neutrality targets may coincide with the goals of the restoration system. It is important to identify shared interests and common elements of data collection, and to integrate any monitoring or reporting efforts for these initiatives to increase efficiency and avoid duplication.

These three steps can be used at any scale to create a streamlined monitoring system. FAO and WRI have created matching indicators and metrics for the national and landscape scale. When answering the question "why restoration," it can be useful to consult the Restoration Goal Wheel (see Figure 2). If the stakeholder's goal is focused on community support, then the indicator recommended would be "people engaged in planning and execution."

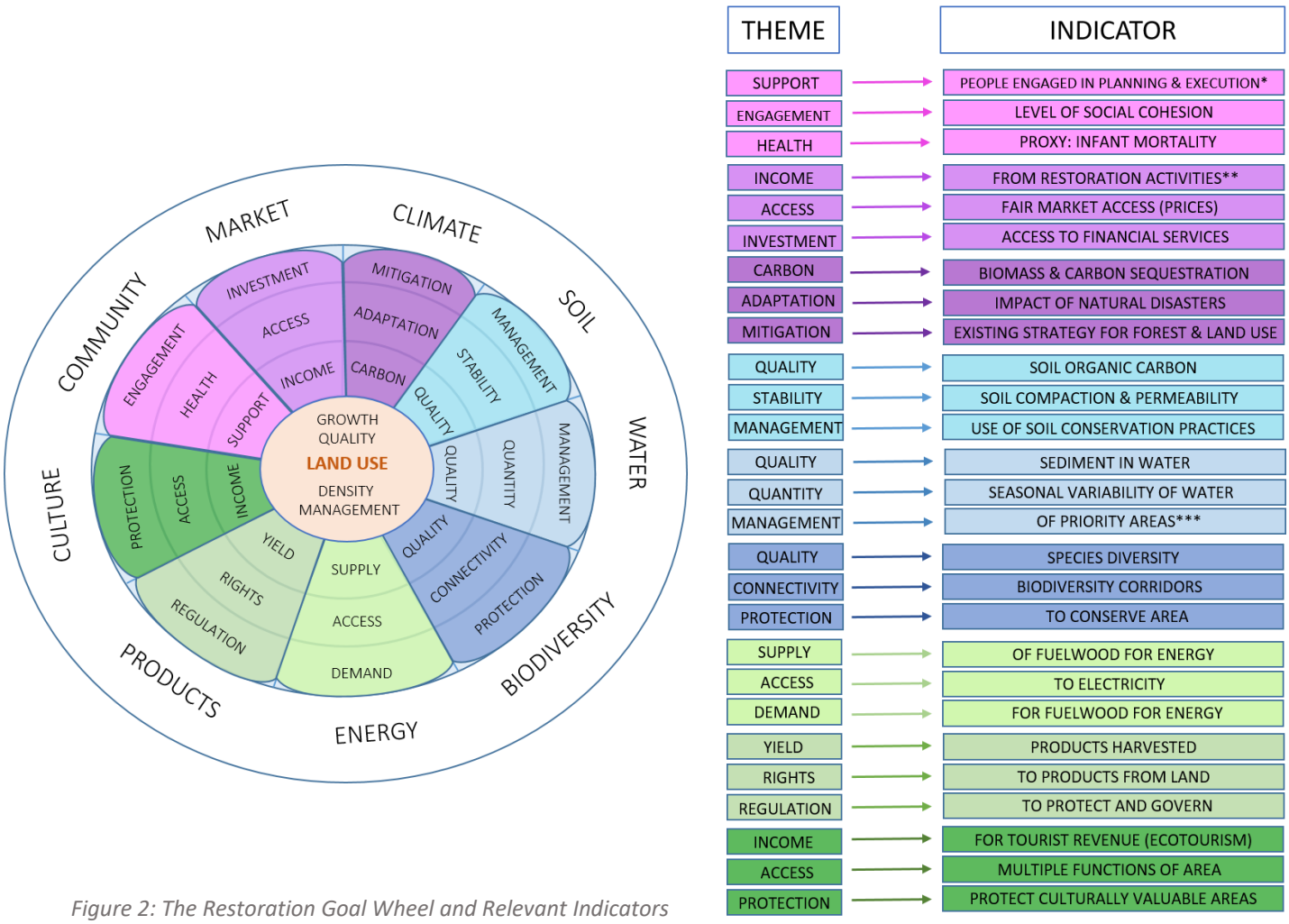

Figure 2: The Restoration Goal Wheel and Relevant Indicators

Following these steps should result in stakeholders agreeing on the indicators and data collection systems. In selecting the most critical monitoring indicators, it is also important to understand the sources of data for each indicator as well as the data collection methods and frequency. The stakeholders can then begin to measure a baseline for each indicator selected as part of the monitoring system. This will be essential for tracking change over time and within the target landscapes.

Within the process of creating a monitoring system, it is important to also devote consideration to:

- **Engaging across sectors and stakeholders at all scales.** Land degradation has drivers and impacts that extend well beyond the environment, and pertain to health, finance, agriculture, and more. Engaging across ministries and with a diverse set of stakeholders at all scales is necessary to develop and implement a successful monitoring system. The process should be inclusive, encouraging participatory identification of indicators whenever possible.
- **Considering tradeoffs.** Data collection can be an expensive and time-consuming process. It is important to find the right balance between costs/effort and the number and frequency of data

points collected to provide information on progress toward goals. This consideration is critical for achieving a long-term, sustainable monitoring system.

- **Developing a communications strategy**. It is important to identify how the results and lessons from the monitoring system will be effectively communicated to the stakeholders to enable adaptive management. An effective communications plan supports adaptive management by generating feedback from stakeholders, ensuring results reach the stakeholders in a format that can be easily interpreted.

Restoration consists of a multitude of different actions with different goals in very different landscapes. Many choices and priorities occur when making land-use decisions, and the monitoring system will also need to be based on similar choices. Within the monitoring system, a variety of stakeholders should be engaged to select the best indicators and align them with existing tools. In the AFR100 context, countries should look to devise monitoring systems that fit with their national restoration strategies, and ultimately support the goal of placing 100 million hectares of land under restoration by 2030 in Africa.

5. Further reading

Buckingham, K., Ray, S., Stolle, F. and Zoveda, F. 2017. *Measuring Progress for Forest and Landscape Restoration -- Working Paper* (ver. 1.0, July 2017); FAO, Rome.
(Can be sent upon request.)

Collect Earth: Augmented Visual Interpretation for Land Monitoring.
http://www.openforis.org/tools/collect-earth.html

Cotillon, S. and Mathis, M. 2016. Tree cover mapping tool—documentation and user manual (ver. 1.0, March 2016): U.S. Geological Survey Open-File Report 2016–1067, 11 p.
http://dx.doi.org/10.3133/ofr20161067.

Hanson, C., Buckingham, K., DeWitt S. and Laestadius, L. 2015. *The Restoration Diagnostic: A Method for Developing Forest Landscape Restoration Strategies by Rapidly Assessing the Status of Key Success Factors* (ver. 1.0, December 2015); WRI, Washington, DC. http://www.wri.org/publication/restoration-diagnostic

IUCN Bonn Challenge Barometer. https://www.iucn.org/theme/forests/projects/bonn-challenge-barometer

6. Annex

Bonn Challenge Barometer of Progress

The Bonn Challenge Barometer is an IUCN initiative to establish a flexible protocol and global platform for tracking and profiling country and jurisdictional progress in achieving forest and landscape restoration commitments that contribute to the global targets of the Bonn Challenge. With support from the International Climate Initiative (IKI) of the German Government, the Initiative will have three main outputs:

1. *Bonn Challenge Progress-Tracking Protocol*—a flexible protocol, developed with input from six countries that have made Bonn Challenge commitments.[2] The protocol will track progress along three dimensions: (1) ENABLING CONDITIONS, including legal/regulatory environment, and finance for restoration; (2) FLR PLANNING, including identification of restoration priority areas, cost-benefit analyses, technical capacity, and monitoring restoration; and (3) RESULTS AND BENEFITS, such as number of hectares under restoration, carbon sequestered, jobs created, and biodiversity impacts.
2. *Bonn Challenge Barometer of Progress*—a web-based platform operationalizing the Progress-Tracking Protocol to clearly and efficiently communicate country implementation of the pledges. It will include downloadable information and reports on restoration progress and multiple links to relevant partner sites.
3. *Flagship reports and events*—to profile progress and leadership on restoration and identify and address implementation bottlenecks. Two comprehensive reports on Bonn Challenge progress will be produced in 2018 and 2020, as well as a *Bonn Challenge Spotlight Report* in 2017 profiling progress and notable work underway.

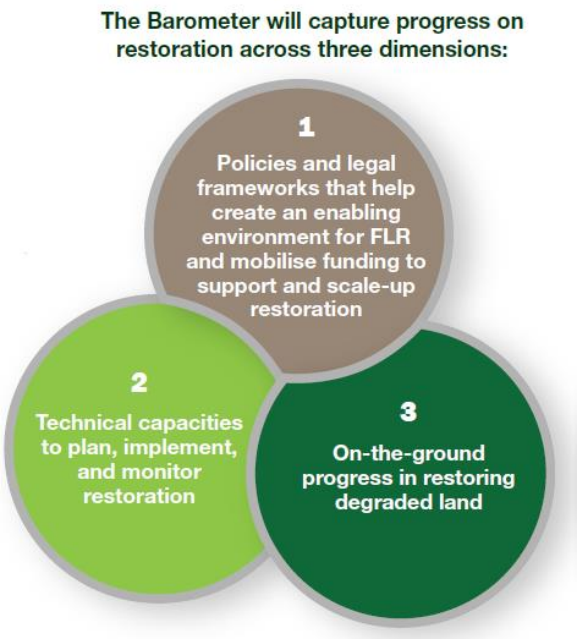

Figure 3: The Three Dimensions of the Bonn Challenge Barometer of Progress

[2] Those countries are Brazil, El Salvador, India, Mexico, Rwanda, and the United States.

Collect Earth

Collect Earth is a user-friendly, Java-based web tool that draws upon a selection of other software to facilitate data collection. It is an open-source, participatory mapping and monitoring tool. In conjunction with Google Earth, Bing Maps, and Google Earth Engine, users can analyze high- and very high-resolution satellite imagery to collect data on tree count, tree cover density, and land use.

Collect Earth functions as a Google Earth plugin, accessing satellite images from a multitude of sources like Digital Globe, Airbus SPOT 6 & 7, as well as Landsat imagery. The program remains free and open-source to encourage increased access. Collect Earth has been used to pilot large-scale restoration monitoring efforts, including over 500,000 sample points in Africa's drylands.

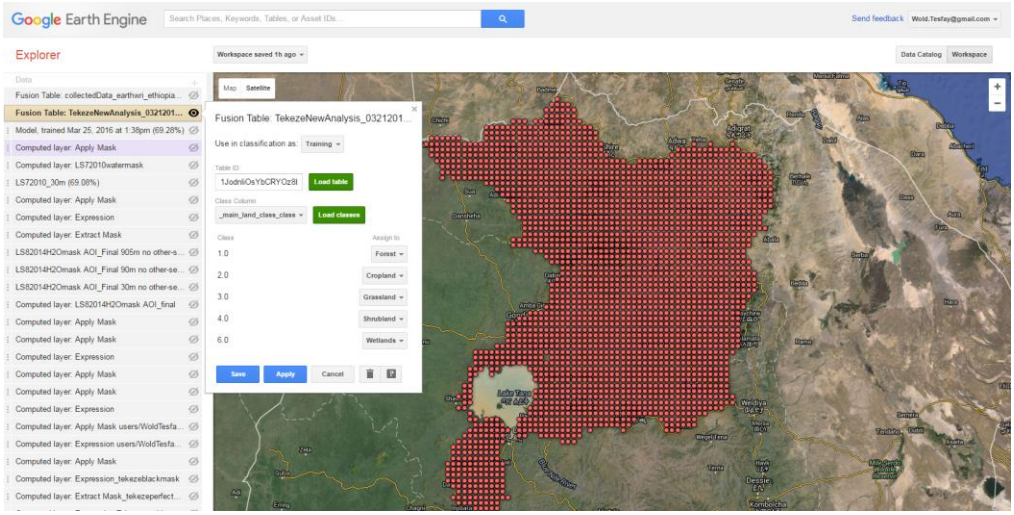

Figure 4: Collect Earth Monitoring Tool Interface Showing Sample Grid

To achieve the most accurate results, Collect Earth "Mapathons" (structured sessions with en-masse mapping) are often conducted with local stakeholders who have local on-the-ground knowledge of the areas being monitored. Collect Earth is especially useful at measuring tree cover (also known as element cover), the number of trees, the land-use type, and the infrastructure in the designated area. Collect Earth's strength lies in showing the change visible by satellites in a time- and cost-effective way, and ensuring ownership from local people.

Tree Cover Mapping Tool

The Tree Cover Mapping (TCM) tool was developed by the United States Geological Survey (USGS) to map tree cover density at a large scale using visual interpretation of high-resolution satellite imagery. The TCM tool is a downloadable add-in to the Esri ArcMap Geographic Information System (GIS) interface. The TCM tool uses a grid-based sampling approach to produce maps of tree cover and is particularly effective at measuring tree cover density outside the forest, such as agroforestry systems on farms. To date, this tool has been used to map on-farm tree cover in Niger, Burkina Faso, and Malawi, and has applicability throughout Africa's drylands.

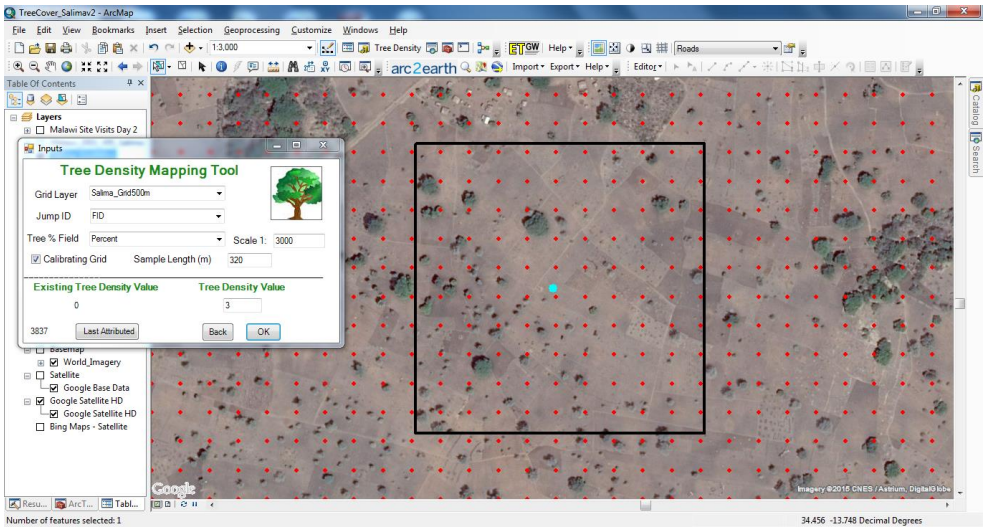

Figure 5. Tree Cover Mapping Tool Interface Showing One Sample Plot

IUCN Framework for Monitoring Impacts to Biodiversity from Restoration

Drawing upon several longstanding IUCN initiatives on biodiversity monitoring, including the IUCN Red List of Threatened Species, the World Database on Key Biodiversity Areas, the World Database on Protected Areas (a joint collaboration between IUCN and UNEP), and the recently established IUCN Red List of Ecosystems, the Species Monitoring Specialist Group (SMSG) of IUCN is developing a framework and tools to support the monitoring of biodiversity impacts from forest and landscape restoration. This work will include:

1. *Framework on Monitoring Biodiversity Impacts from Restoration*—standards and guidelines for monitoring biodiversity in landscapes under restoration. It will include help in selecting appropriate indicators given objectives, data availability, resources, and context; and help in planning and implementing monitoring systems.
2. *Tools for monitoring biodiversity impacts from restoration*—A set of tools for restoration practitioners and policymakers to facilitate efficient and effective monitoring of biodiversity impacts from restoration at multiple scales. It will include online resources and datasets, bringing the most relevant information for establishing baselines and monitoring biodiversity impacts from restoration into the hands of practitioners and policymakers.

***Measuring Progress for Forest and Landscape Restoration*, Working Paper Version 1.0**

Measuring Progress for Forest and Landscape Restoration, Working Paper Version 1.0 (July 2017) is a guide for practitioners on how to establish a restoration monitoring system, which was jointly produced by FAO and WRI. The guide features a step-by-step process for selecting indicators to monitor restoration progress based on specific goals, context, and user needs. The selection process is focuses on a series of questions that guide the user toward a targeted monitoring system. The selection process is supported by a menu of indicator options oriented around restoration goals and themes (see Figure 5). Engagement with a variety of stakeholders is critical to each step of the process.

The Restoration Goal Wheel (on the left side of Figure 5) aids the identification and selection of targeted restoration goals for inclusion in the monitoring system to answer the question on "why restoration." The outer circle represents a menu of common restoration goals, middle wedges are themes within those goals, sand the center of the wheel is the common factor to restoration efforts—land use. Vegetation is categorized into landscapes with trees or with other vegetation, and a menu of indicators related to drivers of degradation is provided.

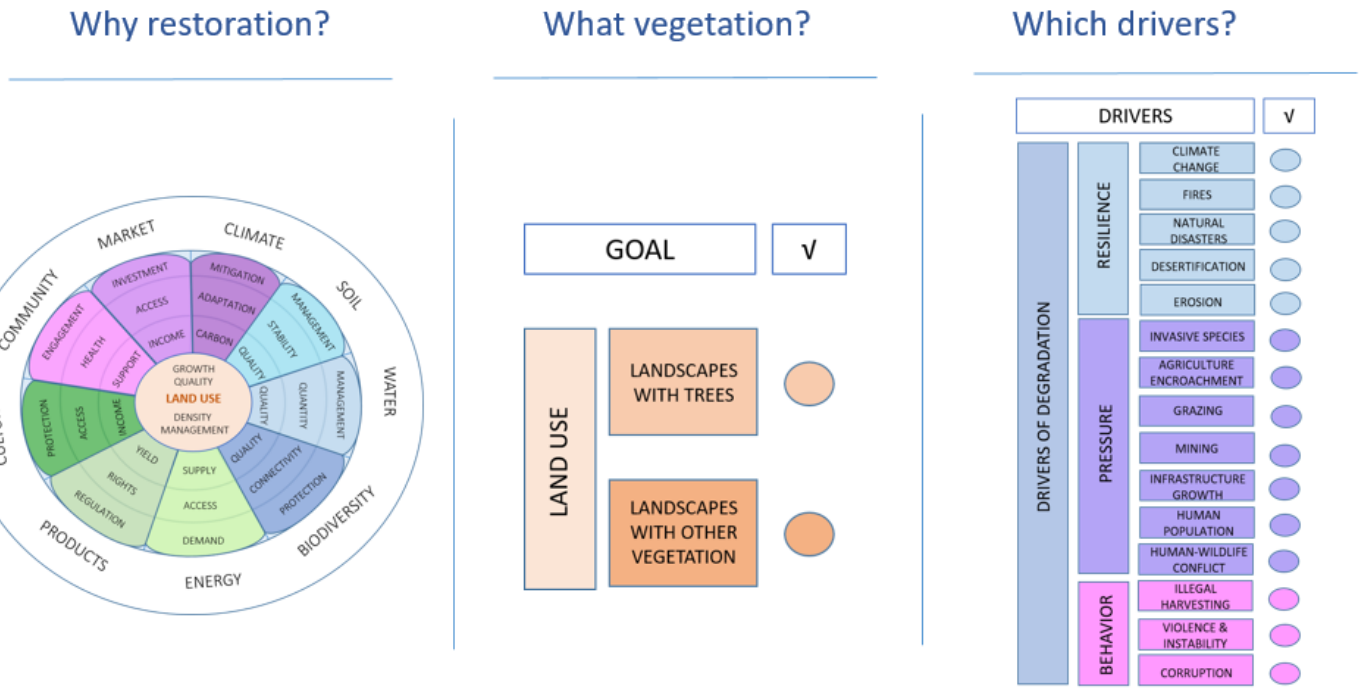

Figure 6: Three Questions to Select Indicators Based on Goals