GeoScience Lab
Landscapes Portal
http://landscapeportal.org

THE LAND DEGRADATION SURVEILLANCE FRAMEWORK

The Land Degradation Surveillance Framework (or LDSF) is designed to provide a biophysical baseline at landscape level, and a monitoring and evaluation framework for assessing processes of land degradation and the effectiveness of rehabilitation measures (recovery) over time.

MEASURING LAND HEALTH

The LDSF is a comprehensive method for assessing soil and land health, from the field to the use of new and advanced data analytics. Land health generally refers to the degree to which the integrity of the soil, vegetation, water and air, as well as ecological processes, are balanced and sustained.

The LDSF provides a consistent set of indicators and field protocols to assess the "health" of an ecosystem. This includes **vegetation cover and structure, tree, shrub and grass species diversity, current and historic land use, infiltration capacity, soil characteristics and land degradation status. It can also be used as part of monitoring frameworks to detect changes over time**.

VALUE OF THE LDSF

- Understand variability of environmental indicators across a landscape
- Establish a biophysical baseline
- Understand interactions between key indicators
- Design land management and restoration interventions
- Determine implications for climate change adaptation
- Monitor soil organic carbon for climate change mitigation
- Better understand drivers of land degradation
- Monitor and track the impact of land management practices over time
- Inform investments
- Improve crop/rangeland/climate models
- Provide evidence to decision- and policy makers

DATA COLLECTION AND ANALYSIS

The LDSF was developed in response to the need for indicator frameworks to measure and monitor soil and land health in a consistent, quantifiable, efficient and replicable way across landscapes.

By applying a multi-scale approach, the framework can be used to conduct robust statistical analysis and inference, including spatial assessments and predictive maps with a high level of accuracy. These outputs can in turn be used to improve the targeting and design of land management, including land restoration efforts, and to monitor the effectiveness of different practices in terms of meeting restoration targets and ensuring sustainability.

1. DATA COLLECTION IN THE FIELD
2. DATA IS UPLOADED TO THE LDSF DATABASE
3. DATA QUALITY IS CHECKED
4. DATA ANALYTICS
5. BIOPHYSICAL BASELINES AND PREDICTIVE MAPS
6. CAPACITY DEVELOPMENT
7. STAKEHOLDER ENGAGEMENT WITH EVIDENCE

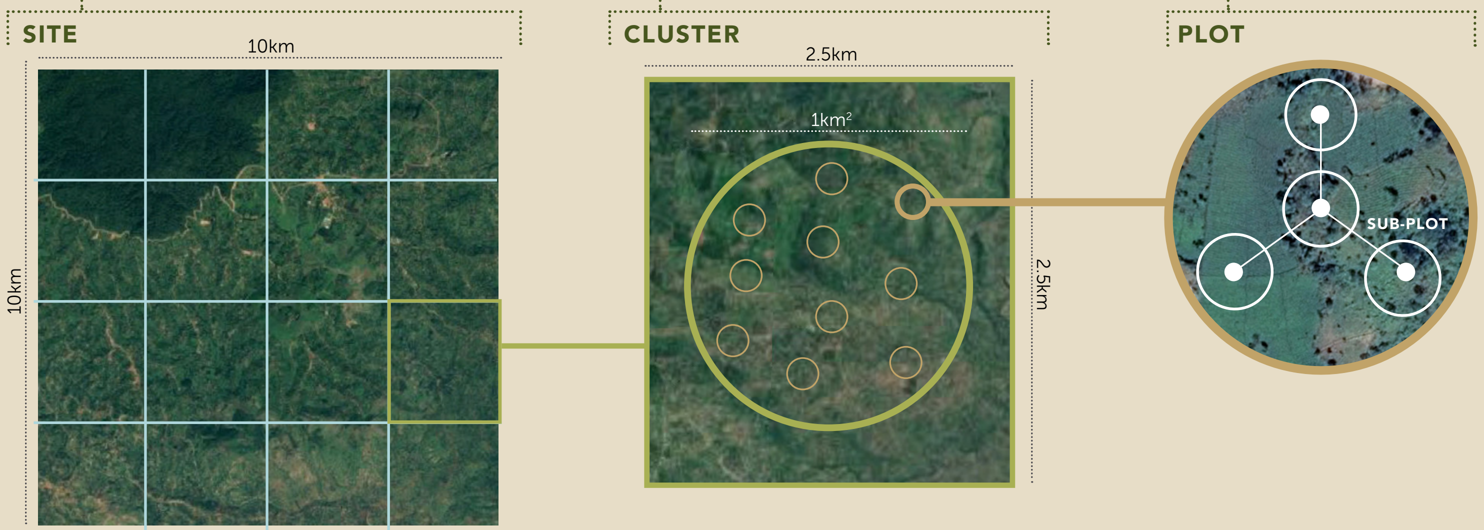
DATA COLLECTION IN THE FIELD

Data is collected at multiple spatial scales to understand how the various indicators vary across the landscape. This nested hierarchical sampling design enables robust spatial statistics, important for setting baselines and for tracking changes over time

Sites [100km²] are selected at random across a region or watershed, or they may represent areas of planned activities (interventions). Each site is divided into 16 tiles of 2.5km x 2.5km each.

Within each tile, random centroid locations are generated for clusters. **Clusters [1km²]** are the basic sampling units and are made up of 10 **plots [1000m²]**. Using each cluster centre-point, the sampling plots are randomized.

Each plot consists of four **sub-plots [100m²]**.



Field observations are made at the plot and sub-plot level. Each site has 160 plots and 640 sub-plots. The randomization applied in the LDSF minimises bias in the sampling as well as captures the biophysical variability in the landscape.

LDSF DATABASE

All georeferenced LDSF data are **stored in the ICRAF LDSF Database** for efficient and safe storage, fast retrieval and to facilitate analysis.

DATA ANALYSIS

All data are subjected to advanced data analytics and robust statistical analysis. **Soil samples are analysed** using mid-infrared (MIR) spectroscopy, to predict key soil properties such as soil organic carbon, total nitrogen, pH, base cations and texture.

OUTPUTS

LDSF INDICATORS

The LDSF measures a wide range of indicators, that serve as a valuable biophysical baseline.

Indicators measured with the LDSF

LAND USE

- Current
- Historical
- Ownership

IMPACT ON HABITAT

LAND DEGRADATION

- Soil erosion prevalence
- Soil water conservation measures
- Root-depth restrictions
- Rock/stone cover

LAND COVER

- Vegetation stucture (LCCS)
- Vegetation types
- Woody vegetation
  - Shrubs
    - Density
    - Distribution
    - Diversity
  - Trees
    - Density
    - Distribution
    - Diversity
- Herbaceous vegetation
  - Type
  - Cover rating
- Rangeland health module
  - Grass species diversity and distribution
  - Annual to perennial ratio
  - Bare ground

TOPOGRAPHY/ LANDFORM

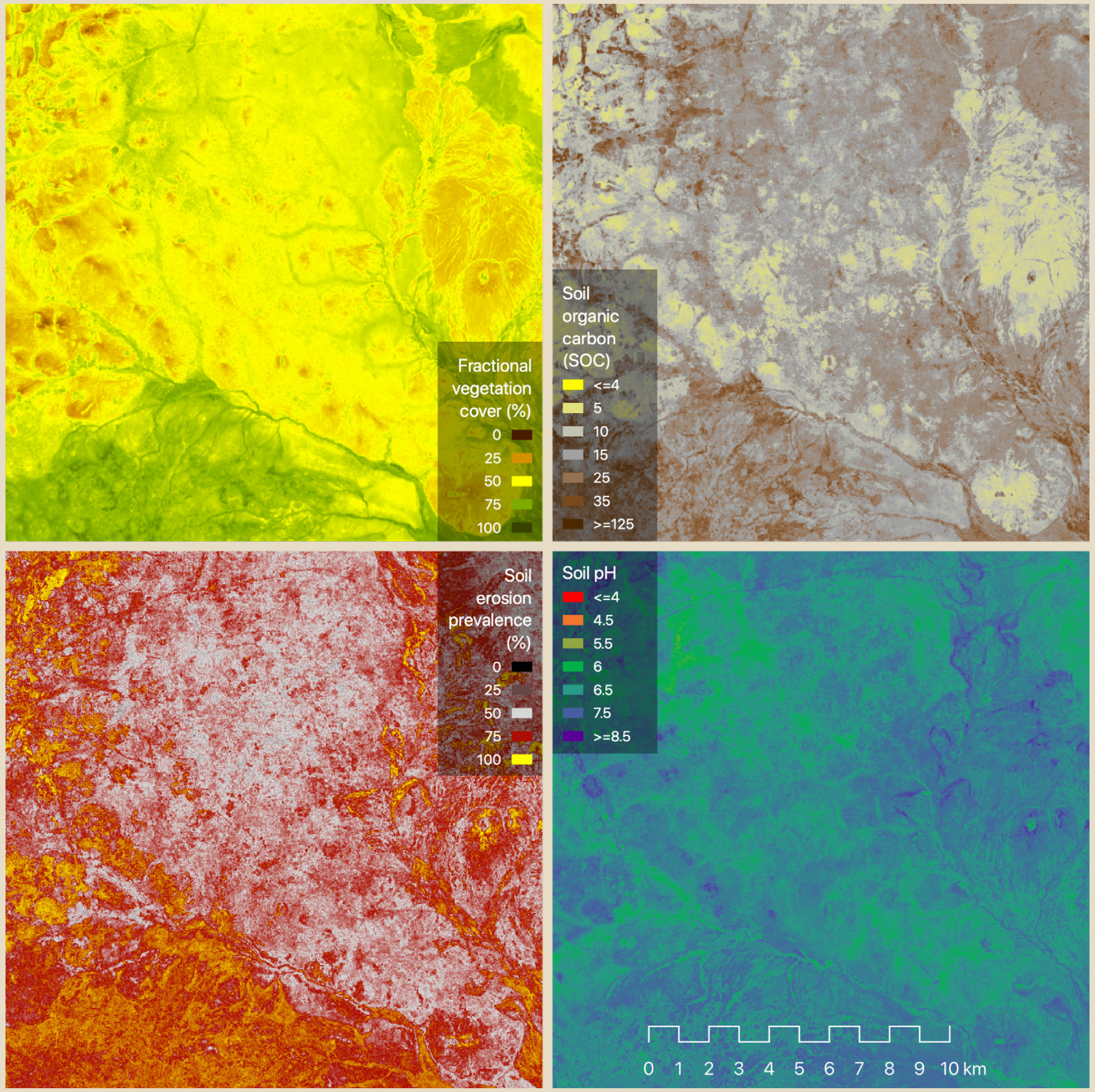
SOIL HEALTH

- Soil organic carbon (SOC)
- Total nitrogen
- Infiltration capacity
- Soil pH/acidity
- Texture (sand and clay)
- Cumulative soil mass
- Earthworm presence

PREDICTIVE MAPS

Data from multiple global sites are used to create predictive mapping outputs at multiple spatial scales, with fine-resolution maps produced at 5 to 10m resolution or lower, high resolution maps at 20 to 30m resolution, and moderate resolution maps at 250 to 500m resolution. This enables you to zoom in to a specific area of your site and assess the possible indicators therein.

The LDSF is part of the Ecosystem Health Surveillance System (EcoHSS) developed by ICRAF. As part of this system, **spatial assessments are produced of land degradation processes, soil functional properties, vegetation cover and biodiversity.**



DATA FOR LAND PLANNING

The LDSF biophysical indicators, spatial assessments, and predictive maps have many practical applications, and are invaluable tools for policy- and decision-makers to be applied in real decision contexts.

CAPACITY DEVELOPMENT WITH PARTNERS

Field training includes all aspects of the LDSF such as: GPS navigation; electronic data entry and upload; LCCS vegetation classification; soil sampling; infiltration measurements; woody biodiversity measurements; and land degradation assessments.

Participants include:
- field technicians
- members of the LDSF field team
- partners interested in learning new techniques for land and soil health assessments

Remote sensing (RS) training to explore key concepts, methods and applications of RS, including: the use of open source GIS and remote sensing software; basic analysis using RS data (creation of image composites, image calculations, generation of vegetation indices and soil maps, etc).

Participants include:
- technical staff familiar with RS and GIS principles.

Data analytics training to explore the LDSF data with R statistics: tidying and visualizing data; applying mixed-effect models to assess key indicators of land and soil health; database development; data management.

Participants include:
- technical staff interested in data analysis and data management
- those who will continue to work with the LDSF datasets

GENERATING EVIDENCE FOR DECISION MAKING

The LDSF provides on the ground evidence combined with other knowledge sources and models to provide the overall picture of land health to support evidence-based decision making.

This allows programs, projects and government agencies a systematic way to provide both a baseline on ecosystem health and track critical indicators of soil and land health over time.

Evidence is generated through systematic on the ground data collection, citizen science to crowd source data from apps and models to produce data and maps. This evidence is applied through capacity support, training and stakeholder engagement to ensure the critical value of having the right information in the right format, demonstrating relationships in the systems (vegetative cover, soil health, etc.) to support decision making around land health.

The LDSF provides data and information that is valuable to:

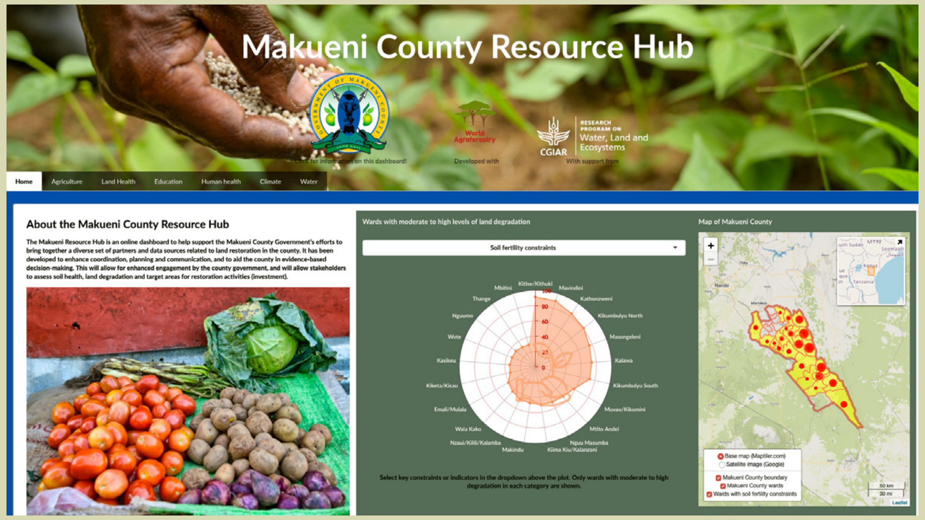
- Farmers and extensionists
- Project managers and monitoring focal points
- National and district level decision makers

VIEW DATA INTERACTIVELY THROUGH A DASHBOARD

Outputs of the LDSF including the indicator calculations and the high resolutions maps can be interactively visualised through a dashboard. A dashboard is a visual display of interactive information and data in a central online point.

Dashboards allow information and data to be quickly and easily communicated to key users and decision makers.

For more information, visit
http://landscapeportal.org.



ACCESS POWERFUL PREDICTIVE DATA FROM A GLOBAL NETWORK OF SITES

The LDSF allows for assessments of key indicators of soil and land health at multiple scales across landscapes. The ICRAF LDSF database, is the largest set of coherent and georeferenced ecosystem health indicators to date.

Hosted within the ICRAF Spatial Data Science and Applied Learning Lab (previously dubbed GeoScience Lab), these data provide an excellent opportunity for partnerships and collaboration around big analytics.

CONTACT

Tor Gunnar Vagen
Senior Scientist
T.Vagen@cgiar.org

Leigh Ann Winowiecki
Soil Systems Scientist
L.A.Winowiecki@cgiar.org

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http://landscapeportal.org

Land Degradation Surveillance Framework
http://landscapeportal.org/blog/2015/03/25/the-land-degradation-surveillance-framework-ldsf/

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