Invest in climate-smart soil and land health

Summary

- Better soil health can increase agricultural productivity, build on-farm resilience and contribute to climate change adaptation and mitigation.

- Assessments of land and soil health surveys were conducted to improve crop modeling predictions under various climate scenarios and guide more targeted interventions.

- The Land Degradation Surveillance Framework (LDSF) was employed across the project sites to assess multiple indicators of ecosystem health at the same geo-referenced locations. The LDSF provides a biophysical baseline at landscape level and a monitoring and evaluation framework to assess the processes of land degradation and the effectiveness of rehabilitation measures over time (Figure 3).

- With the LDSF, vulnerable areas that may require more investment in terms of land restoration were identified early on and priorities determined.

Outcome

The LDSF helps identify and prioritize necessary investments for healthy land and soil that underpin the success of climate-smart agriculture (CSA) interventions at scale.

What?

The LDSF provides us with a snapshot of land and soil health at landscape level. The LDSF uses a hierarchical randomized sampling design to assess multiple variables of ecosystem health, including the assessment of drivers that influence soil organic carbon (SOC) – a key indicator of soil health. These data were were used to enable decisions to be made about vulnerable areas where more investment might be required to restore degraded land, for example:

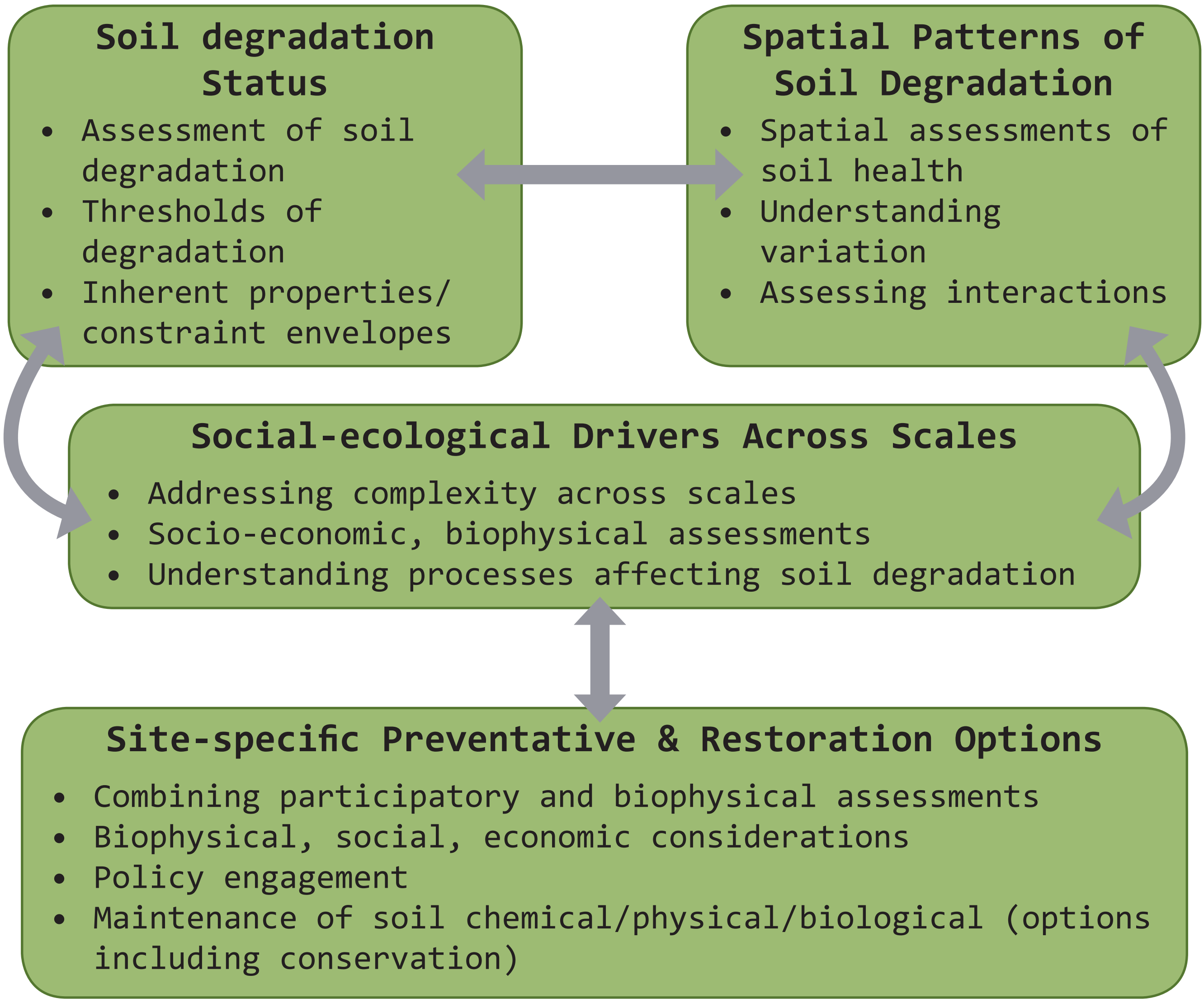


Figure 1. Schematic of the process of assessing land degradation - which includes combining biophysical and socio-economic drivers- in order to prioritize interventions.

Why?

Good land and soil heath is fundamental to sustain successful climate-smart agricultural (CSA) interventions. Soil regulates the water flow in a watershed, as well as provides crops with necessary nutrients for growth. Maintaining and improving soil health by improving the SOC content is recognized as an important strategy for a well-functioning soil ecosystem (Schlesinger, 1991; Palm et al., 2007; Lal, 2010; Vågen et al., 2012; Victoria et al., 2012). Yet to understand and address constraints facing smallholder farmers in building more resilient farming systems, an interdisciplinary, multi-level approach to managing soil health is needed.

How?

The LDSF was conducted at 100 km2 sites in Tanzania and Uganda to assess baseline soil and land health status. Each LDSF site is stratified into 16-1km2 clusters. Each cluster contains 10-1000m2 plots (Figure 3) where observations of vegetation structure, land management practices, soil erosion, tree and shrub densities, as well as soil properties (e.g., sand, pH, SOC and total nitrogen) were made. These data were used to generate baseline information on land and soil health of the action areas as well as produce predictive maps of soil erosion prevalence and SOC. In addition, these LDSF sites are co-located with the socioeconomic household surveys conducted by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in order to enable socio-ecological modeling (Figure 2).

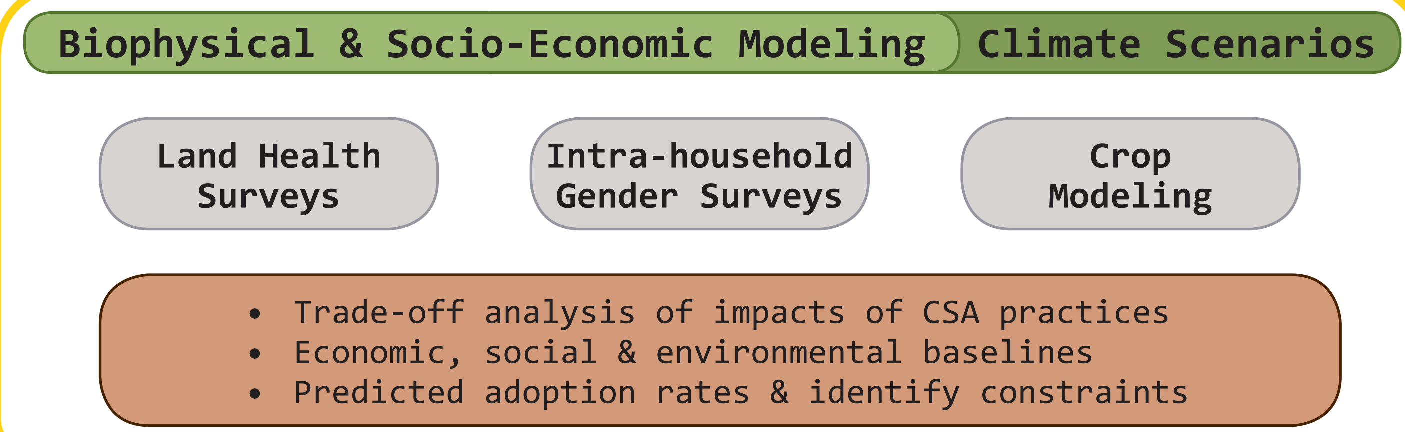
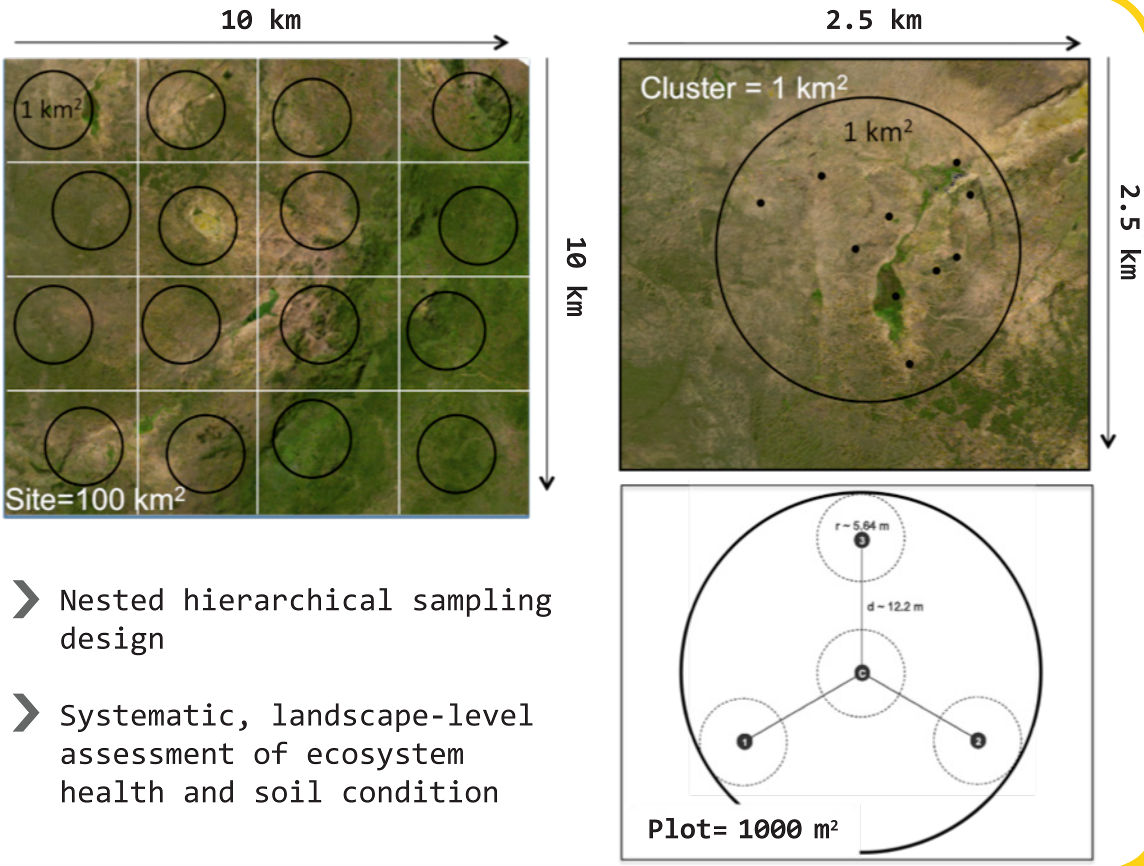


Figure 2. The biophysical data collected using the LDSF contributes to and improves trade-off analysis, baselines and crop modeling



- Nested hierarchical sampling design
- Systematic, landscape-level assessment of ecosystem health and soil condition

Figure 3. LDSF hierarchical sampling design Winowiecki et al., 2016

Improved soil and land health data were used to improve crop modeling predictions as well as to assess the spatial variability of crop performance under various treatments (Figure 4).

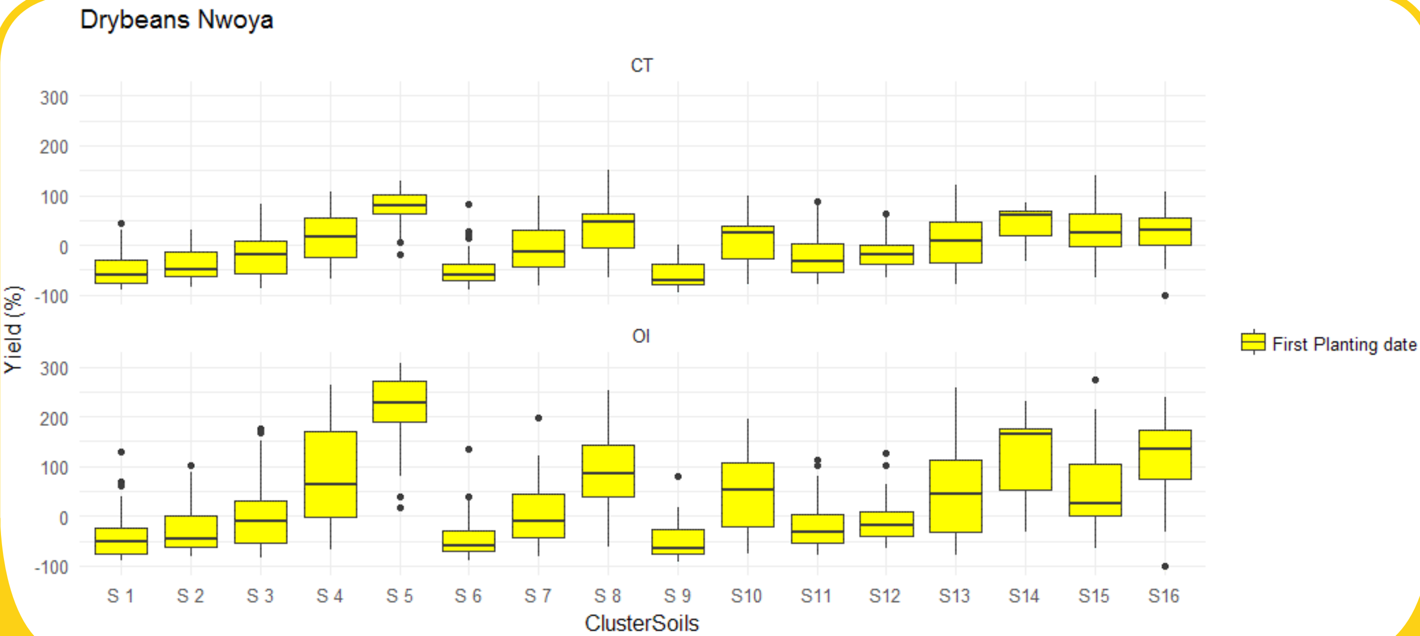


Figure 4. Note the variability in common bean yield across the 16 LDSF clusters in Nwoya, Uganda under control (farmers typical management of no fertilizer (CT) and under combined organic and inorganic fertilizer application (OI). These data highlight the importance of incorporating the variability in soil properties when modeling crop yields across landscapes.

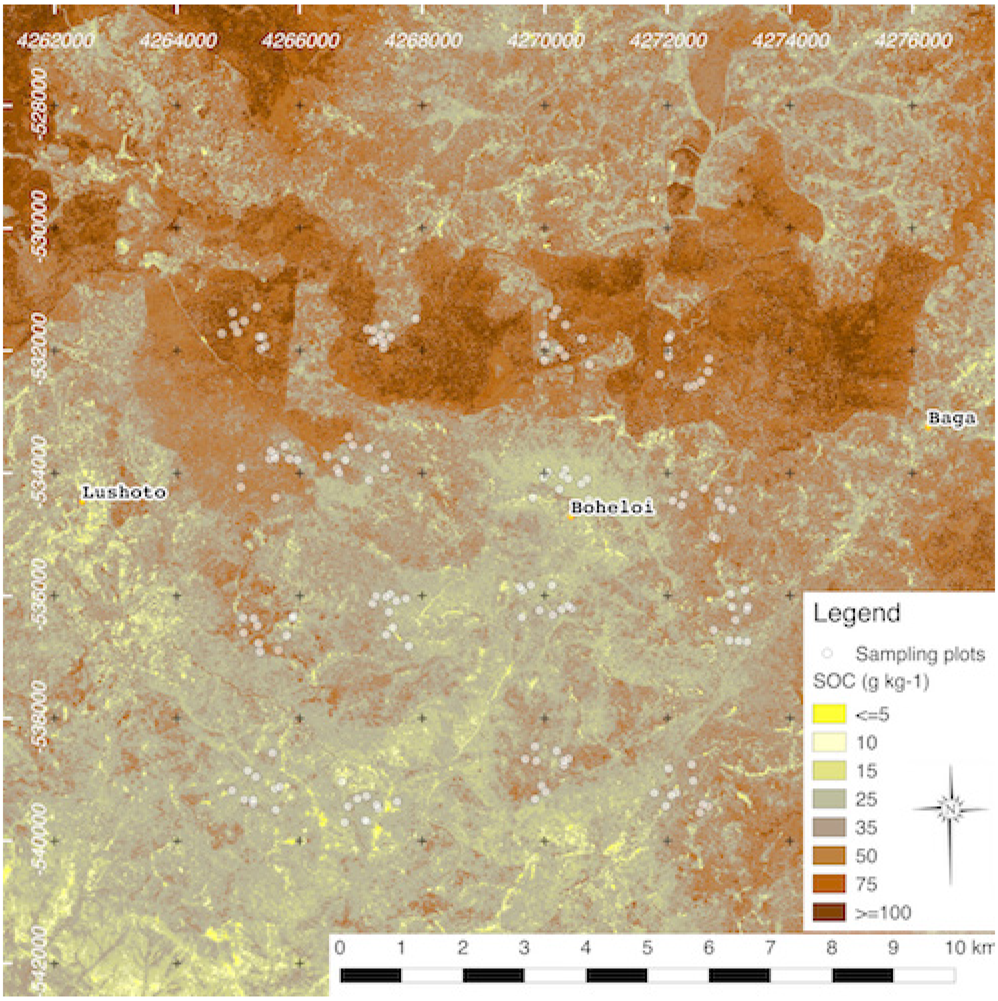


Figure 5. Spatial assessment at 5 m resolution of SOC in Lushoto, Tanzania. Note the high variability in SOC content, which driven largely by land use. Winowiecki et al. (2016)

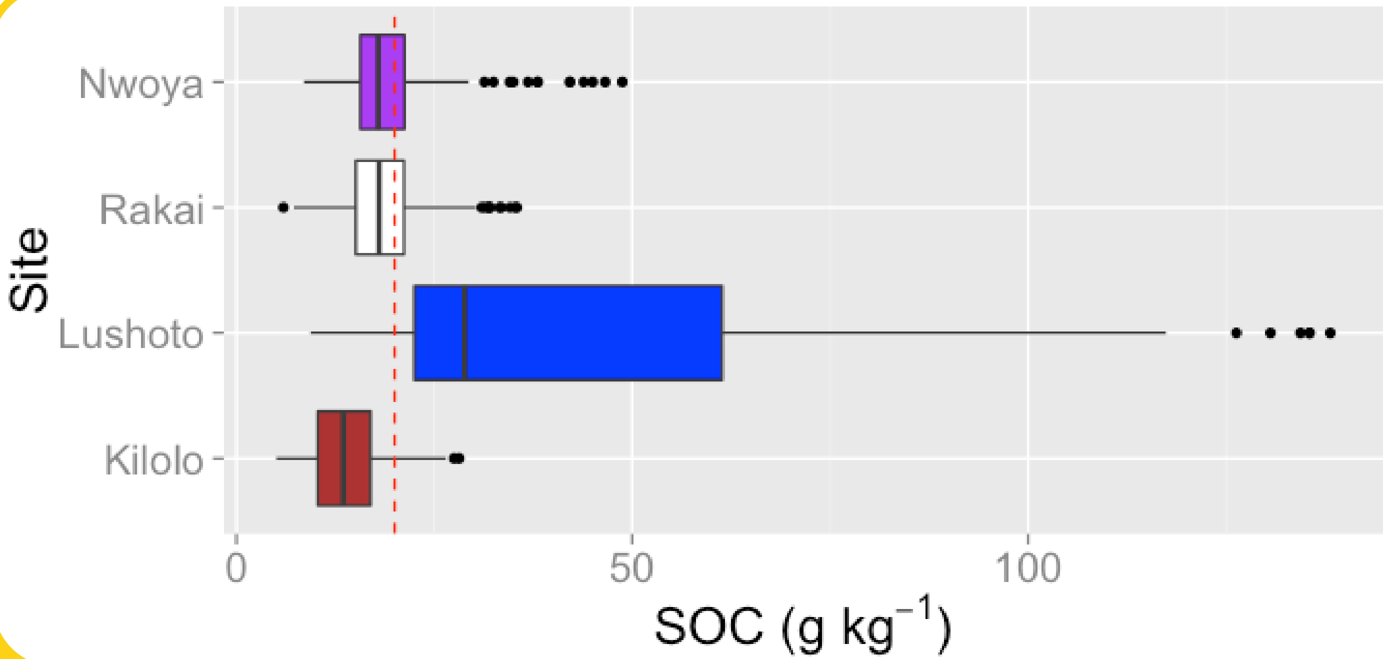


Figure 6. Boxplots showing the variability of SOC within and between the four project action sites: Nwoya and Rakai in Uganda and Lushoto and Kilolo in Tanzania.

More information

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Supporting Materials

- http://www.ciatnews.cgiar.org/2014/12/05/down-to-earth-data/
- http://ccafs.cgiar.org/blog/photo-story-ground-breaking-women
- www.ciatnews.cgiar.org/2015/04/23/new-photo-film-mapping-soil-diversity-in-tanzania/
- http://www.ciatnews.cgiar.org/2015/04/02/scaling-up-tv-helps-farmers-shape-up-soils-in-east-africa/
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