

Environmental services
(additional resources required)

Guide for the Sustainable Intensification Assessment Framework

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Ecosystem services

1) PRODUCTIVITY

- Crop yields
- Animal production
- Variability of production

2) ECONOMIC

- Profitability
- Variability of profits
- Labor requirement

5) SOCIAL

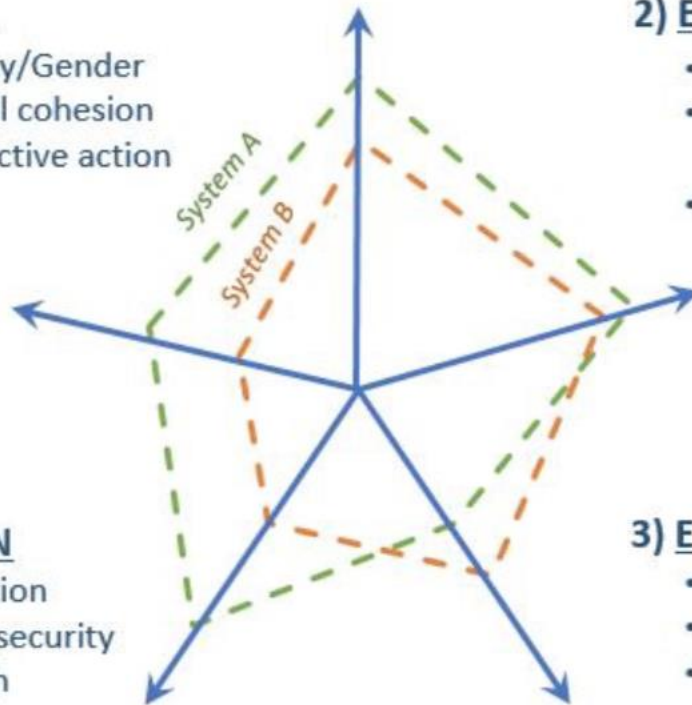
- Equity/Gender
- Social cohesion
- Collective action

4) HUMAN

- Nutrition
- Food security
- Health

3) ENVIRONMENTAL

- Biodiversity
- Water quality
- Soil quality



Landscape + Scale



Farm/Household Scale



Field/Animal Herd Scale



ENVIRONMENT

- Environ= $f(x)$ **soil, climate**, air
- Soil= $f(x)$ Cl, o ,p ,r ,t , m
- Climate= $f(x)$ rainfall, temp

Master indicators of SI

- TOC
- pH

INDICATORS AND METRICS AT FIELD AND FARM LEVEL

Indicator	Field/plot level metrics	Farm level metrics
Vegetative cover	% Vegetative cover by type (tree, shrub, grass, invasive) ^{a,b} % Burned land ^{a,b} % Bare land ^{a,b}	% Vegetative cover by type ^{a,b} % Burned land ^{a,b}
Water availability	Irrigation use by crop [Ⓟ] Soil moisture ^{a,b,c} % of plants wilting ^{b,d} Infiltration rate ^{a,d}	Irrigation use [Ⓟ] % of fields wilting ^{b,d}
Soil biology	Total carbon (% or Mg/ha) ^{a,c} Labile or 'active' carbon (POXC) ^a and/or CO ₂ mineralization ^c Partial carbon budget ^{b,c} Earthworms ^d	Relative measures of plot-level metrics across farm fields Total Carbon ^e
Erosion	Soil loss (tons/ha/yr) ^{a,b,c} Rating of erosion ^{a,d}	

1. Ground cover
 - Field level (LTT)
 - Village level

2. Water availability
 - TDR at flowering (LTT)
 - Stress around flowering (APSIM)

2. Soil biology (LTT)
 - Earthworms
 - Total carbon
 - Labile carbon

4. Erosion and water balance
 - Erosion (APSIM)
 - Water run off (APSIM)
 - Deep drainage (APSIM)

INDICATORS AND METRICS AT FIELD AND FARM LEVEL

Soil chemical quality	Soil pH (acidity) ^a Electrical conductivity ^a Soil nutrient levels ^a Nutrient partial balance ^b Biological nitrogen fixation ^a	Nutrient partial balance ^b Biological nitrogen fixation ^a
Soil physical quality	Aggregate stability ^a Bulk density ^a Water holding capacity ^a Infiltration rate ^a	
GHG emissions	CO ₂ equivalent emitted per ha _{ab}	CO ₂ equivalent emitted per ha _{ab}

5. Soil fertility

- pH (LTT)
- EC (LTT)

6. Soil physical quality

- Aggregate stability (LTT)
- Bulk density (LTT)

7. GHG emissions

- GHG emission calculator

ACTIVITIES

- Protocols
- Identify sites and long term trials
- Remote sensing activity to estimate bare ground for the last 14 years
- Modelling erosion, runoff, and deep drainage for SIMLESA treatments, and sites
- Report & paper writing team