Climate-smart soil protection and rehabilitation in Benin, Burkina Faso, Ethiopia, India and Kenya

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Outline

• Objectives of the CSS project
• CSS evaluation
  • Farm Typology
  • Climate Smartness Assessment (Kalkulator)
  • Evaluation of Land Management Options (ELMO)
  • Attainable impact
• CSA prioritization framework
• Recommendations
Objective of the Climate Smart Soils Project

• Assessment of climate smartness of ongoing and potentially suitable alternative agricultural soil conservation practices, including:
  • analysis of farm-level cost-benefit and tradeoffs
  • evaluation of the overall CSA impact and scope
  • adoption and scaling potentials

• Design of a CSA prioritization process

“Agriculture has to be part of the solution to climate change.”
Climate smart agriculture

Triple-win goal – three pillars (FAO 2013):

1. Sustainably increasing agricultural productivity and incomes;
2. Adapting and building resilience to climate change;
3. Climate change mitigation: reducing greenhouse gases emissions, where possible.

"To ensure a food-secure future, farming must become climate resilient."
CIAT's approach to evaluate the climate smartness

Climate Smartness
- Identification of farm major farm types
- List of major management practices
- Expert assessment of practices
- Evaluation of Land Management Options (ELMO)
- Biophysical assessment
- Farm household modeling
- Evaluation of Land Management Options (ELMO)
- Cost-Benefit Analysis
- Attainable impact

Outcome Indicators

Adoption potential & Impact
CSA rapid assessment - methodology

Stakeholder workshops -> Farming system types -> Case study farmer interviews

- Soil technology shortlist
- Input data

Modelling CSA indicators for baselines and scenarios
Modelling of CSA indicators and trade-offs

Calories produced on farm/hectare
- Cash crops and meat not taken into account
- ‘Potential supply’ only

Soil nitrogen balances farm/hectare
- Simplified, non-holistic indicators

GHG emissions from agriculture per farm/hectare
- Soil C stock changes not included
- IPCC tier 1/2 overestimating for SSA
Farming system types

Factors: intensification, production orientation, commercialization, agro-ecological potential and resource endowment

- Large scale, modern farm
- Medium scale, semi-modern farm
- Small-scale, traditional farm
- Small-scale, female-headed farm
Shortlisted/tested soil technologies

- Stone bunds
- Composting with manure
- Intercropping sorghum/maize with cowpea
- Relay cropping with mucuna

Stakeholders listed most relevant soil protection and rehabilitation technologies
Nitrogen balance

Female-headed small scale farm  Small scale farm  Medium scale farm  Large scale farm

kg N

-60 -40 -20 0 20 40 60 80 100 120

Per Farm  Per ha
Soil erosion

![Bar chart showing soil loss (t soil/year) for different farm sizes and types.](image)

- Female-headed small scale farm
- Small scale farm
- Medium scale farm
- Large scale farm

Soil loss (t soil/year)

- Per farm
- Per ha
Greenhouse gas emissions

- Enteric Fermentation
- Manure Management
- Soil emissions (N2O)
- Rice production
- Burning

<table>
<thead>
<tr>
<th>Per farm</th>
<th>Per ha</th>
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<tbody>
<tr>
<td>Female-headed small scale farm</td>
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<tr>
<td>Small scale farm</td>
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<tr>
<td>Medium scale farm</td>
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<tr>
<td>Large scale farm</td>
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</tbody>
</table>
Trade-offs: Productivity vs. N balance

- Stone bunds
- Compost w/manure
- Intercropping with cowpea
- Relay cropping

□=female-headed small-scale, Δ=small scale, ◊=medium scale and ○=large scale

\[ \Delta \text{Productivity (AME days/ha)} \]

\[ \Delta \text{N balance (kg N/ha)} \]
Trade-offs: Productivity vs. GHG emissions

- □ = female-headed small-scale,
- Δ = small scale,
- ◊ = medium scale and
- ○ = large scale

ΔGHG emissions (t CO2e/ha) vs. ΔProductivity (AME days/ha)

- Orange circle: Stone bunds
- Gray triangle: Compost w/manure
- Yellow diamond: Intercropping with cowpea
- Blue square: Relay cropping
Evaluating Land Management Options (ELMO)

Participatory tool for assessing farmers’ land management (LM) decisions, preferences & trade-offs

1. Identify techniques & attributes to be discussed
2. Record respondent characteristics
3. Define LM techniques & baseline
4. Rank & Score LM costs & input requirements
5. Rank & Score LM benefits & desired outcomes
6. Rank LM advantages & positive attributes
7. Rank LM disadvantages & negative attributes
8. Rank and weight LM alternatives overall

Individual discussions with farmers
ELMO - results

Relative importance of advantages & disadvantages of practices

Advantages
- Diversifies income
- Lasting impact
- Multiple benefits
- Fills critical food/cash gaps

Disadvantages
- Can't see effect
- No market for products
- Too labour-intensive
- Too time-consuming
- Too expensive

Shows average scoring by farmers
Overall preference of practices

Shows average weight attributed according to overall preference relative to other land management practices. Note that total exceeds 100%, because interviews cover different combinations of land management practices.
Farmer’s general perceptions and preferences

• Practices that demand large amounts of labor and other purchased items are beyond the reach of many farmers

• Diversity of benefits is an important factor shaping farmers’ land use preferences

• Practice must be able to show improvements in soil fertility, crop yields and income generation and also contribute towards better food supplies to be attractive and viable

• Being able to demonstrate quick wins in monetary terms, although desirable, are not by themselves enough to make a practice the most preferred choice or most viable option for the farmer
Calculating “attainable impact” across the two regions

1. Number of farm households of each farm type
   ~ rural population / HH-size * farm type %

<table>
<thead>
<tr>
<th></th>
<th>Small-scale / Traditional managed by woman or young man</th>
<th>Small-scale / Traditional</th>
<th>Medium-scale / Semi-modern</th>
<th>Large-scale / Modern</th>
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</thead>
<tbody>
<tr>
<td>%</td>
<td>5</td>
<td>35</td>
<td>49</td>
<td>11</td>
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<tr>
<td>Number HHs</td>
<td>7,359</td>
<td>51,514</td>
<td>72,119</td>
<td>16,190</td>
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</table>

2. Adoption rates (% of the HHs likely to adopt the specific intervention) per farm type
   ~ ELMO

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Small-scale / Traditional managed by woman or young man</th>
<th>Small-scale / Traditional</th>
<th>Medium-scale / Semi-modern</th>
<th>Large-scale / Modern</th>
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<tr>
<td>Composting with manure</td>
<td>35</td>
<td>12</td>
<td>12</td>
<td>16</td>
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<tr>
<td>Intercropping cereal/cowpea</td>
<td>12</td>
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<tr>
<td>Mucuna relay</td>
<td>12</td>
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<tr>
<td>Stone Bunds</td>
<td>16</td>
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20% or
Calculating “attainable impact” across the five districts

3. Number of adopting farms x estimated impact per farm

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<thead>
<tr>
<th></th>
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<th>Intercropping cereal/cowpea</th>
<th>Mucuna relay</th>
<th>Stone Bunds</th>
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<tbody>
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<td>Large-scale / Modern</td>
<td>30.38M</td>
<td>9.95M</td>
<td>0.01M</td>
<td>0.36M</td>
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<tr>
<td>7K</td>
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<tr>
<td>Medium-scale / Semi-modern</td>
<td>39.47M</td>
<td>9.66M</td>
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<td>51K</td>
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<tr>
<td>Small-scale / Traditional</td>
<td>0.26M</td>
<td>0.02M</td>
<td>0.36M</td>
<td>0.01M</td>
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<tr>
<td>72K</td>
<td></td>
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<tr>
<td>Small-scale / Traditional managed by woman or young man</td>
<td>0.26M</td>
<td>0.01M</td>
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<tr>
<td>16K</td>
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## Importance of expected adoption rates

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<tr>
<th>Method</th>
<th>Composting with manure</th>
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<tr>
<td><strong>5K</strong></td>
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<tr>
<td><strong>Medium-scale / Semi-modern</strong></td>
<td>69.08M</td>
<td>5.82M</td>
<td>0.07M</td>
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<tr>
<td><strong>51K</strong></td>
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<tr>
<td><strong>Small-scale / Traditional</strong></td>
<td>0.51M</td>
<td>0.01M</td>
<td>0.09M</td>
<td>0.00M</td>
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<tr>
<td><strong>72K</strong></td>
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<td><strong>Small-scale / Traditional managed by woman or young man</strong></td>
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<td><strong>16K</strong></td>
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Trade-offs with GHG emissions

### AME days

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<tr>
<td>Small-scale / Traditional</td>
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### GHG emissions

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<tr>
<td>Large-scale / Modern</td>
<td>0.00M</td>
<td>0.00M</td>
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<tr>
<td>Medium-scale / Semi-modern</td>
<td>0.00M</td>
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<tr>
<td>NA</td>
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<td>Small-scale / Traditional</td>
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## Trade-offs with soil fertility

<table>
<thead>
<tr>
<th>AME days</th>
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<td>Intercropping cereal/cowpea</td>
<td>Mucuna relay</td>
<td>Stone Bunds</td>
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<tr>
<td>Large-scale / Modern</td>
<td>58.27M</td>
<td>0.03M</td>
<td>0.01M</td>
<td>0.30M</td>
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<tr>
<td>Medium-scale / Semi-modern</td>
<td>50.00M</td>
<td>0.03M</td>
<td>0.07M</td>
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<tr>
<td>Small-scale / Traditional</td>
<td>0.68M</td>
<td>0.90M</td>
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<tr>
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<td>0.48M</td>
<td>0.36M</td>
<td>0.00M</td>
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<tr>
<th>N Balance</th>
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<td>Intercropping cereal/cowpea</td>
<td>Mucuna relay</td>
<td>Stone Bunds</td>
</tr>
<tr>
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<td>0.62M</td>
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<td>Medium-scale / Semi-modern</td>
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<tr>
<td>Small-scale / Traditional</td>
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<td>0.96M</td>
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<tr>
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<td>0.56M</td>
<td>0.06M</td>
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CSA prioritization framework

- Scoping
  - Delineate Geographic Area
  - Identify Farm Types
  - Agree on Key Indicators
  - List Practices to Consider:
    - WOCAT Database
    - CSA Compendium
    - Expert Assessment

- Expert Scoring of Long List of Practices

- Short List
  - Farm & Household Modeling
  - Biophysical Assessment
  - Cost-Benefit Analysis
  - Evaluation of Land Management Options

- Portfolio
  - Project Design & Implementation at Scale

- Outcome Indicators
- Scaling potential

- Climate Smartness

Stakeholder Consultation & Workshops
Thank you!