



SANREM CRSP: Soil Quality & Carbon Sequestration

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Invent the Future



Background

- Carbon & nutrient mining
 - Soil degradation
 - Low OM
 - Result: low input response



Rationale

- Critical limit: 1.1% SOC in tropics
 - Yields ↓ ~20% (Aune & Lal, 1997)
- For every 0.04% ↑ SOC, yield ↑ by:
 - 200-300 kg maize/ha
 - 100-140 kg sorghum/ha
 - 40-60 kg pulses/ha (Lal, 2006)



Rationale

- CA principles:
 - Minimize soil disturbance
 - Permanent soil cover
 - Crop rotations
- Known to:
 - ↓ Erosion
 - ↑ SOC
 - ↑ H₂O holding capacity



Hypotheses

- CAPS enhance the productive capacity of smallholder soils
- CAPS enhance soil quality, promote carbon sequestration, reduce soil erosion, and reduce risks associated with climate change through improved water management and productivity



Objectives

- To quantify the biophysical impacts of CAPS vs traditional cropping systems
- Quantify:
 - Soil C sequestration
 - Infiltration rate
 - Erosion risk
 - Soil fertility status (NPK)



Methodology



- Minimal continuity among LTRAs
- Common minimum dataset (MDS):
 - soil C sequestration
 - soil fertility
 - soil erosion
- Before Time 0 data collection



Methodology

- Caveat:
 - Uniform methodology generally not appropriate
 - Generally recommend methodology appropriate to the region/project
 - Field expedient methodology needed
 - BUT:
 - Soil chemical properties should have some common methodology
 - Methodology subject to consensus



Proposed MDS

- Soil chemical properties:
 - Total C
 - TOC if calcareous
 - 0-5, 5-15, 0-60 cm or limiting layer
 - Beginning and end of expt.
 - Methodology appropriate to project
 - Total N
 - 0-5, 5-15 cm
 - Beginning and end of expt.
 - Methodology appropriate to project



Proposed MDS

- Soil chemical properties:
 - Plant available / extractable P & K:
 - Mehlich 3 for acid or neutral soils
 - Olsen for calcareous soils
 - 0-5, 5-15 cm
 - Beginning and end of expt.
 - Soil pH
 - 0-5, 5-15 cm
 - 1:1 soil:water
 - Beginning and end of expt.



Proposed MDS

- Soil physical properties:
 - Infiltration rate
 - Beginning and end of expt.



Proposed MDS

- Soil physical properties:
 - Bulk density
 - 0-5, 5-15 cm
 - Beginning and end of expt.



Proposed MDS

- Soil physical properties:
 - Soil texture
 - 0-15 cm
 - Beginning of expt.



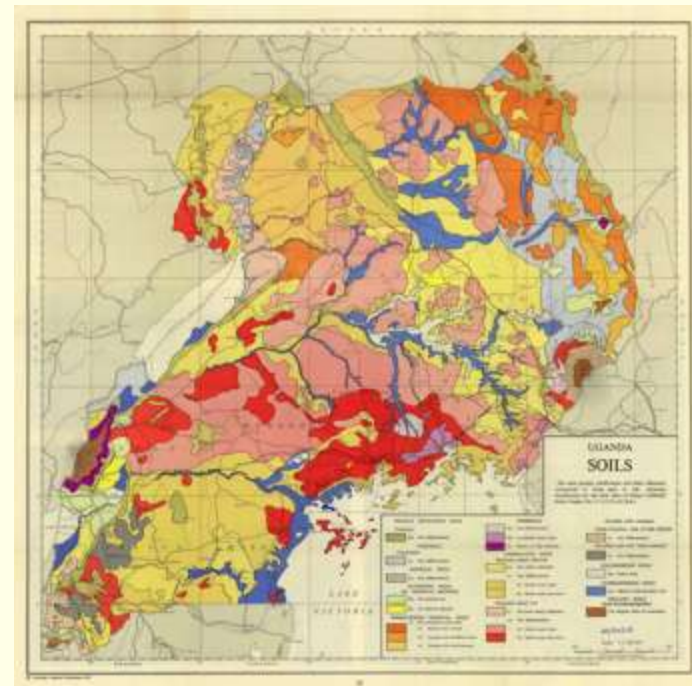
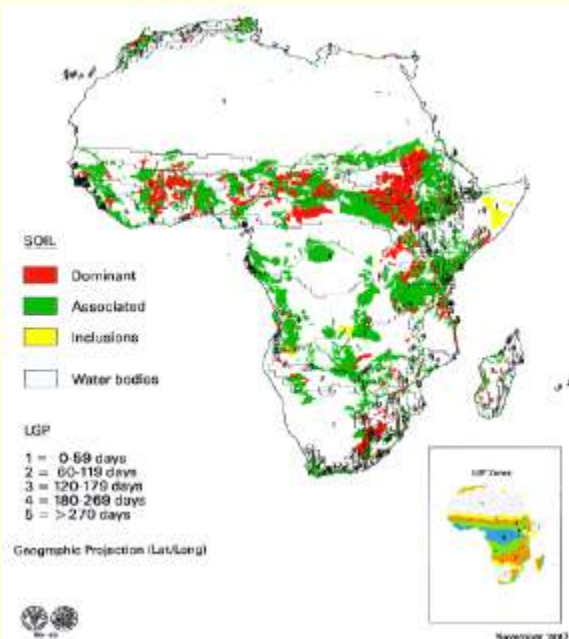
Proposed MDS

- Soil physical properties:
 - Field length
 - Beginning of expt.
 - Field slope
 - Beginning and end of expt.



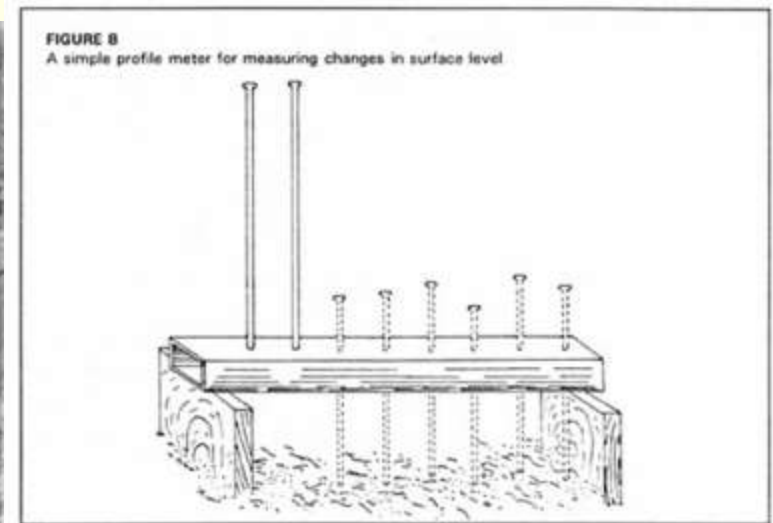
Proposed MDS

- Soil physical properties:
 - Soil classification
 - USDA taxonomy or appropriate to region
 - Reliable soil maps?



Proposed MDS

- Soil physical properties:
 - Erosion estimates
 - Runoff plots
 - Profile meter
 - WEPP



Proposed MDS

- Soil amendments
 - Type, formulation
 - Dates of application
 - Application method
 - Rates



Proposed MDS

- Crop properties:
 - Grain yield
 - Per area basis
 - Residue C
 - Post-harvest
 - Per area basis



Proposed MDS

- Biomass data:
 - % ground cover
 - After planting
 - Biomass after harvest
 - Biomass removal



Proposed MDS

- Climate data:
 - Daily rainfall
 - Daily air temp.
 - Max, min, ave.
 - At 5 ft



\$260



SANREM CRSP

Shaping a sustainable future



Creating, organizing, and disseminating knowledge that improves livelihoods through sustainable agriculture and natural resource management

