Status, priorities and needs for sustainable soil management in Madagascar

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Some facts about Madagascar

- Location: Island situated 400 km East of Mozambique
- Latitude: 20°00’ S, Longitude: 47°00’ E
- Total area: 587,040 km²
  - Water: 5,500 km² (1%)
  - Lands: 581,540 km² (99%)
- Shoreline: 5,000 km
- Fourth biggest island in the World
- Climate: tropical climate along the Littorals, temperate in the Central High Plateaus, and aridic in the South.
The major soil types

• Morpho-pedologically, Malagasy soils are subdivided to:
  • 1) Cristalline terrains: Red Ferralic soil
  • 2) Sedimentary terrains: Yellow Ferralic soil, Red Ferrugenous soil, Calcareous soil
  • 3) Volcanic terrains: Andosols, Ferralic soil
  • 4) Alluvial and colluvial terrains: Fluvisol, Hydromorphic soil, Podzol, Ferralic soil
Main soil characteristics/properties

- Acidic to very acidic (4.5<pH<5.5) except for calcareous soils
- High Fe content (Iron toxicity in rice cultivation)
- High Al content (Al toxicity in upland crops, like maize)
- Very low available P (high P-fixation due to high amount of Al and Fe oxides)
- N deficient
- Poor SOM
- Pockets of K and S deficient soil emerging
- Probably some micronutrients deficiency
- Compact, low infiltrability, high erodibility
Major issues: degradation of watersheds

Causes:

• Over use of soils (population pressure) and inappropriate agricultural practices, over grazing...
• Erosion (lavaka) very frequent in the Central High Plateaus (Ferralitic soils)
• Wild fire, tavy (slash and burn agriculture practiced on steep slope, very humid environment)
• Deforestation
• Absence of vegetal cover
• Heavy rains
• Steep slopes
Degradation of watersheds (cont’d)

Consequences:
• Loss of top soil (5-20 Mg.ha$^{-1}$.yr$^{-1}$)
• Loss of nutrients and of soil fertility
• Siltation (paddy fields, lakes, rivers, irrigation networks...)
• Economic impacts
Degradation of watersheds (cont’d)

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Two case studies

• In the Alaotra Basin, there are 4,735 lavakas, of which 13% are stable (*Source: Situation de l’ érosion en lavaka et ses impacts, ONE - Rabarimanana Mamy, 2002*)

• *In the Region of Itasy, out of the 400 lavakas inventoried, only 2% are stabilized.*

• The mean size of thelavaka ranges from 3 to 15.5 ha.

• NB: Methodology: Landsat Imagery
Just for illustration

Assuming

- a) Lavaka (40%)
- Blanket erosion (60%)
- Average area of one lavaka : 10 ha
- Average depth of one lavaka : 15 m
- Number of lavaka : 5,000

Then

- volume of soil lost : 7.5 \times 10^9 \text{ m}^3
- B) Blanket erosion (60%) = 11.25 \text{ m}^3
- Total soil loss = 20 Billions \text{ m}^3
Evolution of the « lavaka »

- Active lavaka
- Pseudo-stable lavaka
- Stabilized lavaka
Evolution of soil fertility

• Farmer perception between 1990 and 2001, at Commune level
  – For paddy soil (lowland rice soil)
  – For upland soil

NB: In the legend
  – Not available (blue)
  – Dramatically degraded (light pink)
  – No change (pink)
  – Less fertile (light brown)
  – More fertile (dark brown)
Carte F1.7.1a : EVOLUTION DE LA FERTILITE DES RIZIERES

Source : INSTAT (2009)
Carte P1.7.1b : EVOLUTION DE LA FERTILITE DES TANETY
Current efforts to address soil management challenges

• National program for watershed and irrigated areas protection (WB, FAD, GEF, Government...)
• Promoting integrated use of mineral and organic fertilizers in any fertilizers recommendations
• Promoting agro ecological techniques and conservation agriculture (mulching, Legumes cover crop, zero or minimum tillage...)
• National Strategy for Fertilizers Use
• Promote use of locally available materials (guano, liming materials, ammonium sulfate from Ambatovy Plant Co-Ni after identifying areas where it could be used,...)
Some challenges towards sustainable soil management

- Soil degradation and erosion
- Declining soil fertility
- Inappropriate farming practices
- Low adoption of techniques by farmers
- Bridge the gap in terms of policies (land use)
The needs

• Update soil inventories and mapping using state of the art digital /geospatial tools
• Training of young Soil Scientists
• Make accurate and sound fertilizers recommendations
• Capacity building and strengthening (soil, plant and fertilizers testings and analytical labs) (research and public service)
• Set up fertilizer blending plant (in collaboration with PS)
ASANTI  SANA
THANK YOU
GRACIAS
MERCI
MISAOTRA