



# Sustainable Soil Management

## Pillar 1 of the Global Soil Partnership



**GLOBAL SOIL  
PARTNERSHIP**

**FAO Natural Resources & Environment and  
Agriculture Departments**



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- 5. Governance and policy for sustainable soil management-  
the Global soil partnership**
- 6. Action plan: What is needed to bring about a transformation towards SSM by farmers and other land users?**
- 7. Next steps: Regional process to agree on priorities,  
process and required support**

# What is sustainable soil management?

**Soil health:** The capacity of a soil to function as a vital living system within ecosystem and land use boundaries to sustain plant and animal productivity and health and maintain or enhance water and air quality (Doran, 1996)



**Soil quality:** the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant & animal productivity, maintain or enhance water and air quality, and support human health and habitation" (SSS of America, Karlen et al., 1997).

**Sustainable soil management** requires balancing the needs for human purposes with those for environmental conservation and functioning

Soil quality /health is reduced through human-induced degradation processes (**erosion, nutrient mining, compaction, acidification, pollution, etc.**)



# Soil type, quality and management vary across the landscape

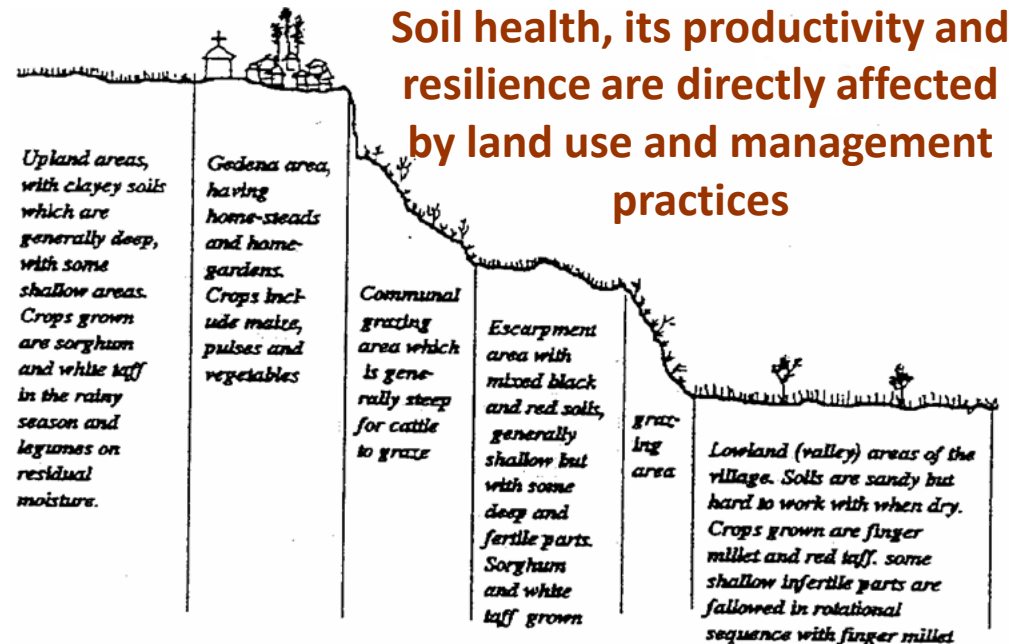


**A healthy living soil** provides the basis for plant establishment and growth and for crop, forest and livestock production.

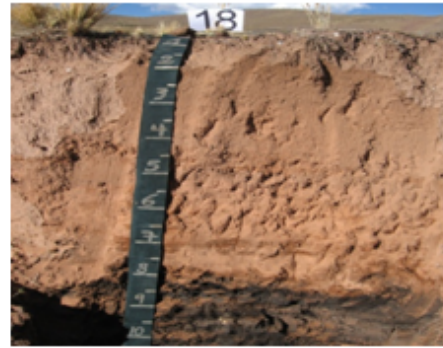
- it provides support, nutrients and water for plant root uptake
- it contributes to the regulation of water, carbon and atmospheric gases.

**Soils vary across landscapes and with depth** due to differences in geology, topography, climate, vegetation and management over long periods of time.

**Soil productivity** depends on managing its properties (physical, chemical and biological) and minimising erosion



# Soils contribute to a range of ecosystem services and functions



## Life support services

- The soil renews, retains, delivers nutrients and provides physical support for plants;
- It sustains biological activity, diversity, and productivity;
- The soil ecosystem provides habitat for seeds dispersion and dissemination of the gene pool for continued evolution.

## Provision services

- Soil is the basis for the provision of food, fibre, fuel and medicinal products to sustain life;
- It holds and releases water for plant growth and water supply.

## Regulating services

- The soil plays a central role in buffering, filtering and moderation of the hydrological cycle;
- It regulates the carbon, oxygen and plant nutrient cycles (such as N, P, K, Ca, Mg and S) affecting the climate and plant production;
- Soil biodiversity contributes to soil pest and disease regulation. Soil micro-organisms process and break-down wastes and dead organic matter (such as manure, remains of plants, fertilizers and pesticides), preventing them from building up to toxic levels, from entering water supply and becoming pollutants.

## Cultural services

- Soil provides support for urban settlement and infrastructure;
- In some cultures, soils may also be of specific spiritual or heritage value.
- Soils are the basis for landscapes that provide recreational value.

A healthy soil is fundamental for sustained production intensification and the maintenance of other vital soil-mediated ecosystem processes.

- Management of soil properties (structure, SOM, soil moisture / water, soil nutrients, mineral composition, pH, soil life/biological activity)
- On-farm management of soils (productivity; food, fibre, fuel, etc.)
- Land uses and habitat management (crop, rangeland, forests, wetlands, urban areas for biodiversity and sustainable livelihoods).
- Landscape/ watershed level management (for hydrology, carbon and nutrient flows/cycling, erosion control and climate regulation)
- Local and national soil governance (tenure, access, individual and common property resources , protection)





# Challenges of Managing soils sustainably



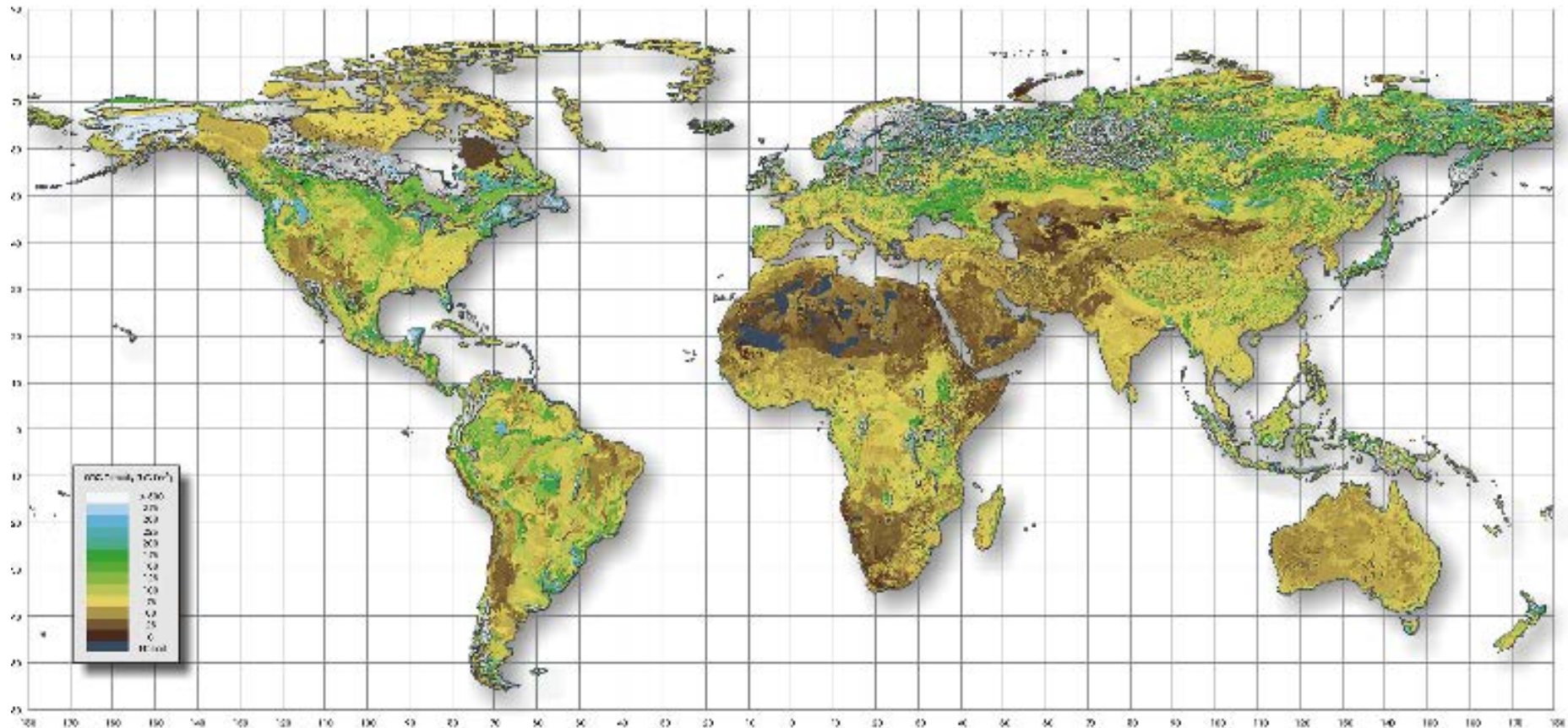
Soils in a human time frame are a non-renewable resource, but increasingly degraded and being lost from productive use.

- **Population and economic growth:** Need to increase food, feed and fiber production to meet demands (diet, income, urban, markets,)
- **Environment:** Need to reverse soil/land degradation, soil biodiversity loss and adapt to and mitigate climate change (MEAs)
  - Erosion and sediment load in water
  - Nutrient mining and overload/pollution
  - Water scarcity and climate change adaptation
  - Compaction and sealing
- **Competition over resources:** Need to manage competing demands, support smallholders (social equity) and protect productive land for agricultural development, food security, sustainable development

Sustainable crop, grazing and forest systems can sequester huge amounts of carbon from the atmosphere and store it in soils and also in vegetation.

The top metre of the world's soils holds some 2,200 GT of carbon, two thirds of which is in the form of SOM. This is more than 3 times the amount of carbon held in the atmosphere!

Estimates of global soil organic carbon (t/ha of carbon) from amended HWSO

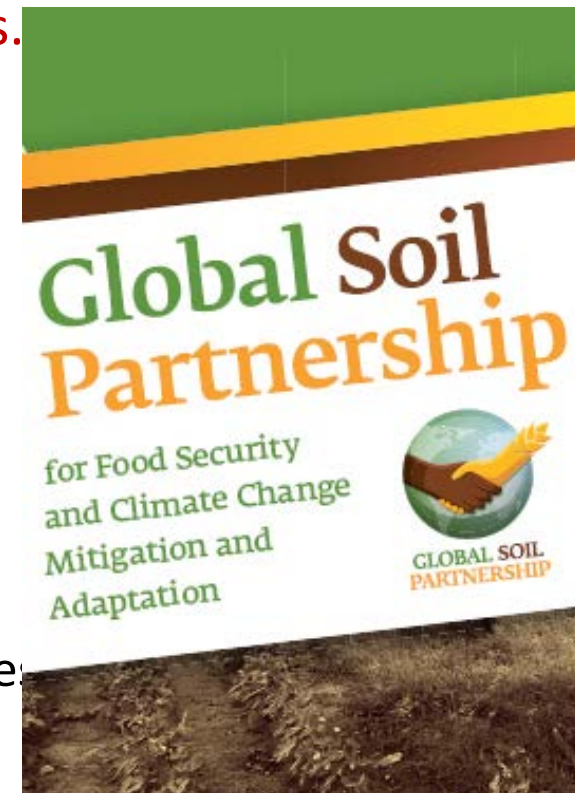




**GSP Mandate:** to improve governance of the limited soil resources of the planet in order to guarantee healthy and productive soils for a food secure world, as well as support other essential ecosystem services.

## 5 GSP Pillars (interrelated)

1. Promote sustainable management of soil resources.
2. Encourage investment, technical cooperation, policy, education awareness and extension in soils.
3. Promote targeted soil research and development focusing on identified gaps and priorities.
4. Enhance the quantity and quality of soil data and information.
5. Support harmonization of methods, measurements and indicators for sustainable soil management - with national validation that takes into account the difference of production systems and ecosystems.





# Soil Understanding & Knowledge for SSM



## Wealth of knowledge, data & expertise on soils worldwide, but:

- dispersed among technical specialisations, not shared or harmonized
- not accessible to key stakeholders: land users (farmers, livestock owners, foresters) or policy makers/planners
- inadequately used in interdisciplinary, ecosystem approaches
- soil scientists are disappearing as lack of attention and support for soils
- countries have differing knowledge, data, capacities and expertise



# Soils Training & Capacity Development for SSM



## Training and capacity development

- Build on / strengthen existing training capacities and efforts (universities, national & regional institutes, private sector)
- Update and educate the next generation of soil expertise
- Coordinate knowledge & build synergy among work on soils to meet today's challenges
- Knowledge management for farmers /producers associations
- Knowledge management for policy makers-

**The Traditional Minga system - ISFM and drought management:** Farmers in Chiquitania region, Santa Cruz, Bolivia community CC adaptation plan (30 years) Practice for improving soil structure, soil water retention & nutrient availability to cope with increased rainfall variability and intensity (dig a trench close to the plants , fill it with manure, cover with mulch or residues) It is being scaled up (FAO/INIAF) for increased and reliable yields even in drought years.



Community training



Preparing the manure



Digging the row



Filling the manure

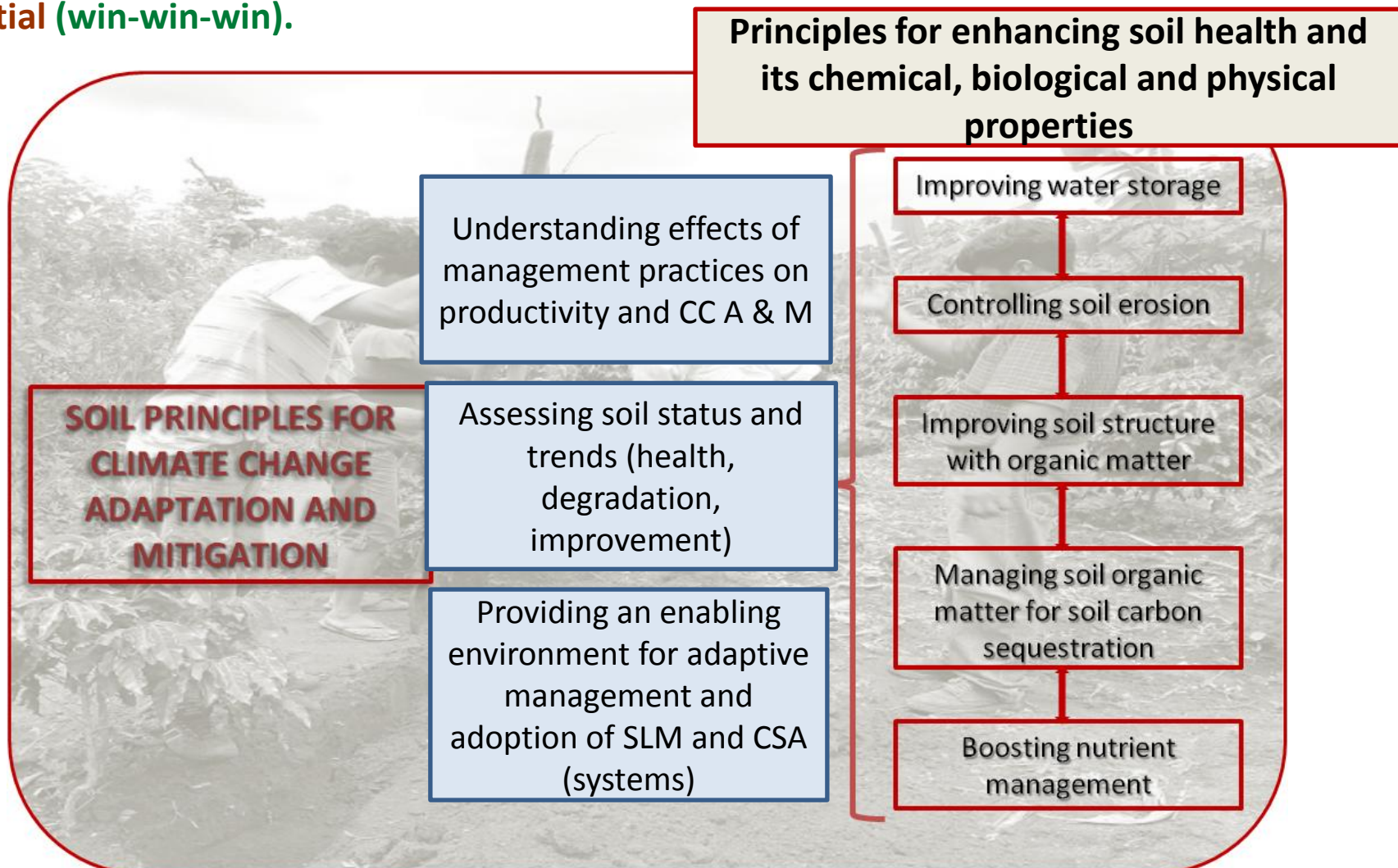


Row filled with manure



Covering the surface with residues

There is a need to assess and support adaptive management and provide incentives for adoption of systems & practices with greatest **production, mitigation & adaptation potential (win-win-win)**.





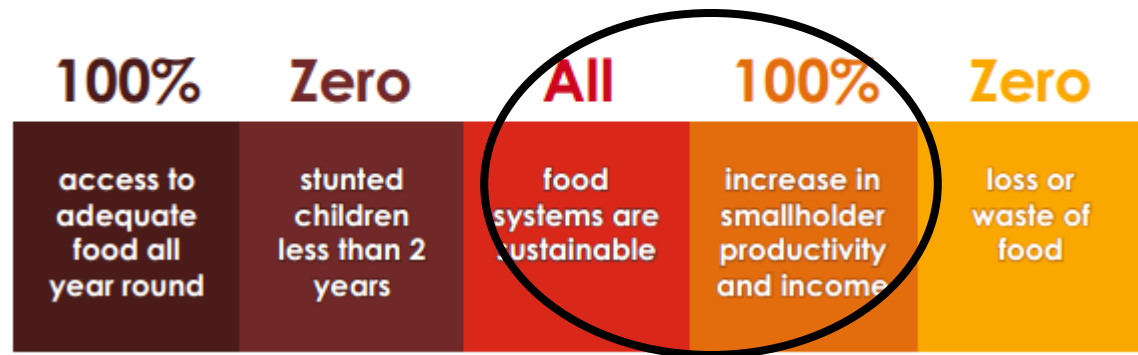
# Soils governance, policy & Institutional Issues for SSM



- Raise awareness of policy makers of importance of soils (food security, climate change, biodiversity conservation, water resources, poverty alleviation, human health, peace).
- Enhance land tenure security & access to natural resources (VG on tenure)
- Build synergy among and contribute to global commitments for SD
  - Rio+20 targets (zero hunger; zero net land degradation targets)
  - FAO (food security; sustainable production)
  - UNCCD, CBD, UNFCCC....

- Mobilize technical cooperation and investment in soils
- Identify areas with biggest win-wins and effects on poverty and food security

## Zero Hunger Challenge





# Identify Actions with all stakeholders



- 1. Land users:** capacity development for adaptive management of soils as part of their crop, grazing and forest systems (to enhance productivity, cope with climate change, and reduce GHGs- **climate smart agriculture**)
- 2. Technical sectors:** improved understanding of biophysical & socio-economic dimensions and develop SSM guidelines for different soils
  - land use change and governance (effects of fragmentation, tenure security, access rights of diverse land user groups)
  - diversity and current status and trends of soils, NR and climatic conditions (potentials and limitations)
  - extent /severity of LD processes and effectiveness of various SLM measures.
  - costs and access to seeds, fertilizers, markets, PES opportunities
  - national & partners' development objectives/decisions)
- 3. National assessment and targeted research** to address major soil related problems that impact on food security and climate change (e.g. salinity, compaction, nutrient mining, agrochemical contamination, etc.)
- 4. Enabling environment** for soil protection and sustainable management : policy, investment and technical cooperation in all regions to address key issues

- **Expected Workshop output:** Outline action plan for sustainable soil management

Action: make it available for further regional and global consultations, ensure involvement of all stakeholders.

- **Regional consultations :**

- **3 Regional partnerships started** (Near East, Asia, Latin America and Caribbean) initial focus on soils information and data (Pillar 4) Action: need to mobilise their consultation for Pillar 1 on SSM)

- **3 Regional partnerships being planned for Africa** (West – launched 1<sup>st</sup> week Feb; East & Central; and Southern)

Action: Need to ensure focus on information & data and sustainable soil management (pillars 4 and 1)

- **Finalise GSP Pillar 1 Action plan** with inputs from each region (priority actions, process, timing, actors/ partners, required support) and **Mobilise investment and technical cooperation**





We are facing 5 global challenges:

1. food security / scarcity
2. water scarcity
3. climate change
4. Soil nutrient overload and mining
5. Soil loss through urbanization

... and soil management has to address all of them ...

In this presentation I will give a short overview of:

- Integrated soil health management
- Soil and water management (WOCAT technologies, CA)
- soil nutrient and SOM management
- Soil variability and management

## Integrated Soil Fertility / Health Management

### *Characteristics:*

1. Basis on sound SOM management and on organic material at the disposal of farmers -> Bernard Vanlauwe (IITA) will present the details of it;
2. Taking into account soil-borne and non-soil-borne pest/diseases – examples:
  - soil-borne: nematodes on plantain in the humid zone of Africa
  - non-soil borne: maize stemborer – soil fertility interaction
3. Judicious use of mineral fertilizers, notably on degraded / nutrient depleted soils; goal is to “kick-start” crop biomass and manure production, notably in SSA  
-> the combination of inorganic and organic fertilizers has additional benefits



# Soil health management



## Soil and water management (WOCAT technologies, CA)

### *Characteristics:*

1. Locally adapted low-cost technologies, geared towards integrated land management, and promoted by WOCAT ([www.wocat.net](http://www.wocat.net)) e.g., bunding, terracing, etc.
2. Complete system approaches, such as Conservation Agriculture, with 3 basic global principles:
  - Cropping system diversification – integration of soil-improving legumes
  - Soil surface mulching for permanent soil cover
  - No tillage to keep natural soil structure and minimize SOM loss

## Soil nutrient and SOM management

### *Characteristics:*

1. SOM is the basis of soil fertility management, but nutrient availability is yield-constraining on many soils, thus we need a judicious top-up with mineral fertilizers, in particular in SSA
2. Legumes need soluble soil-P (and Mo/Zn) in order to fix N to their full potential
3. P, K, Ca, Mg and micronutrients (Zn, B, ) are yield limiting on Nitisols in northern Nigeria and on Ferralsols in southern Cameroon
  - > Ca deficiency causes “pops” in groundnut (southern Cameroon)
  - K-deficiency increases stemborer attack on maize in West and Central Africa
  - N-P-K deficiency of plantain causes toppling and up to 100% yield loss
4. Rhizobia and mycorrhiza enhancement



# Institutional and policy issues



1. Capacity building for farmers and scientists
2. Fragmentation of soil work – need to create COP's
3. Food security and climate change are intricately interlinked (CFS, 2012)
4. National soil policies are existing in some countries (e.g., U.K., Germany), but are missing at regional (EU) and international level  
-> soil degradation is NOT part of the MDG-7: Environmental Sustainability



Thank you for attention and coming to  
this important workshop!