GSP WORKSHOP
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STATUS AND PRIORITIES OF SOIL MANAGEMENT IN ZAMBIA

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Outline

- Location
- Agro-Ecological Regions
- Farming Systems
- Current Soil Status
- Activities Leading to present Day Status
- Soil Management – Best Bet Options
- Factors/Forces Affecting Soil Management
- Challenges Faced in Soil Management
- Research Institutions
- Information Dissemination

ZAMBIA: Location

- Southern Africa: Latitude 10-18 degrees South and 22-36 degrees East
- Area/ Size: 752 614 Sq. Km;
- It is **land locked**;
- Surrounded by **eight (08) neighbours** i.e. DRC in the North, Tanzania in the North East, Malawi and Mozambique in the East, Zimbabwe, Botswana and Namibia in the South, and Angola in the West;
- Capital city is Lusaka.

MAP OF ZAMBIA WITH HER NEIGHBOURS

(Source: Geography of Zambia)

Zambian Climate

- It has a pleasant, but seldom unpleasant tropical climate with three seasons i.e.
- Cool dry season (April – August);
- Hot dry season (August – November);
- Warm wet season (November – April);

Agro-Ecological Regions

Three (03) main agro- ecological regions:

Region 1:

- Luangwa and Zambezi rift valley areas covering 14% of the land area;
- Unpredictable rainfall <800mm;
- Recurrent droughts and floods;
- Summer (rainy season) temperatures can exceed 38 degrees Celsius;
- **Soils** are mostly Haplic Luvisols and Haplic Solonetz which **are highly erodible**.

Agro-Ecological Regions and Soil Status

Region II (Zone IIa)

- **Central** and **Eastern** plateaus of Zambia comprising 28% of the land area;
- Rainfall ranges from 800 – 1000mm;
- Summer temperatures range from 20- 33 degrees Celsius;
- **Soils** are mainly Haplic Lixisols (FAO, 1973) and other soils which are **more productive**;

Agro-Ecological Regions and Soil Status

Region II (Zone IIb)

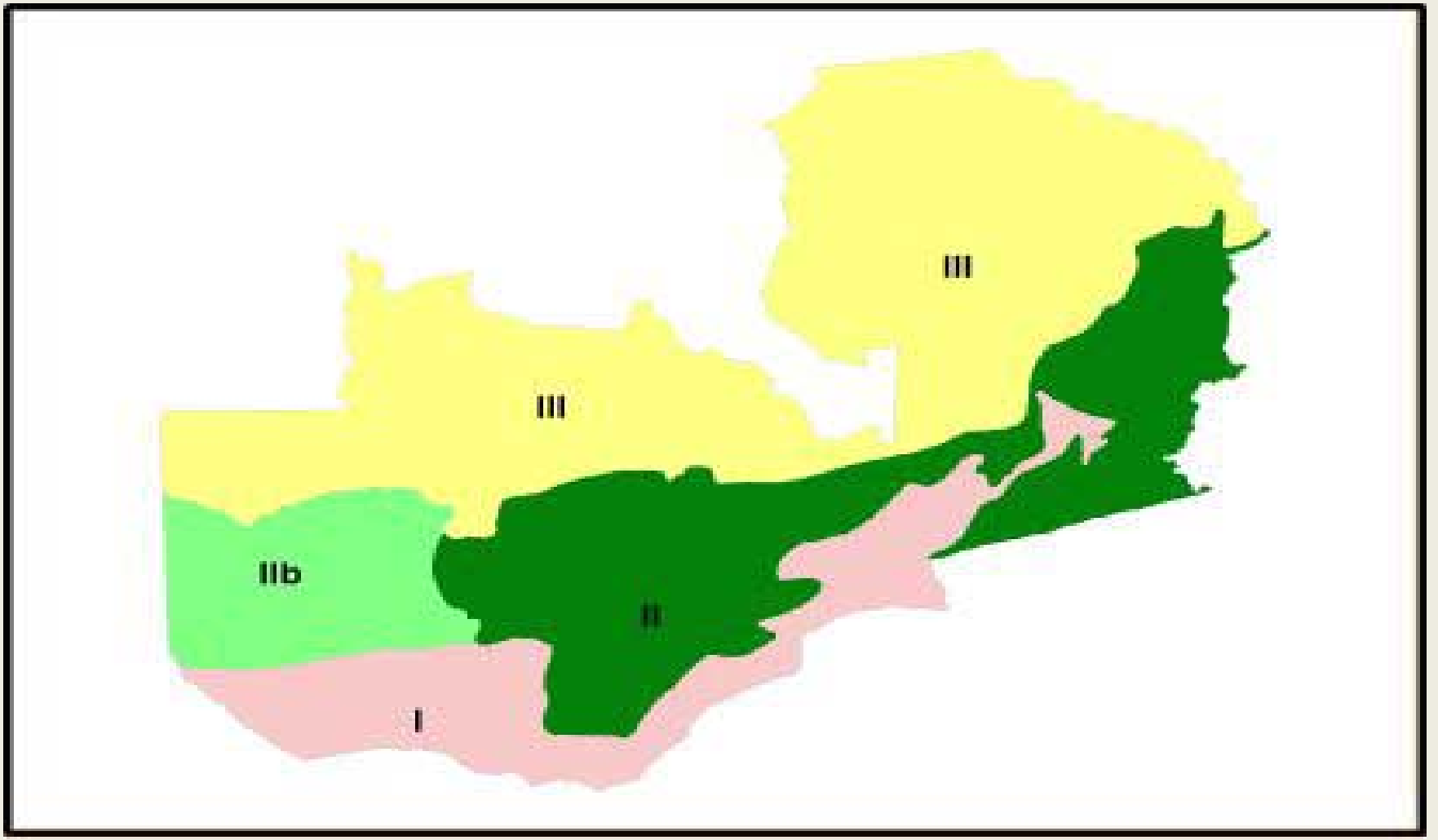
- Semi arid plains of **Western Province** comprising 12% of the land area;
- Rainfall >800mm;
- Ferralic Arenosols (FAO, 1973) which are predominantly **infertile coarse Sands** and alluvial soils.

Agro-Ecological Regions and Soil Status

Region III

- **Northern** parts of Zambia comprising 46% of the land area;
- Rainfall is above 1200mm;
- Summer temperatures are 18-30 degrees Celsius; and extended cloudy periods;
- Mostly Haplic Acrisols which are **highly leached and acidic soils** of relatively low fertility predominance.

Zambia Agro-Ecological Regions



Sources: CFA, Zambia Branch Homepage

Zambia Agro-Ecological Regions I, IIa, IIb and III
KEY

Region	Annual Rainfall
I	Less than 800 mm
IIa	800 - 1000 mm
IIb	800 - 1000 mm
III	1000 - 1500 mm

Farming Systems in Zambia

There are five (05) major farming systems that have been recognised in Zambia *i.e.*

- 1. Shifting cultivation system;
- 2. Semi-permanent hoe system;
- 3. Semi-permanent hoe and Ox plough system;
- 4. Semi commercial cultivation system;
- 5. Commercial system.

(Saasa, 2003)

Farming Systems in Zambia

1. Shifting Cultivation System

- Traditionally been practiced in region III; it involves slashing and burning of trees (*Chitemene system*); Ashes improve fertility;
- It leaves completely cleared and stumped fields for a period of 15-20 years as fallows;
- Dominant crops are maize, cassava, millet, groundnuts and beans;
- The system is unsuitable in the long run due to inadequate land to allow for long fallow periods;

Farming Systems in Zambia

Shifting Cultivation System (Cont'd)

- Declined with availability of subsidized fertilizers from the government Farmer Input Support Programme (FISP); about 20% smallholder farmers access fertilizers;
- Fertilizers have partially taken the place of ashes to improve soil fertility;
- On the other hand use of ammonium nitrate has exacerbated the soil acid levels.

Farming Systems in Zambia

2. Semi-Permanent Hoe System

- Practiced in the lowest rainfall areas of region I;
- Prominent crops are bulrush millet, sorghum, maize crop out put is low;
- Livestock is also reared.

Farming Systems in Zambia

3. Semi-Permanent Hoe and Ox Plough System

- Practiced in region II;
- Crops include finger millet, maize, cassava, groundnuts, beans;
- Livestock a major source of animal draught power(ADP), decline in ADP due to animal disease and drought;

Farming Systems in Zambia

4. Semi-Commercial Hoe and Ox Plough System

- Practiced mainly in region II;
- Prominent crops being maize, groundnuts, cotton, beans;
- Livestock is a major asset;
- Farming heavily depend on inorganic fertilizers.

Farming Systems in Zambia

5.Commercial Farming System

- Characterized by well developed agronomic management practices;
- Intensive use of mechanized farming;
- Liming is used to mitigate effects of soil acidity

Current Status of Soils in Zambia

- Low soil fertility status;
- Low crop yield levels;
- Moisture stress due to drought;

Background:
Activities Leading to Present Day Soil Status

- **Mono cropping**: Growing same crop on one field for much longer periods; maize is biggest culprit, it is the main staple food;
- **Continuous use of inorganic fertilizers**: In the past it was easy to access inorganic fertilizers, hence the indiscriminate use contributed to increased soil acidity levels;
- **Burning crop residues:** burning residues from the previous season-soils getting exposed to direct rains, heat, wind and low in organic matter content.

Background: Activities Leading to Present Day Soil Status *(Cont'd)*

- **Ploughing**: most farmers wait for rains in order to plough; ploughing can take several days or even weeks; rain splash pulverises the soil causing capping/hard pan which encourages run off and interferes with crop emergence;
- **Ridging**: moving soil backward and forward each year. Ridges are split each year and new ridges made in the previous furrow. If ridges are not made on the contour, erosion gullies form

Soil Management in Zambia

(*Major Current Activities Being Promoted*)

The best bet options being promoted include:

1. Green manure and dual purpose legumes;
2. Organic manure;
3. Nitrogen fixing trees and shrubs;
4. Conservation agriculture

1.Green Manure and Dual Purpose Legumes

Green Manure: The practice of incorporating a green woody growing crop into the soil to enhance soil fertility

Species commonly used in Zambia

- Velvet beans (*Mucuna*), Sunnhemp (*Crotalaria*), *Sesbania*, *Tephrosia* – soil fertility restoration, cover crops, weed suppression and erosion control;

Dual Purpose Legumes

- Cow peas (*Most Common*) : Soil fertility improvement, cover crop, leaves as vegetables and grain for human nutrition.

2. Organic Manure

Animal and Compost manure

- **Animal manure**: cattle, sheep, goats, chickens;
- **Compost manure**: crop residues, natural vegetation, kitchen refuse

Well decomposed manure release nutrients for plant growth, help improve soil structure, hence improves water retention and aeration

3. Nitrogen Fixing Trees and Shrubs

- **Improved fallows**: Using species for one or two years to replenish soil fertility *e.g. Sesbania Sesban, Tephrosia vogelli, grillicidia sepium, pigeon peas*
- **Tree/crop intercropping**: systematic inter-planting of maize with *Faidherbia albida*; in places where per capita land holding size is small, high population areas and on permanent land

Farmers choose a legume species and systems suitable to their agro ecological zones as well as soil condition

4. Conservation Farming (CF)

Due to variations in weather and annual rainfall pattern, the effectiveness of CF varies across crops, regions and over time

Four (4) Key Elements of CF

1. **Cereals - legume rotations:** soya beans, groundnuts and common beans – legumes improve nutrient recycling and nitrogen fixation;
2. **Targeted application** of farm inputs in restricted fixed locations – Inputs applied closer to the crop;

4. Conservation Farming (CF) *(Cont'd)*

3. **Retention of crop residues** from previous harvest and not burning them – Improves water infiltration and reduces soil erosion;

4. **Minimum tillage**: Land preparation using minimum tillage methods during the dry season - Enables farmers to plant early as land preparation is done in the dry season

Factors/Forces Driving Soil Management

- The speed of earning benefits – present challenges in the use of say intercropping maize with faidherbia albida;
- Availability of land to put to fallow where land is limited;
- Competition of legume based technologies with other crops for limited resources such as labour, land, cash;
- Availability and affordability of the required inputs – legume seeds, manures, fertilizers

Factors/Forces Driving Soil Management *(Cont'd)*

- Availability of extension services to the farmers;
- Farmers' experience in farming.

Challenges faced in Soil Management

- **Low adoption rates** on soil improvement techniques among smallholder farmers, more work still needs to be done to raise awareness;
- In high population areas high potential land is becoming less available leading to farming activities being conducted in more **fragile areas**;
- **Poor road infrastructure** hinders easy access to agricultural inputs at affordable costs to smallholder farmers;
- **High fertilizer costs** due to removal of government subsidies;

Challenges faced in Soil Management *(cont'd)*

- Most farmers have **few animals** to produce the required quantities of animal manure to use in soil fertility improvement, hence what is available is mainly used **on high value crops** than in subsistence food crops;
- **Transport** problems *(10 -20 t/ha organic matter)* for the huge quantities of the required manure.

Research and Development Institutions

- To respond to the various challenges in soil management, a number of institutions have collaborated with national partners and farmers to bring about integrated soil fertility management technologies;
- Main aim is to introduce soil fertility improvement technologies suitable for the different types of resource poor farmers;
- To introduce technologies that help to improve biological and physical properties of soil leading to reduced soil erosion on farmlands

Research and Development Institutions

- Zambia National Farmers Union (ZNFU);
- Golden Valley Agricultural Research Trust of Zambia (GART);
- Conservation Farming Unit of the ZNFU;
- World Agro-forestry Centre (ICRAF);
- Tropical Soil Biology and Fertility Programme (TSBF);
- Soil Fertility Consortium for Southern Africa (SOFECSA);
- African Conservation Tillage (ACT);
- Zambia Agriculture Research Institute (ZARI).

Information Dissemination and Activities' Promotion Approaches

- Learning from demonstration plots;
- Lead-farmer concept
- Training of trainers
- Media (TV, radio and exhibition shows);
- Farmer to farmer exchange visits;
- Farmer research groups;
- Study circle concept;
- Farmer field schools; and others

END OF PRESENTATION

THANK YOU FOR YOUR TIME

References

Ministry of Agriculture and Cooperatives (2006). Sustainability Our Goal – Fertilizer Support Programme (FSP)

Geofrey Ndawa Chomba (2004). Factors affecting smallholder farmers' adoption of soil and water conservation practices in Zambia

Ministry of Agriculture and Cooperatives (2000). Conservation Farming Hand Book No. 1 - Living Soils

Conservation Farming Unit (2003). Conservation Farming in Zambia. Conservation Farming Hand Book for Hoe Farmers in Agro Ecological Region III – The basics

Conservation Farming Unit (2009). Conservation Farming and Conservation Agriculture Hand Book for ox Farmers in Agro Ecological Regions I and IIa

Conservation Farming Unit (2009). Conservation Farming and Conservation Agriculture Hand Book for Hoe Farmers in Agro Ecological Regions I and IIa – Flat Culture