Dry Agriculture production Systems development Potential Limitation in Ethiopia and Beyond

Part A

Theme: Enhancing Food + Feed and Water Security for Improved Production and Rural commercialization in the dryland ecosystem of Ethiopia

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- **Part 1 introduction and background information: what are dryland areas, coverage, resource base, Economic importance**
- **Part 2: crop production system strategy**
- **Part 3: livestock production strategy (focus**
- **Part 4: NR conservation and management, water, soil conservation, fertility and nutrient management, irrigation, climate change**
- **Part 5: Agricultural mechanization**
- **Part 6: Agricultural economics, extension, and gender**

Why drylands matter?

- Dryland areas have wide and diversified agroecologies and farming systems
- Lowlands pastoral/agropastoral
- In the highlands with crop/livestock
- Future prospect of agricultural developing Ethiopia is in the dryland areas, it is going the development forum

Dryland agroecology (skip coved by Yitebitu)

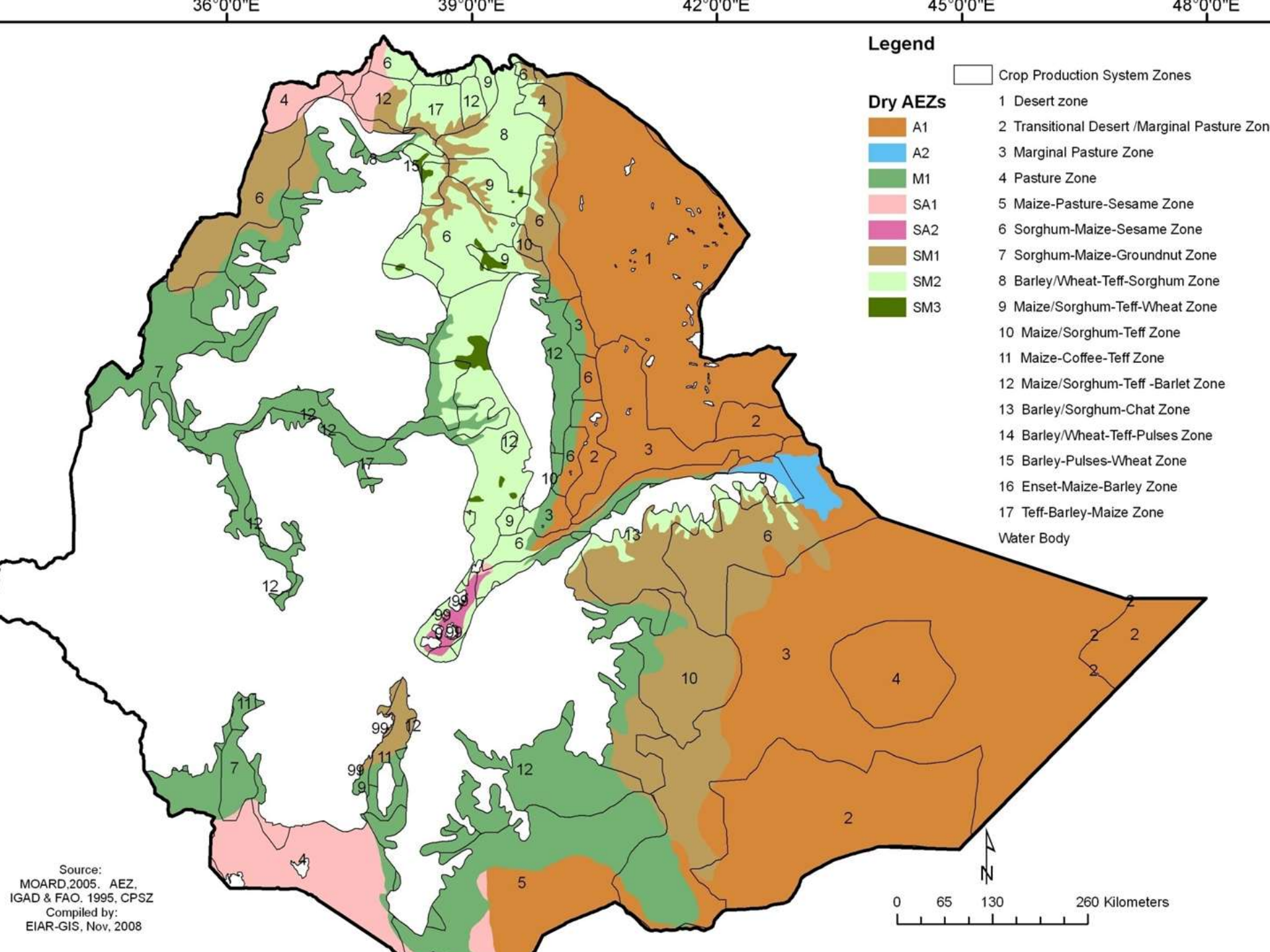
DA range from -126 m below sea level to about 1500 m above sea level and beyond

Rainfall from less than 200 mm to about 800 mm and length of growing period 90 to 180 mm.

The details of the agroecological zones which include arid, semi-arid and dry sub-humid are described below.

Arid zone: 0.03 to 0.3 the area coverage of this zone 31, 005, 622 ha.

- **Semi-arid: 0.2 to 0.5 with an area coverage of 38,577,876 ha,**
- **Dry sub-humid 0.5 to 0.65 area coverage of 14,583,350**


36°0'0"E
39°0'0"E
42°0'0"E
45°0'0"E
48°0'0"E
Legend
Crop Production System Zones
Dry AEZs
A1
A2
M1
SA1
SA2
SM1
SM2
SM3
1 Desert zone
2 Transitional Desert /Marginal Pasture Zon
3 Marginal Pasture Zone
4 Pasture Zone
5 Maize-Pasture-Sesame Zone
6 Sorghum-Maize-Sesame Zone
7 Sorghum-Maize-Groundnut Zone
8 Barley/Wheat-Teff-Sorghum Zone
9 Maize/Sorghum-Teff-Wheat Zone
10 Maize/Sorghum-Teff Zone
11 Maize-Coffee-Teff Zone
12 Maize/Sorghum-Teff -Barlet Zone
13 Barley/Sorghum-Chat Zone
14 Barley/Wheat-Teff-Pulses Zone
15 Barley-Pulses-Wheat Zone
16 Enset-Maize-Barley Zone
17 Teff-Barley-Maize Zone
Water Body
N
0 65 130 260 Kilometers
Source:
MOARD,2005. AEZ,
IGAD & FAO. 1995, CPSZ
Compiled by:
EIAR-GIS, Nov, 2008

Resource Base of Drylands with a perspective pastoral and agropastoral systems

- **The DAs are naturally rich in various resource bases. These include:**
- **Large land area for development, Tigray, Amhara, Afar, Somali, Yabello, central rift valley**
- **DAs are habitat and home to various types of domestic and wildlife, animals, vegetation**
- **Rangelands in provides** forage for **livestock** and **wildlife.** Range Eco-systems supply **minerals, soil, plant, water, wildlife, wind, radiant energy, fish, gums, resins, free seeds and aesthetics.**
- **Energy and mineral Resources**
- **There are water sources rivers and lakes in the Rift valley, rich sources of solar and wind energy, as well as geothermal and fossil fuels such as gas many mineral deposits are also found (i.e. limestone, marble, salt, potash Sulphur, gold etc.).**

Major Rivers

Resource base

- The **center of origin** and diversity of many cultivated crops
- Natural vegetation provides food, fodder, fuel and building materials
- **Medicinal Plants**: produce herbal drugs and plant derived medicines. The use of traditional medicine is increasing

  compared with the past
- **Wide life and Tourism**
- **The Livestock Genetic Resource base is rich**

Resource Base...

LIVESTOCK RESOURCES Pastoral Agropastoral and wild life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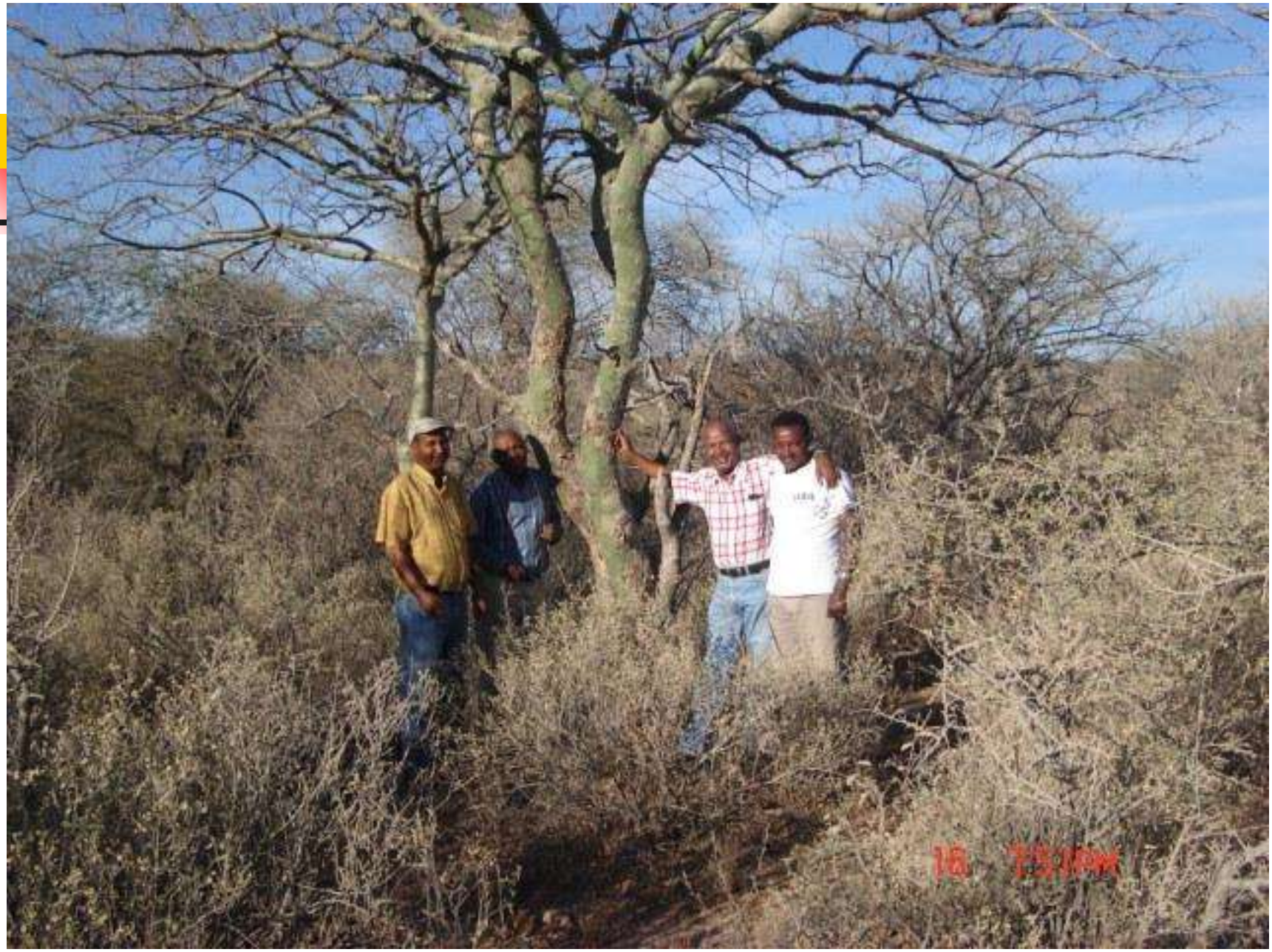


Parks and wildlife resources

Gambella National park	**5, 061 km**
Omo and Mago parks in SNPPRS	6,230 km
Netch Sar park in ranges	514 mm
Awash park in Afar rangelands	750 km
Yangudi and Rasa park in Afar	4,731 km
Total	17, 268 km

Resource Potential

- **Drylands have a comparative advantage over higher rainfall regions due to (a) reduced disease pressures; and (b) more sunlight, fertile soils and more water resources**
- **The highest returns and most prosperous agricultural areas in the world are in the former drylands, California, Israel, Australia, Spain and South Africa.**
- **This was obtained through the use of right technologies by combining water harvesting, utilizing inorganic fertilizers and new cultivars.**

Water harvesting encourages the production of high value crops.

Problems, challenges and issues

- Conceptual Problem by Policy makers, planners researchers and Development workers
- Gap of understanding of the dryland ecosystem and the interaction of society and ecology
- Lack of focus in R & D, limited capacity and budget allocation
- Limited research capacity, human power, facilities, institutions, Lack networking b/n research, extension, education
- Lack of Policy Framework and Good Governors

Issues challenges and problems in DA

General problems

- **Water stress**
- **Natural resource degradation**
- **Drought and climate change**
- **Land pressure**
- **Pests and diseases**
- **Poverty and unsustainable land use practices…poverty trap**
- **Lack of appropriate policy and management**
- **Low trained human power and instructional capacity (no center of excellence)**
- **Lack of access to knowledge and information**
- **Socioeconomic problems**
- **Lack of data base**

Steps taken by the government to strengthened R&D

- Establishment DAR by the GOV.
- Establishment pastoral standing committee
- Higher learning Institutions
- New Research Centers
- Ministry of Federal Affairs (PCDP)
- Capacity Building, Human power development through WB, FAO UNDP
- Extension for Pastoral Agropastoral by MOA

Cont..

- **Pastoral Day**
- Encouraging NGO and other development partners to work in pastoral and agropastoral areas
- **Preparation of research strategy for DAs PAP by EARO**

Strengthening…

- **Despite this move there were some problems observed which delay progress and are indicated below.**
- **Limited Incentive Mechanism**
- **Inappropriate research review system**
- **Improper allocation of research staff**
- **Budget allocation**
- **Lack officially delegated Center of Excellence**

Rational for research for development strategy

- **To use the potential resource of the drylands we need a research approach that combines natural resource management, integrated crop and livestock management improvement, and socioeconomics in research that considers agricultural livelihood system in integrated and holistic way.**
- **This system approach is important because scarce water resource, land degradation, urbanization, commodity price shocks, overall climate change are affecting dry areas particularly harshly.**

Cont..

- **water productivity in terms of the biophysical, economic, social and environmental returns per unit of water.**
- **Increased emphasis on socio-economic research to strengthen community and institutional frameworks, and develop policy options for the successful implementation and adoption of new technologies.**
- **Expansion of research on diversification of livelihood options and associated market research to promote income generation, improve nutrition, and reduce the vulnerability of the rural poor.**

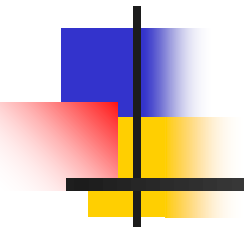
Goal

- **The overall goals of dryland agriculture aim at contributing towards:**
- **Alleviating poverty and attaining food security,**
- **Increasing income generation, employment opportunity and promoting a healthier better nourished human family.**
- **Conserving natural resources and reducing pressure on fragile ecosystem.**
- **Promoting people centered policies for sustainable agricultural development**

General objective

To increase agricultural production and productivity including crop and livestock production on sustainable and diversified bases with due consideration to reduce greenhouse gases emissions, increase sequestration, environmental sustainability, better livelihoods and food and feed security of the dryland areas of Ethiopia.

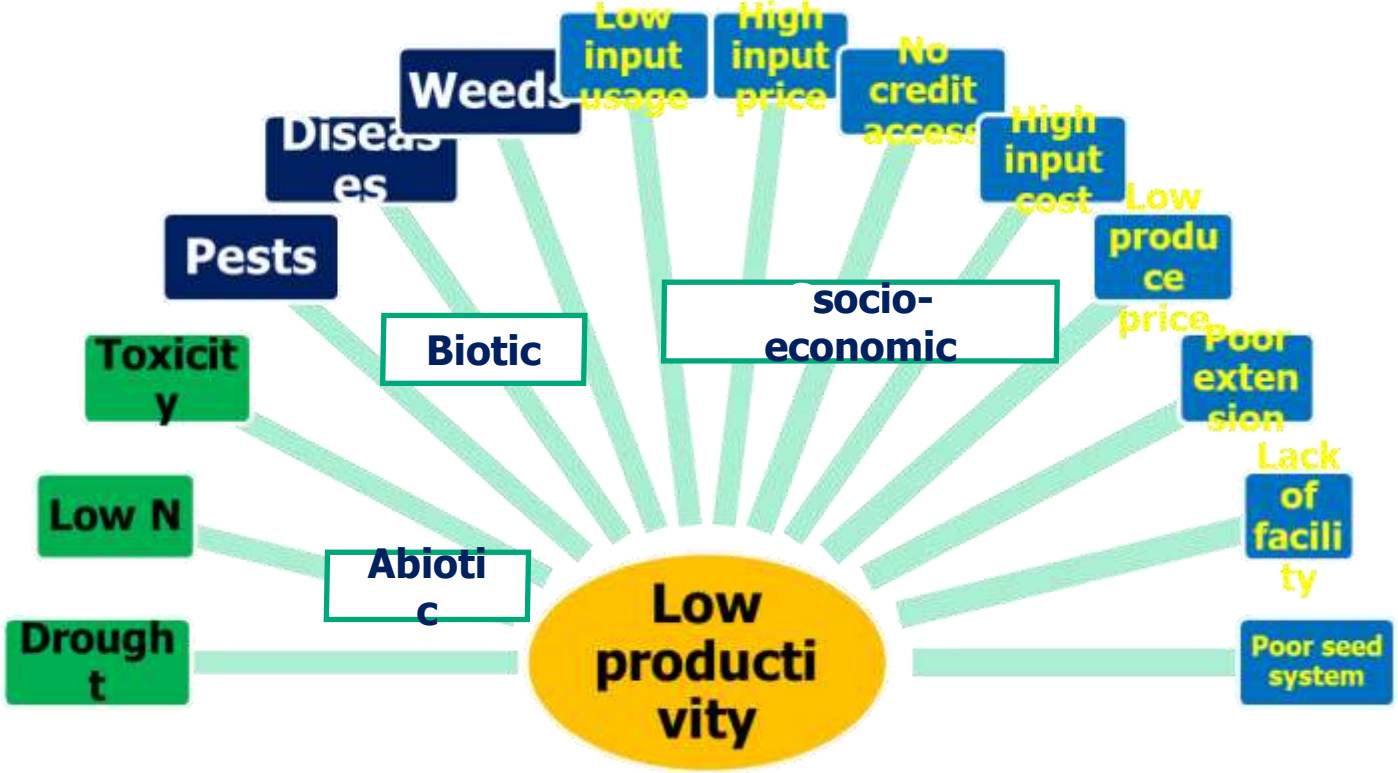
PART B
Drylands Development-crops, Agronomy and water Supply



Background

- **Encompass between 1/4 and 1/3 of the small-scale farmers growing stable crops**
- **Developing crop production in the dryland areas to cater for food and nutritional, economic growth for a better livelihood is important.**
- **This requires good understanding of the production system the potential, opportunities, and major problems and challenges hindering the development of the system.**
- Ethiopia is the center of origin and diversity of many cultivated crops, **plant biodiversity:** It has over 6,000 species of higher plants.

Challenges and bottlenecks for development



Technologies availability and relevance to farming communities

- There are many technologies available and almost all of them are documented
- But are they adopted by farmers if not **why not.**
- Lack of input, **Lack of supportive services e.g. credit**
- **Poor marketing linkages, lack of tailored extension approach, limited use of farm implements for efficient and timely performing of farm activities**

Extension to Facilitate technology adaption

Pass it on

After technologies have been developed the next step is to find ways and means to transfer them to end users. Some examples:

- **On Farm participatory research for development**
- **Operation research approach for linking research with development approach**
- **Introduce combination of technologies in a package**
- **Weak linkage among development partners (ADPLACs)**

Intervention areas to improve the extension service delivery

- Allocate sufficient resource to FTCs
- Develop the communication skills of experts at all levels
- Enhance participatory technology development, verification and dissemination
- Strengthen the capacity of development groups (FRG)
- Improving training to farmers
- Creating awareness and shared vision of ADPLACs among development partners networking

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What changes are needed for development crop production?

- Need for a paradigm shift in research and development to develop crop production
- Integrated genetic and natural resource management as a way forward
- Make major food crops more productive, nutritious, and affordable
- diversify utilization options for stable crops
- Develop tools and techniques to manage risk and more sustainably utilize the natural resource base of dryland areas, options to diversify income generation

Part 2

What is Agronomy?

- The science of agronomy deals with the principles and practices of crop production and soil management. In its broad sense it includes agro-metrology, crop ecology, crop production (including cropping systems), crop nutrition, soil fertility, agroforestry, water management, weed control, seed technology, cropping and farming systems etc.
- Agriculture has its roots in agronomy

PAST research approach in crop improvement

- Agronomy the key to crop production on sustainable basis but was marginalized
- Cultivar only strategy on development
- Integrated management package was not focused
- Development of technologies with weather sensitive
- **Food Science and post-harvest technology to add value to products and enable farmers economically capable**

Agronomy was marginalized

- **In the past the research focus on variety development with less emphasis on management practices. Many factors interact to influence the yield potential of a crop**
- **The improved varieties if combined improved soil and water and fertility management and improved agronomic practices offers better pest, disease and stress resistance leading to low risk and greater yield stability especially.**
- **Therefore the role of agronomy in improving crop production and food security is evident**

Part 3 water management in drylands

- Water shortage is major limiting factor of crop production. Thus improving for production and techniques needed for increased production is well documented.
- It is a universal problem in dryland areas and therefore without solving the problem of water shortage it is futile to talk about improving agricultural production on sustainable basis
- Therefore, the approach in research and development should deal with water as nucleus and additionally watershed approach as a unit
- We should devise and design integrated approach of soil and water conservation practices for in situ and ex situ water harvesting practices.
- Therefore to develop effective water conservation practices we need to understand the causes and their drivers and effect

WATER

Ethiopia is endowed with water resources

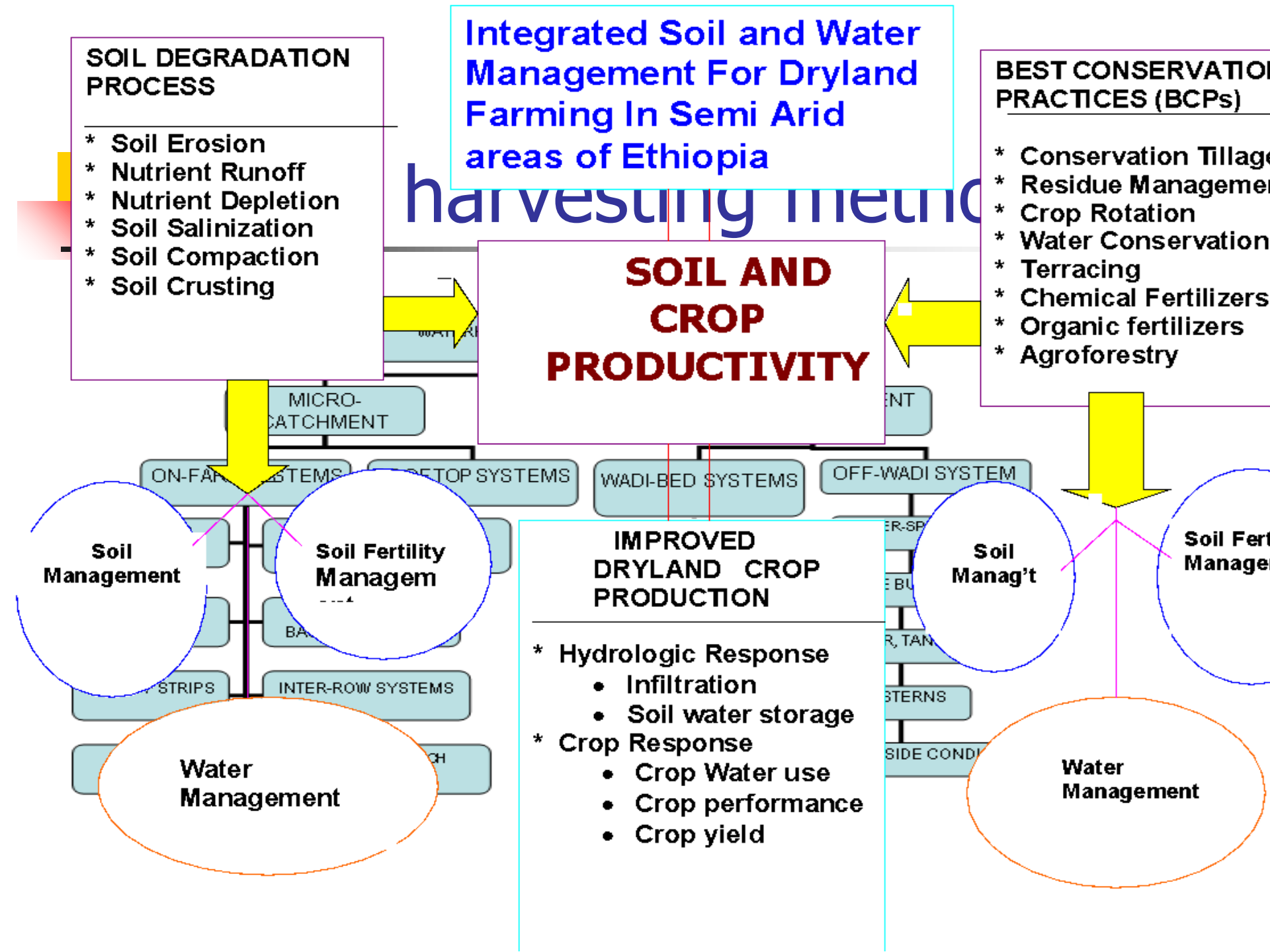
The total surface of the 18 natural and artificial lakes in Ethiopia is about 7,500 Km^2.

- Seven out of the eight major natural lakes are found in the dryland areas of the rift valley
- irrigation potential of Ethiopia is high but only 4.6 % is been utilized.
- Most of the important rivers, which could be used for irrigation are located in the dryland areas.

Drought erratic rain short rainy season

Drought erratic rain short rainy season		
High runoff	Period Walter deficit	Dry spell at critical times
In situ water conservation	Flood irrigation	Storage for supplementary irrigation
Eye brow terraces, counter strips, furrows, counter bunds, trash lines, terraces, pits ridges, conservation tillage	Spate irrigation, stream flow diversion, ground water recharge, runoff spearing systems, flood runoff	Surface dams, spring development tanks
Low risk reduction **Low investment**	Medium risk reduction Low investment	High risk reduction High-investment

Integrated Soil and Water Management For Dryland Farming In Semi Arid areas of Ethiopia



Improving water productivity Soil: Water Harvesting Plus Improved Agronomic Practices

Treatments	Yield t ha^{-1}
Broadcasting, no fertilizer, late weeding 6 weeks after emergence, flat planting (check)	1.3
Row planting, no fertilizer, late weeding 6 weeks after emergence, flat planting	1.7 (37)
Late weeding 6 weeks after emergence, tied ridges	1.9 (46)
No fertilizer, early weeding 3 weeks after planting, tied ridges	2.3 (73)
40 N 46 P2O5, early weeding 3 weeks after planting, tied ridges	2.9 (117)

Recommended research methodology

A. Genetic intensification

- **Crop improvement for**
  - ✔ **drought and heat tolerant**
  - ✔ **Development crops of good root system to enable crops explicate extract water and nutrients both dry season and wet season, greater efficiency in taking up nutrients from the soil**
  - ✔ **high grain and biomass yield**
  - ✔ **Nutritive value (nutrient dense grains)**
- Seed Research
  - ✔ **Seed systems (seed production, seed quality, processing, distr.)**
  - ✔ **Biodiversity conservation and utilization**

Research needs and wayforder

- Concentrate on water conservation and water use efficient practices;
- Integration of soil-water-plant relationships with development plant physiology;
- Soil fertility management practices;
- Biological dynamics of N cycling and availability;
- Micro-biological research on biological N fixation and mycorthizae;
- Relationships between particular soil characteristics and cropping systems;
- Understanding of cropping systems (e.g., trees, legumes, and forage/livestock), in relation to nutrient cycling, sinks, and supply;

Contd. Research Needs

- Understanding of agronomic systems (e.g., rotations, tillage, risks, and input/output costs), in relation to weed and pest control;
- Importance and value of crop residues in relation to maintenance of soil productivity, nutrient pools, livestock feed, water conservation, erosion control, and risk management;
- Relationship of unitary costs of food production to farmer objectives (e.g., risk and other factors);
- Relationship of sustainable dryland agricultural production potentials to income factors, urbanization, and world marketing; and
- Focus on farm participatory research for effective technology transfer.

- **Thank You**
- **Do not forget the drylands!**