Conceptual and Practical Approaches to Integrated Watershed Management and Agroforestry to address Food Security and Environmental Degradation in Lake Tana and the Blue Nile River Basin, Ethiopia

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Presentation Outline

- Introduction/background
- Objectives
- Methodology
  - Concepts of sustainability
  - Ecosystem Based approach
  - Participatory Approach
- Results
- Recommendations
- Conclusions

Location of the Project Area

Map of the Upper Blue Nile Basin, Ethiopia.

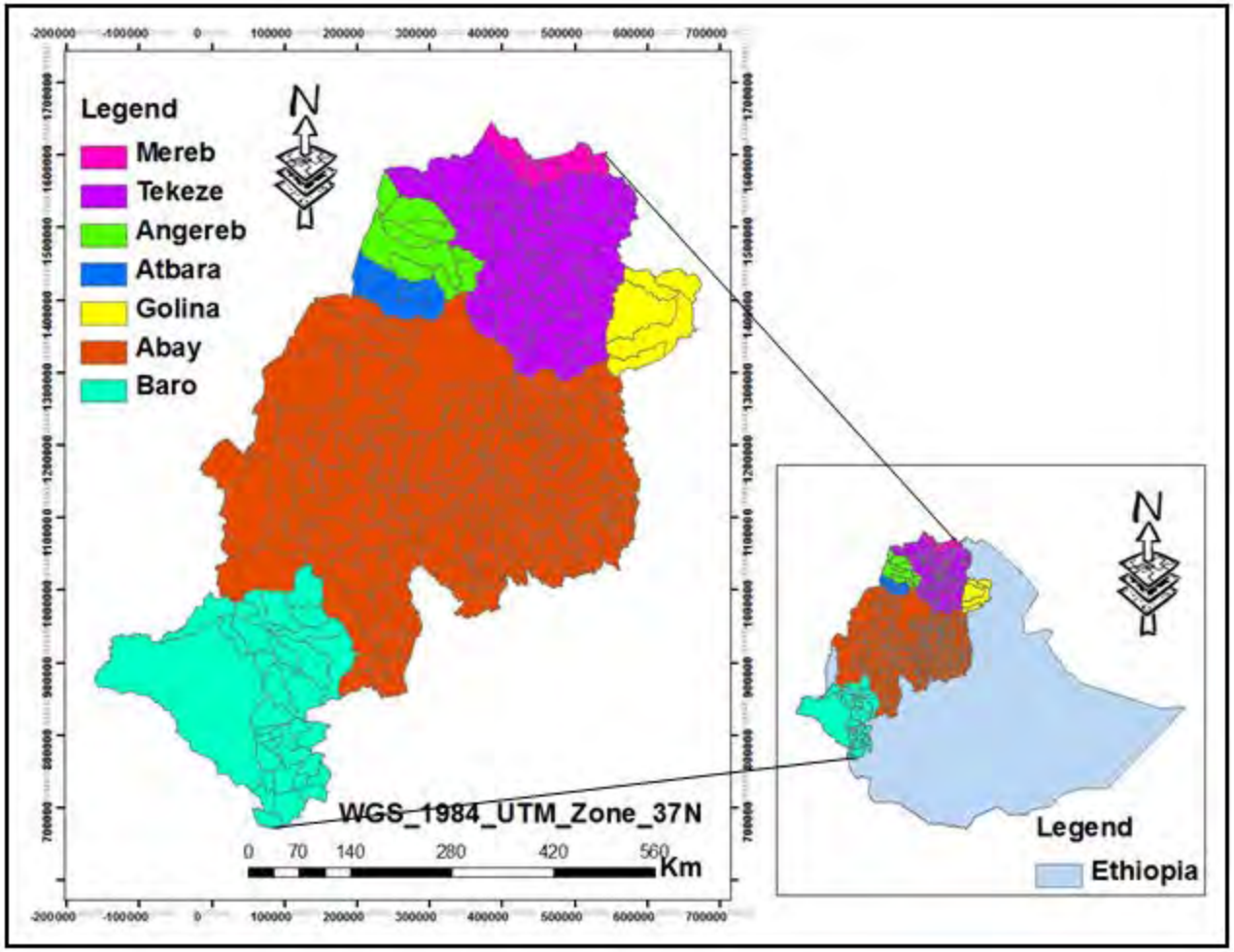


Figure 1. Map of the Upper Blue Nile Basin, Ethiopia.
Kidane and Alemu, 2015.

Angereb Watershed Gondar

Rural / Urban Interface Gondar

BACKGROUND OF PROJECT AREA

LOCATION

- Found in North Gondar Zone of Amhara Regional State
- Located at about 748 Km. from Addis Ababa
- Altitude range of 2100 to 2870 m.a.s.l.
- Average slope ranges from 8 – 30 percent.
- Watershed covers ~ 7,600 ha., and is part of the Blue Nile drainage.

CLIMATE

- Annual rainfall from 700 to 1800 mm
- Mean annual rainfall is 1160 mm
- Mean monthly temperature from 18^0C to 22^0C

POPULATION & SETTLEMENT

- **GONDAR CITY**
  - ❖ 360,000 People (2020)
  - ❖ Male to Female Ratio is 1:1
  - ❖ 21 Kebeles
- **ANGEREB WATERSHED**
  - ❖ 29,000 People
  - ❖ 10 Kebeles (7 Rural & 3 Urban)

    (i.e., Lay Armachiho 5, Gondar Zuria 2 and Gondar city 3 Kebeles)
  - ❖103 Villages (49 within & 54 outside)

'https://www.macrotrends.net/cities/20926/gondar/population'>Gondar,

AGRICULTURE – Mixed Farming

Major crops:

- Wheat, Barely, Teff & Beans
- Rain fed agriculture
- Traditional irrigation: 4.3% of the total HHs

Livestock:

- 7013 cattle, 6320 sheep, 1110 goats, 6540 donkeys, 125 horses, 8 mules,

  3571 chickens and 431 beehives.

Forest Cover 808 ha.

- plantations = 750 ha
  - Private = 145 ha
  - Communal = 400 ha
  - State = 200 ha
- Natural (scattered) = 60 ha

The Corvallis-Gondar Sister Cities

Gondar – King Fasil Castle

Corvallis – Court House

The Corvallis-Gondar Sister Cities

- **Established in 2005 by groups of citizens** in both Corvallis, Oregon and Gondar, Ethiopia

- **objectives of the group are:**
  - to promote awareness and increase cultural understanding between the two cities, and
  - to undertake projects that are beneficial to both places.

- **The C-GSCA has initiated a number of work groups,**
  1) Water and Watershed,
  2) Education, and
  3) Health

http://sistercities.corvallis.or.us/gondar/water-workgroup/

Planning Visit to Gondar 2009

- Observed the watershed,
- Talk to farmers and kebele administrators,
- Identify problems and constraints of land use,
- Propose alternative action plan for implementation.

Stakeholders in the Angereb Watershed

- Gondar City Administration
- Ministry of Agriculture
- Gondar City Water Affairs
- Urban and Rural Kebeles and Farmers Associations
- Bridge of Hope (NGO)
- Corvallis-Gondar Sister City Association
- Organization for Rehabilitation and Development of Amhara
- University of Gondar

Field visit to Angereb Watershed

Participatory Approach involve communities

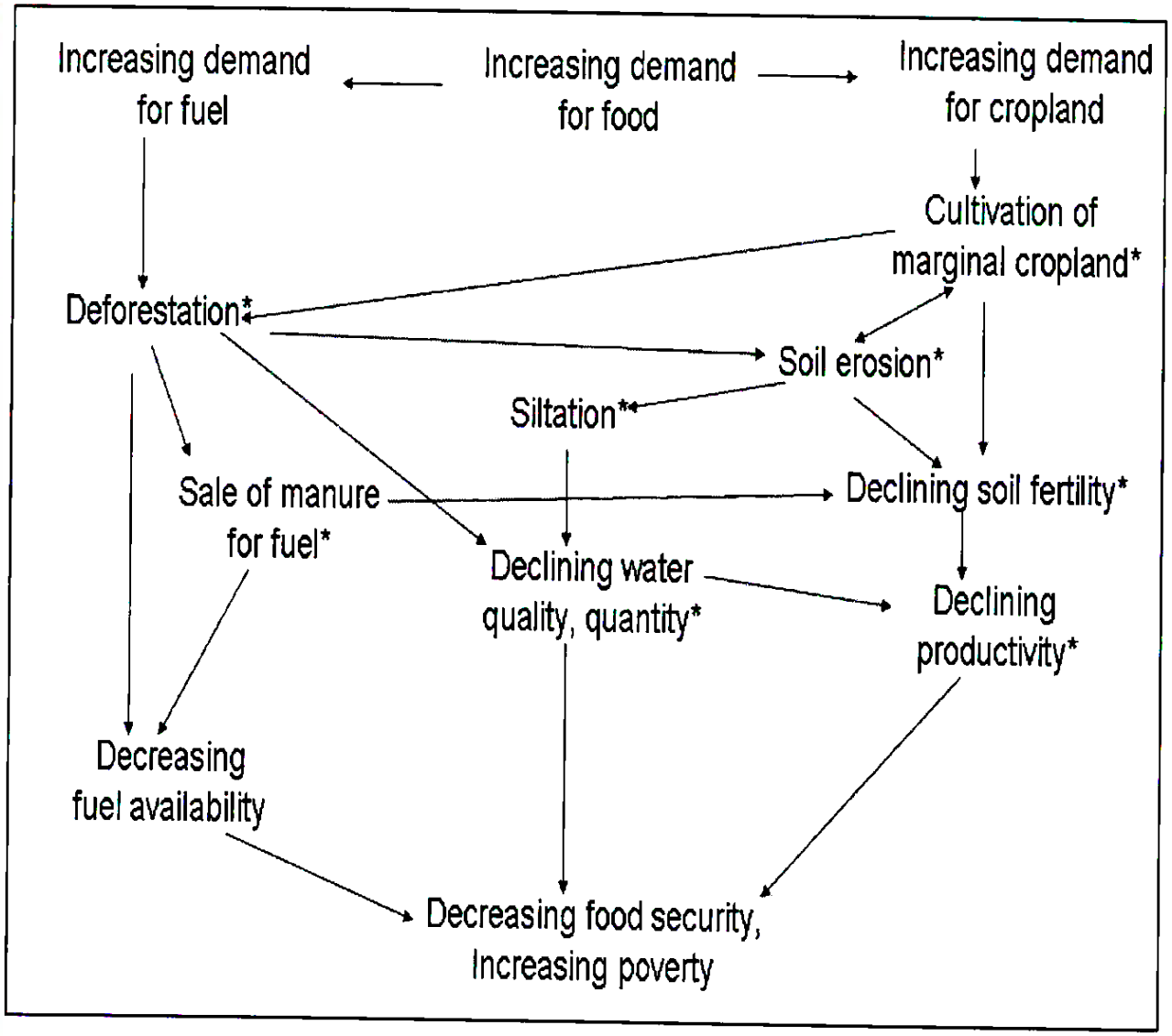
Meeting with Kebele and Farmers Committees

Meeting with Gondar City Administrators

Angereb Watershed Problems

- Deforestation
- Soil erosion
- Loss of soil fertility
- Severe water shortage (urban and rural)
- Chronic Health problen
- High levels of poverty

Problem Model



Environmental Degradation, Food Insecurity and Poverty

The objectives

- Promote integrated watershed management, soil conservation and longevity of the Angereb reservoir;
- Collaborate with farmers, government representatives and NGOs to develop sustainable practices and enterprises;
- Promote tree planting through Agroforestry to improve environmental function;
- Increase the awareness and participation of people who live in the watershed.

Concepts of Sustainable Development

- The concepts of sustainable development was first introduced by the United Nations General Assembly in early 1980s.

- The Assembly was concerned about world population growth, Deforestation, and environmental challenge.

- In 1987 the Commission published "The Brundtland Report" or know as "Our Common Future":

Concepts of Sustainable Development

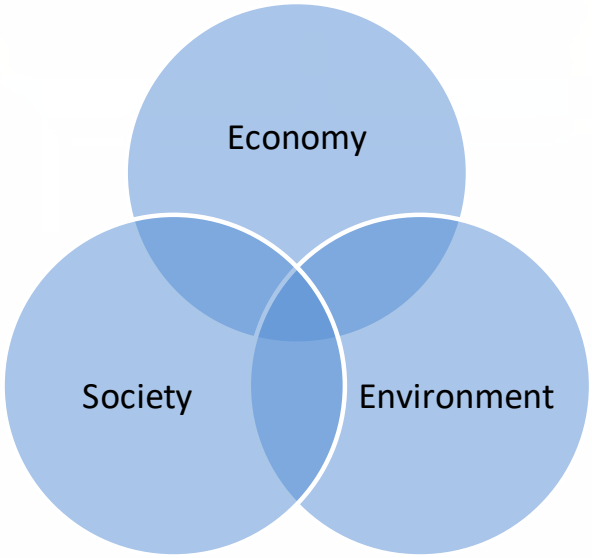
- In this report they defined Sustainable Development:
  - "Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs"

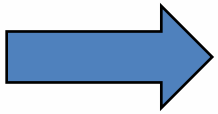
    Burndtland, 1987

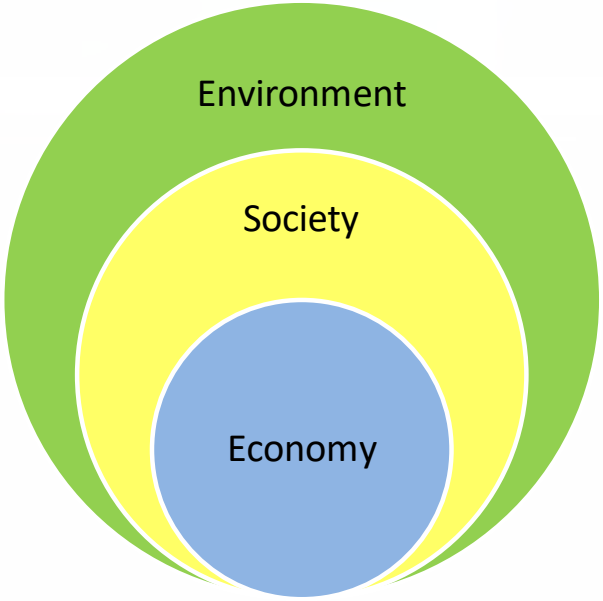
- The three pillars of sustainability include:
  - Environmental – addresses productivity and ecosystem services,
  - Society includes: social, cultural, ethical and political aspects,
  - Economy

Sustainability Model

Triple Bottom Line: Interconnected and Interdependent benefits







Weak Sustainability

Three legged stool with equal Importance Interchangeable legs

Based on Burndtland 1987

Strong Sustainability

A healthy environment is the foundation of social and economic sustainability

Giddings 2002

Ecosystem Based Approach

- The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use.
- It is based on the application of scientific knowledge focused on levels of biological organization.
- The ecosystem approach encompass the essential processes, functions and interactions among organisms and their environment.
- It recognizes that humans, with their cultural diversity, are an integral component of ecosystems.

https://www.cbd.int/ecosystem/

Application of Ecosystem Approach and Sustainability

- Integrated Watershed Management:
  - Management of land, water and living resources
- Integrated **socio-agro-ecological approach:**
  - Long term approach (Fig. 2)
- Integrates farming practices, resource conservation, and reservoir maintenance:
  - Sustain long-term function.
- Adaptive management:
  - Learning-by-doing.

Ecosystems and Sustainability Approach

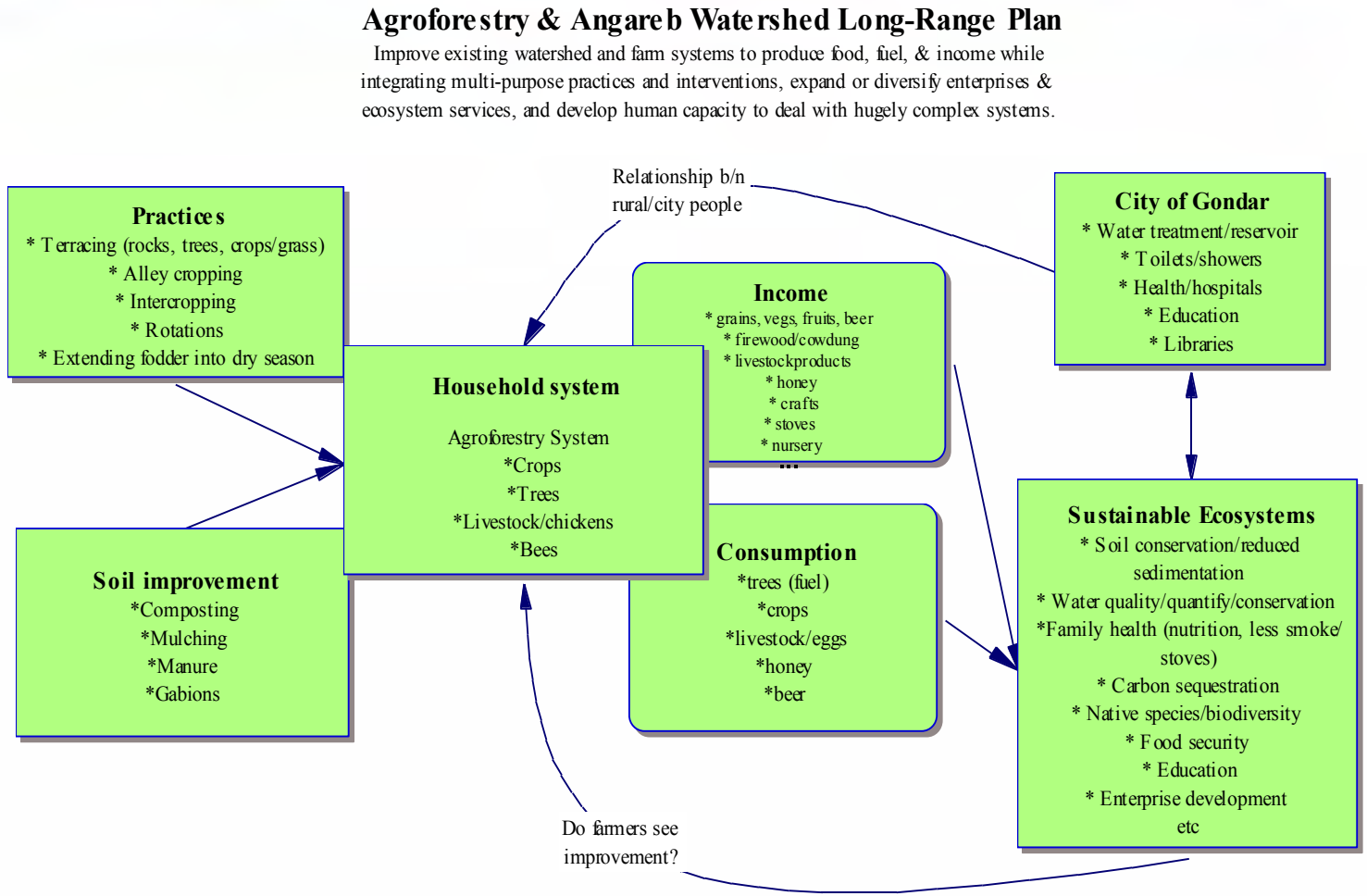


Fig. 2. Angereb watershed long-range plan

Project Implementation

Agroforestry and Tree planting

- Nursery improvement
- Tree planting and building terraces

Community Participation

- Participatory approach
- Trainings, Workshops & Education

Strong Integration

- Watershed restoration,
- Water group
- Education

Agroforestry and Tree Planting Project

Weleka Nursery

Sowing seeds and raising multipurpose seedlings

Selecting multipurpose trees for Agroforestry

Seedlings ready for field planting

Preparation for Field Planting

Current Planting site Bukaia Sheleko Sub Watershed

Agroforestry and Tree Planting Project

Seedlings Produced and planted in the Angereb Watershed 2008 - 2019

Year	# Seedlings
2008	67,000
2009	250,000
2010	350,000
2011	291,165
2012	228,347
2013	253,160
2014	262,548
2015	200,000
2016	125,000
2017	125,000
2018	125,000
2019	100,000
Total	**2,497,220**

Assuming 1.5m X 1.5m spacing = 2.25m^2/Seedling , will plant ~ 4,450 seedlings/ha.

Well construction

- Since 2010, 19 water sources were constructed.
- In 2015
  - 2 Drilled wells
  - 1 Hand dug well
  - 2 Developed springs
- Provide clean water to 1,700 households in Gondar city and surrounding villages

Agroforestry is a dynamic, ecologically-based, natural resource management system

The Right Tree for the Right Place and Right Purpose

A. Trees for Products

fruit

firewood

medicine

income

sawnwood

fodder

B. Trees for Services

soil fertility

carbon sequestration

soil erosion

watershed protection

shade

biodiversity

AF for Production and Environmental Services

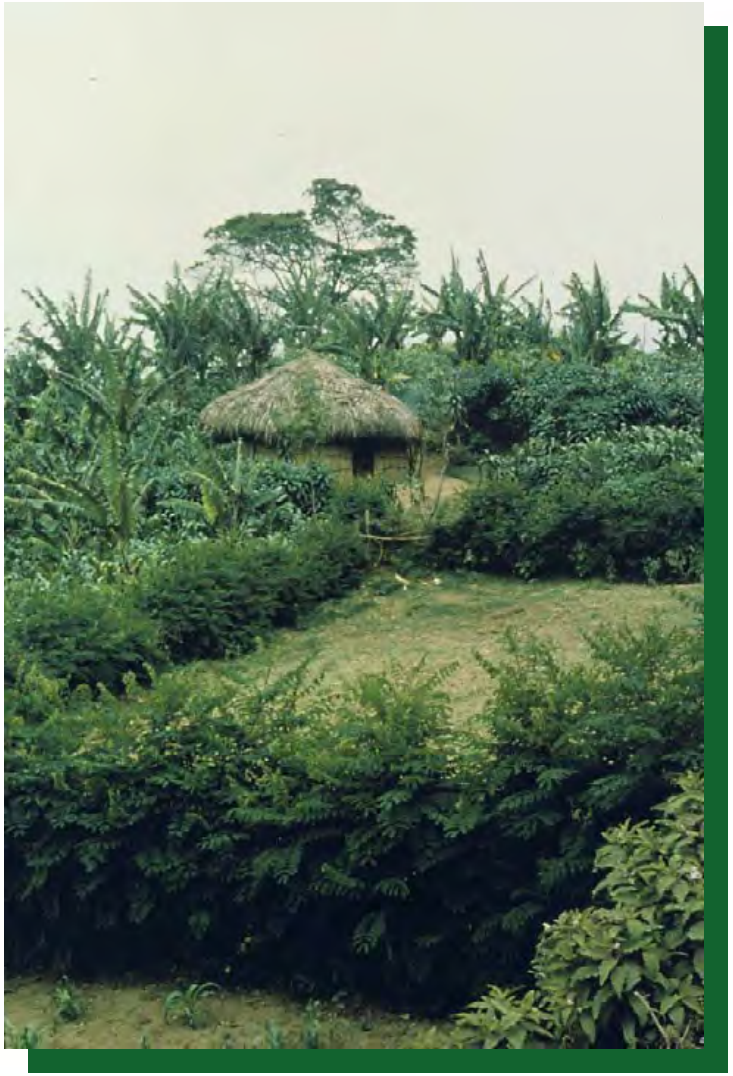
- **Tree-based Agricultural Systems**
  - Improve food security and livelihoods,
  - Diversify food and livestock production, mixed farming,
  - Reduce deforestation and increase forest cover,
  - Provide for people's physical and economic viability.

Agroforestry for Soil and Water Conservation

- **Soil and Water Conservation**
  - Trees and shrubs planted on terraces reduce soil erosion.
  - Trees and shrubs create physical barrier and enhance water infiltration.
  - Nitrogen fixing trees improve soil fertility and increase crop yields (income).

Agroforestry for Biodiversity Conservation

- **Increase Biodiversity and Reduce Risk**
  - The multipurpose trees and shrubs planted in agroforestry systems increase vegetation diversity.
  - The diverse nature of agroforestry helps reduce crop failure and economic risk.



Agroforestry for Carbon Sequestration

- **Trees for Carbon Sequestration:**
  - Trees and shrubs on farms sequester carbon and mitigate climate change,
  - Agroforestry systems store significant amounts of carbon belowground.
  - Carbon stored by Agroforestry systems could be sold in carbon credit markets (income).

Recommendations for IWM and Agroforestry

- Control soil erosion by constructing check dams, terraces and soil improvement activities,
- Focus on multi-purpose trees, shrubs, and fruit trees to improve agricultural production and increase incomes,
- participatory approach and build on exciting culture and addressing local development issues,
- Build the capacity and awareness of local people through training and workshops,

Recommendations for IWM and Agroforestry

- Education and training in environmental health and climate change at elementary, high schools and universities,

- Increase the scientific knowledge on ecosystem-based approach by engaging universities, national and international research institutions,

- Increase interagency collaborations and ministries, such as Agriculture, Forestry, Environment, Water, Health, Education, etc.

Save Lake Tana – Fight Water Hyacinth

- Water Hyacinth is an invasive weed
- Integrated control strategy, manual, mechanical and biological.
- Riparian buffer along the lake to filter sediment, nutrients and pesticide.
- Integrated watershed management to reduce erosion.
- Practice agroforestry to address food security.

Grand Ethiopian Renaissance Dam - July 2020

- First phase filling the GERD dam is a great success!
- Great concern about siltation of the dam.
- Treat the Blue Nile River Basin with integrated watershed management and Agroforestry.
- Green Legacy project.

Conclusions

- Adaptive management is the approach: Learning-by-doing is necessary as we address climate variability and change.

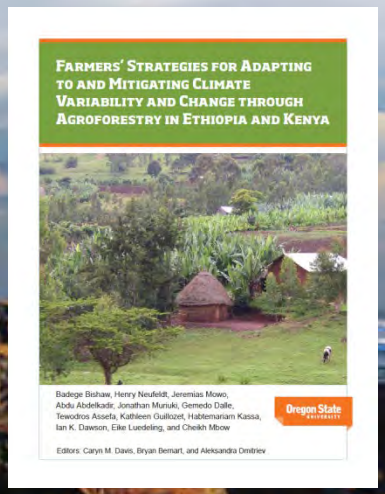
- To improve agroecosystems robustness and increase the resilience of both rural communities and the environment:
  - Use and expansion of agroforestry is critical,
  - It is an ecological based and traditional farming system.

- Scaling up the experiences gained from the Angereb watershed on soil and water conservation and agroforestry to address:
  - Water Hyacinth invasion on Lake Tana, and
  - Reduce siltation of the GERD is critical.

Conclusions

- Create international cooperation between the Nile Basin countries.
- Promote sustainable and equitable water use between member countries.
- Create an institution to bring people and business to dialog and create understanding.
- Work towards regional peace and sustainable development.

OSU Institutional Collaboration with African Institutions



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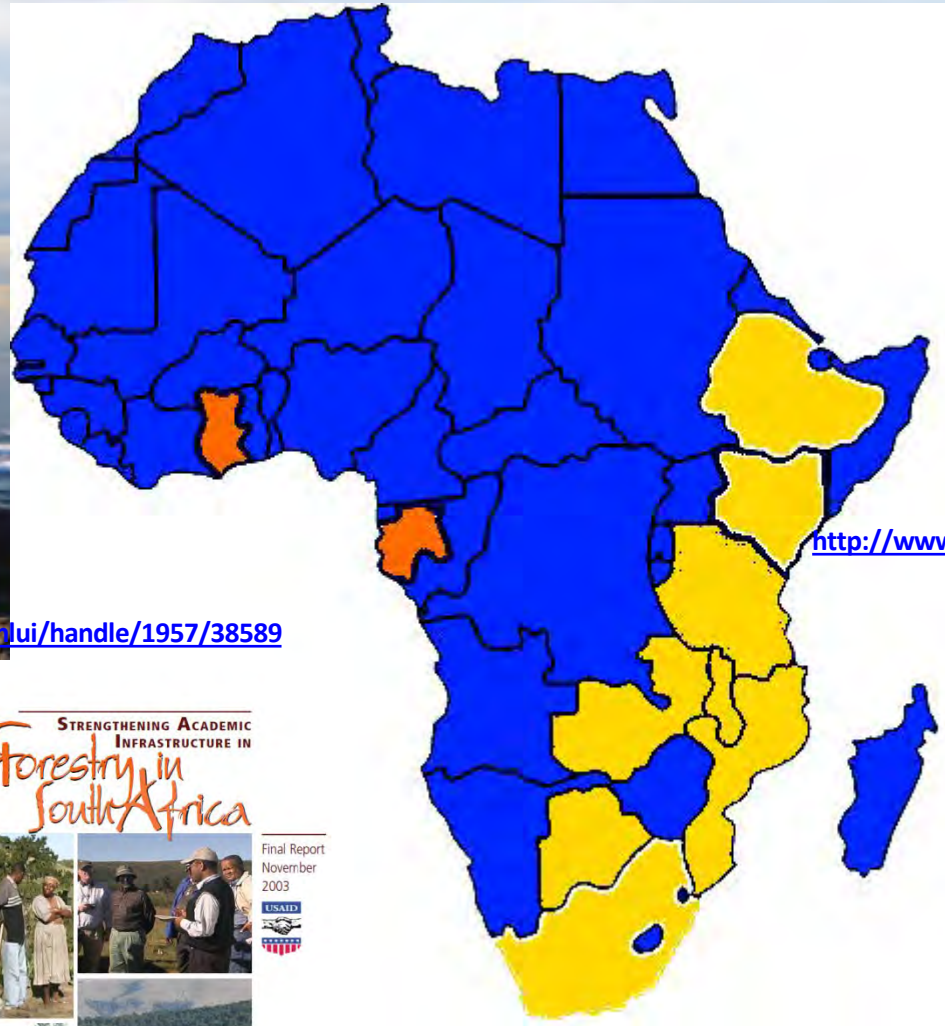
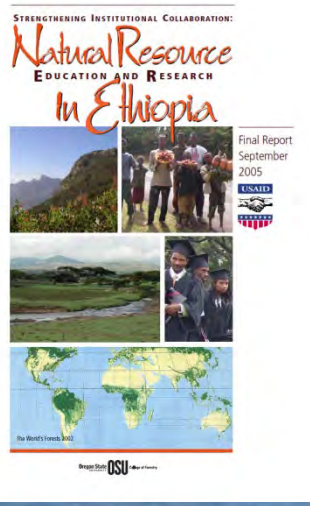
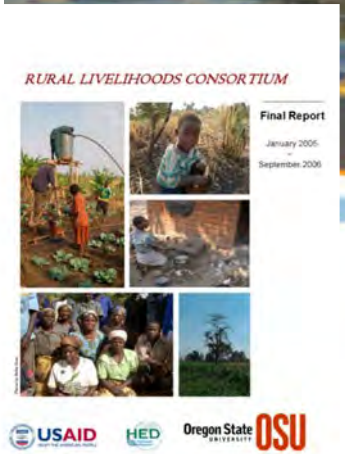




http://www.cof.orst.edu/project/ethiopia/

http://www.cof.orst.edu/project/usaidalo/index.htm



http://international-programs.forestry.oregonstate.edu/sites/ip/files/Final%20Report%20Rural%20Livelihoods%20Consortium.pdf

UNEP

OSU-University of Gondar Collaboration MOU

Social and Culture

Questions?