Overview of Climate Change & adaptation in Africa/Ethiopia

Aster Denekew Yilma

Third United Nations International UNSPIDER Workshop: "Disaster Management and Space Technology - From Concepts to Application “

Bonn, Germany
21- 23 October, 2009

Introduction - CC impacts

The African continent is vulnerable to the impacts of climate change because of several factors:

- poverty,
- recurrent droughts,
- Population growth and urbanization,
- inequitable land distribution,
- over exploitation of resources,
- subsistence rain-fed agriculture, etc.

Introduction - CC impacts

Sectors particularly vulnerable to climate change:

- **Agriculture:** Extreme weather events, combined with a low capacity to adapt to the adverse impacts of climate change, aggravate food security risks
  - Due to shortage of rainwater/changes in rainfall patterns,
  - exposed to flooding /erosion, declining soil fertility,
    decline in productivity, reduced yield, food insecurity
- **Water:** floods or droughts, loss of wetlands

- **Ecosystems:** rapid environmental degradation resulting from agricultural expansion to marginal lands and deforestation,
  - loss of biodiversity, desertification, etc.
- **Human Health:** Climate-related hazards have a significant impact on human health.
  - Malaria (increase in temperature), vector and water borne diseases, malnutrition (during drought years)
- **Energy**: use of biomass as source of energy increase CO2 emission.

Cases: Drying Lakes

- Lake Haromaya, Ethiopia: the most dramatic changes on wetland degradation
  - severe soil erosion, resulted from the intense rainfall, and steep slopes,
  - over abstraction of the water leads to problem of sedimentation and siltation and
  - complete dried up of the lake.
- The case of Lake Haromaya can be an example of the serious threat and an alert for other existing lakes in Ethiopia/Africa.

Lake Haromaya in the year 1989 (a) and in the year 2005 (b).

(Dagnachew, 2007)

Cases: Drying Lakes …

- Lake Naivasha, Kenya, an official 'Ramsar Site' - 30,000 ha, has turned into a shallow mudpool.
- The wetland areas are facing commercial overexploitation. Flower farmers in the lake continue their production, despite the extreme water shortage that the area is facing.

(Source: Wetlands International)

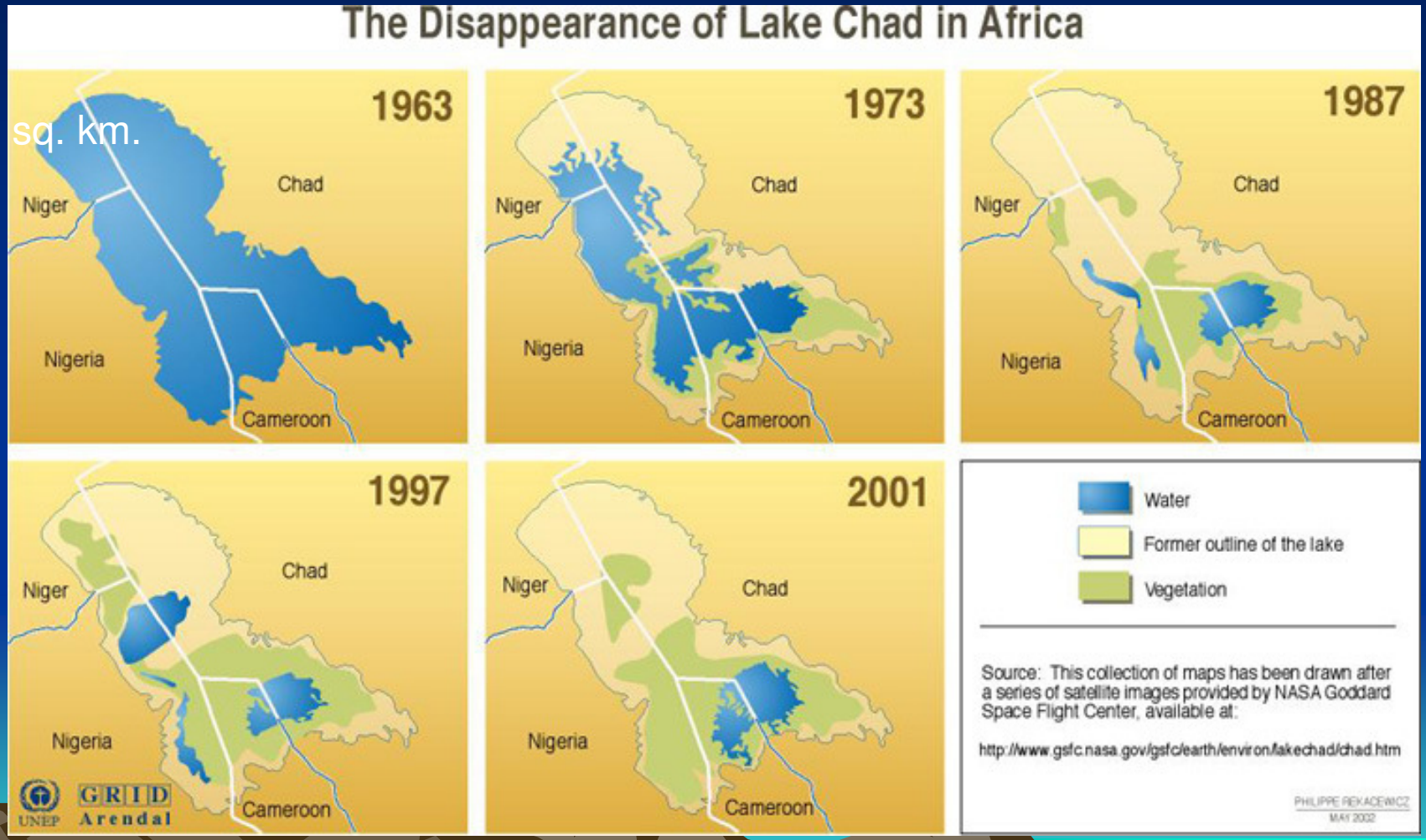
poor wetland management, especially unsustainable use of water resources, is the root cause of the totally drying up of wetlands in Africa.

Cases: Drying Lakes …

- Lake Chad, once one of Africa's largest freshwater lakes, has shrunk dramatically in the last 40 years.
- Lake Chad's shrinkage is due to:
  - ever increasing demands of an expanding population
  - Overgrazing surrounding the lake, and
  - subsequent decline in vegetation causing extensive desertification.
  - * this environmental degradation is mainly due to resource depletion

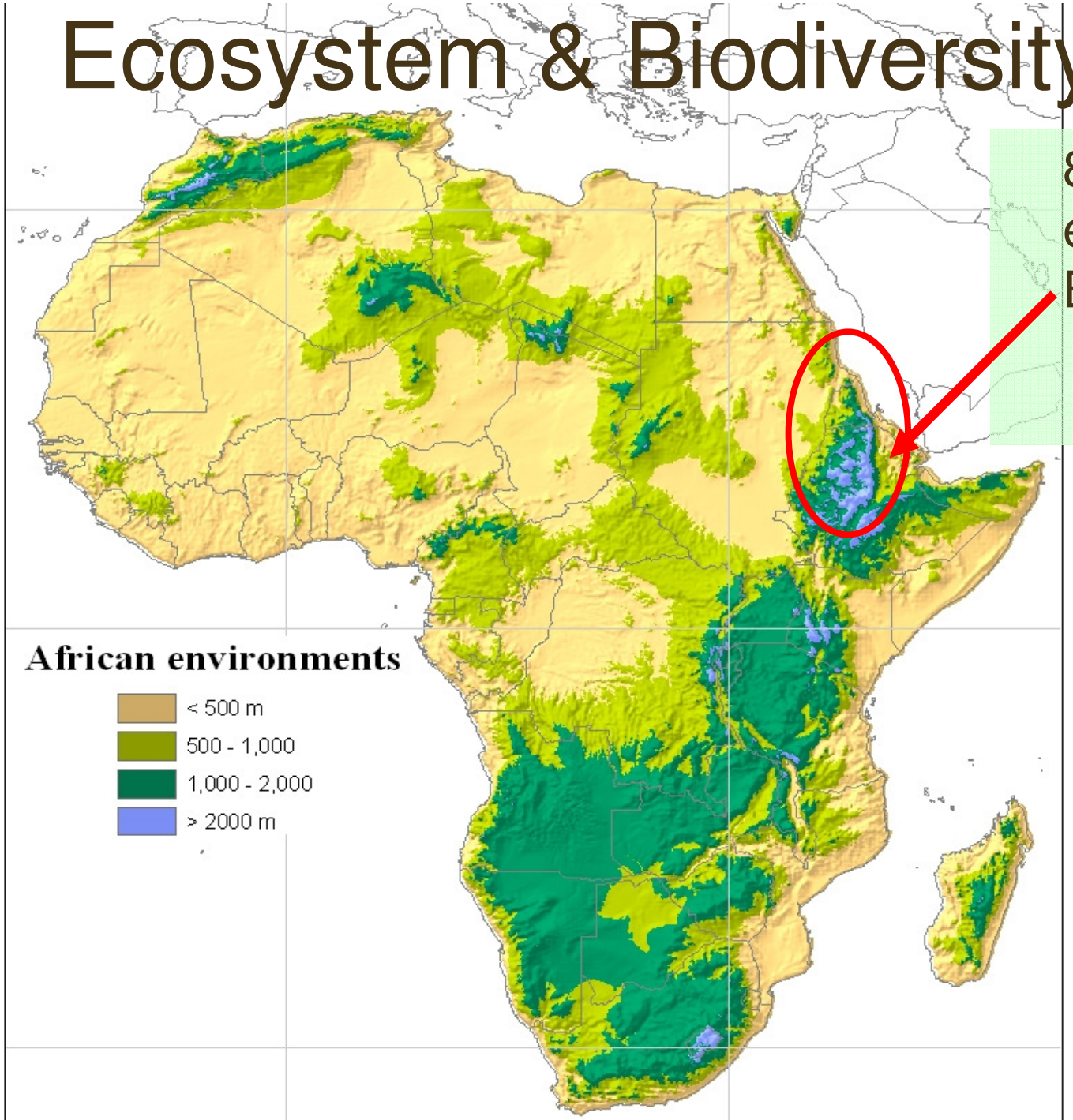
Cases: Drying Lakes …

25,000 sq. km.



1,350 sq. km.

Ecosystem & Biodiversity



80% of Afro alpine ecosystem falls in Ethiopia

(Gete, 2007)

Ethiopia: Shaded Relief

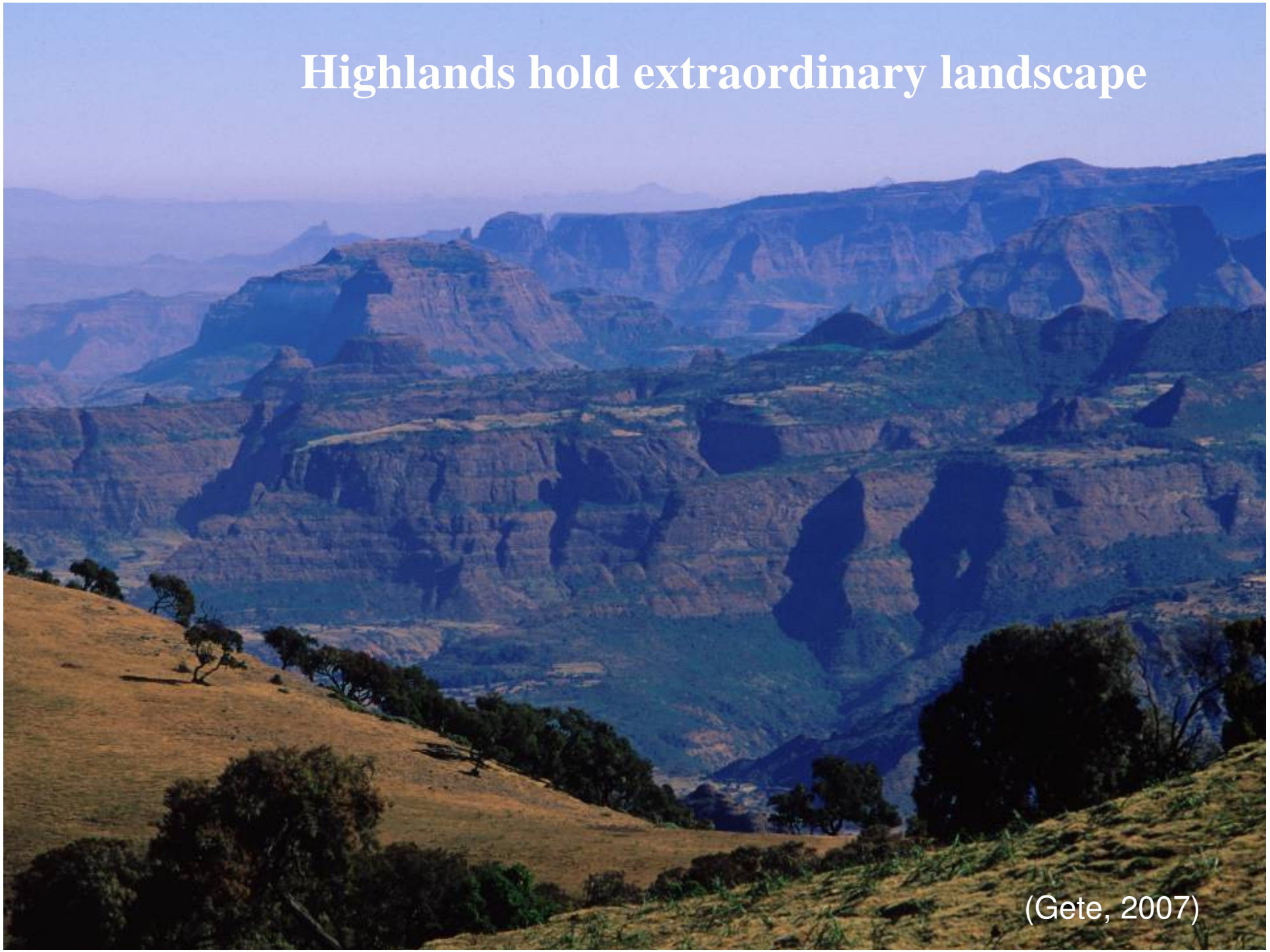
- Nearly 50% of total area
- 90% of Agriculturally Suitable Areas
- 90% human population
- 60% all livestock

0 60 120 180 240 300 Miles

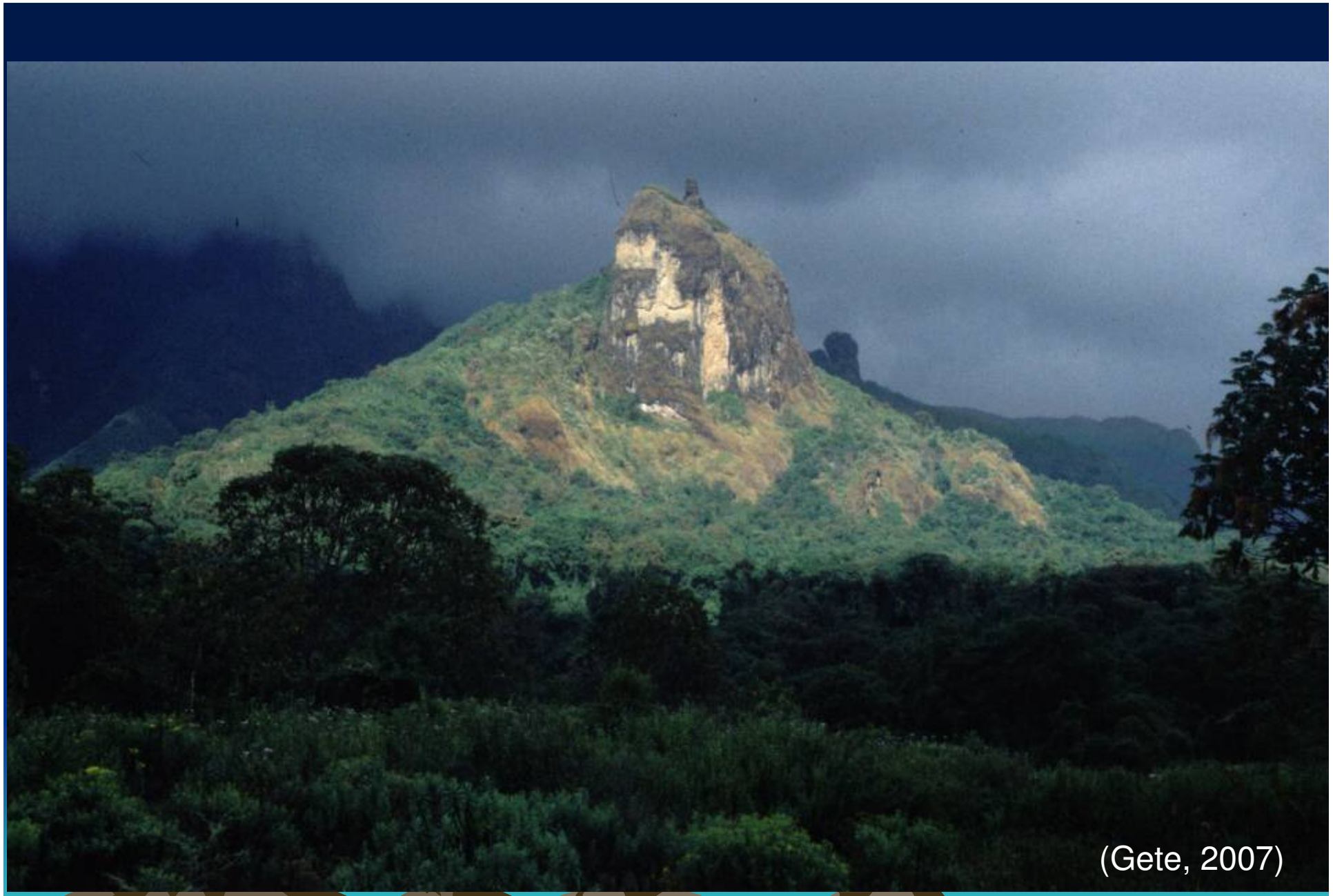
(Gete, 2007)

USGS science for a changing world

Highlands hold extraordinary landscape



(Gete, 2007)



The Bale & south-western forests are about 8,000 years old

(Gete, 2007)

The evergreen montane forests of Harenna (3,200 to about 2,000 m asl) Bale Mountains.

Biodiversity …

5,200 plants, of which 555 endemic

(Gete, 2007)

620 bird species,

29 endemic Species

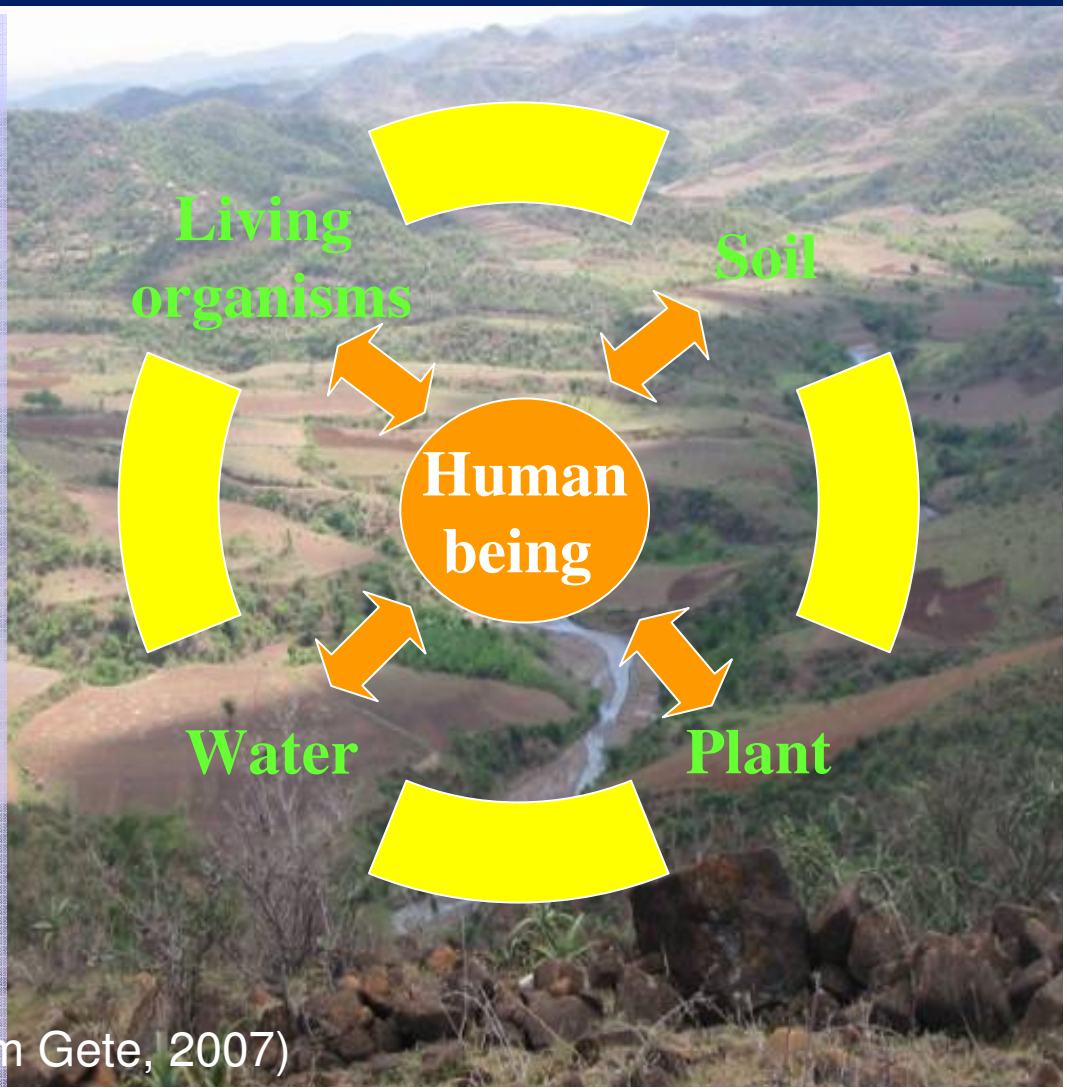
(Gete, 2007)

Biodiversity …

Wild life species,
endemic Species

Land Degradation

- **Highlands are facing serious land degradation and loss of biodiversity**
  - **Human intervention**
  - **Poor land and water management**



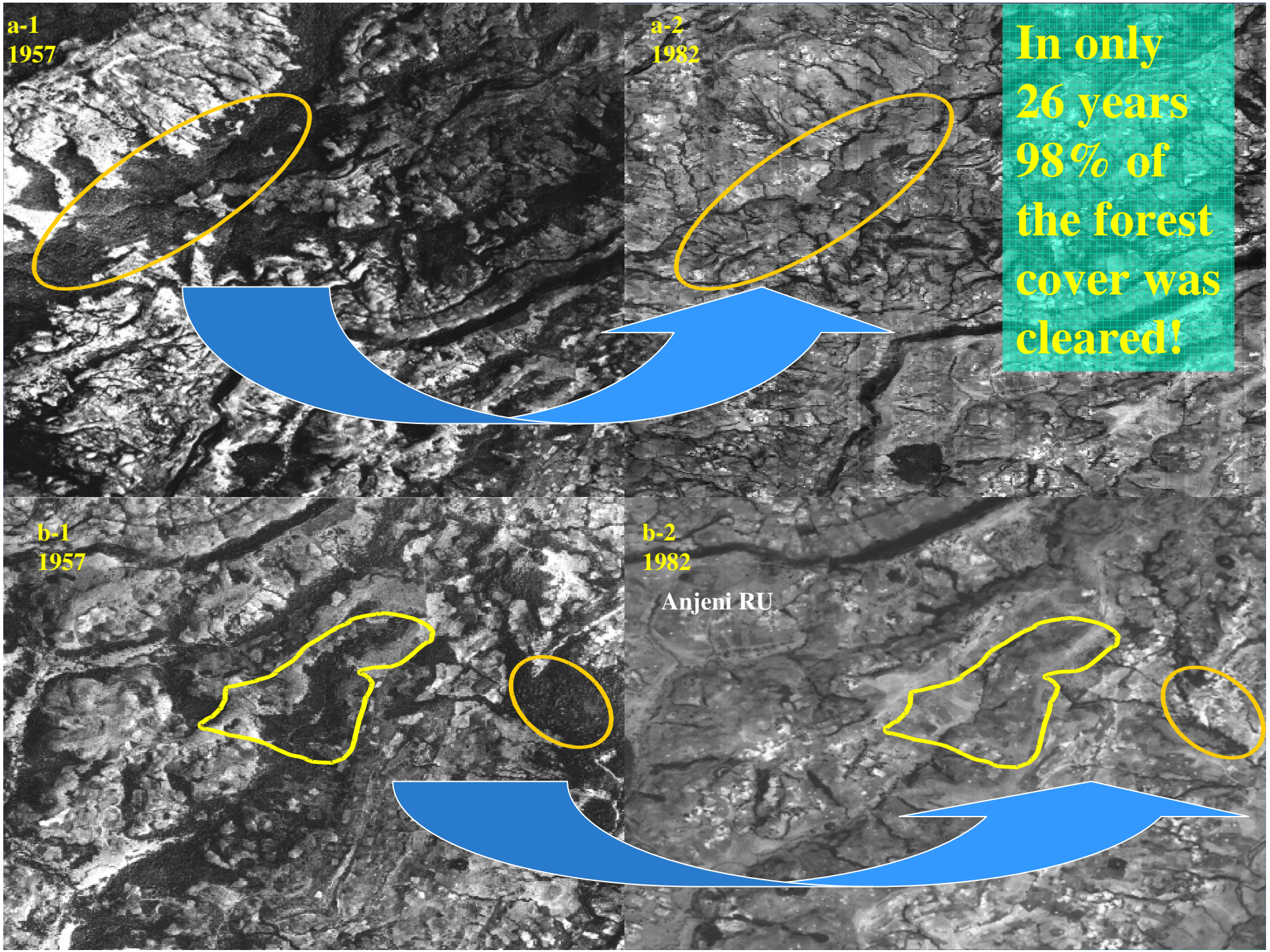
(Slide adapted from Gete, 2007)


Poor land management
(Gete, 2007)

Results:

- Barren landscapes unprotected in many parts of the country,
- Encroachment of virgin forest areas for cultivation without protection

(Gete, 2007)


a-1
1957
a-2
1982
In only 26 years 98% of the forest cover was cleared!
b-1
1957
b-2
1982
Anjeni RU

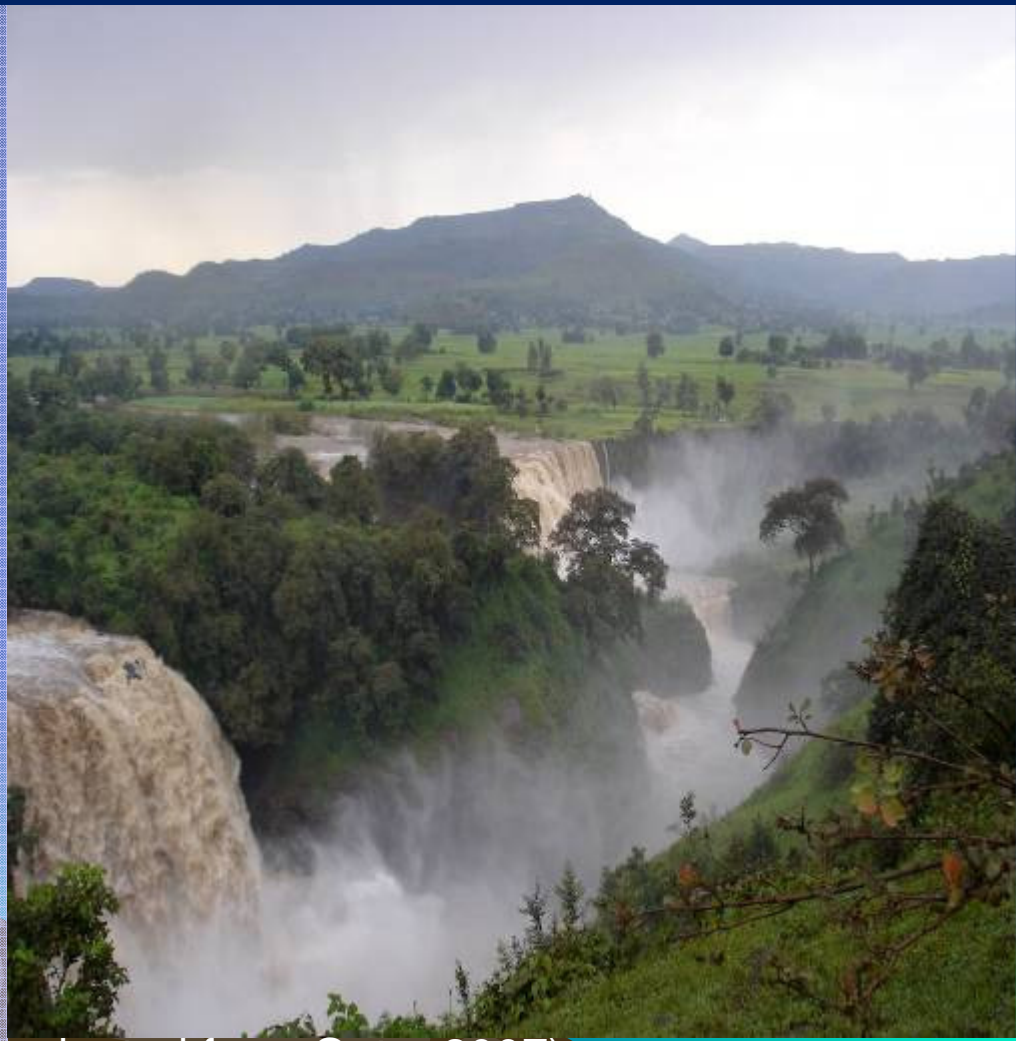
Land Degradation…

- Huge gully erosion washed away cultivated lands
- common in most parts of Abbay (Blue Nile)Basin

(Gete, 2007)

Land Degradation …

- Ethiopian Highlands are water Tours of Africa
- Annual surface flow from 12 major river basins is about 124 billion m^3
  - 75% drains to the neighboring countries



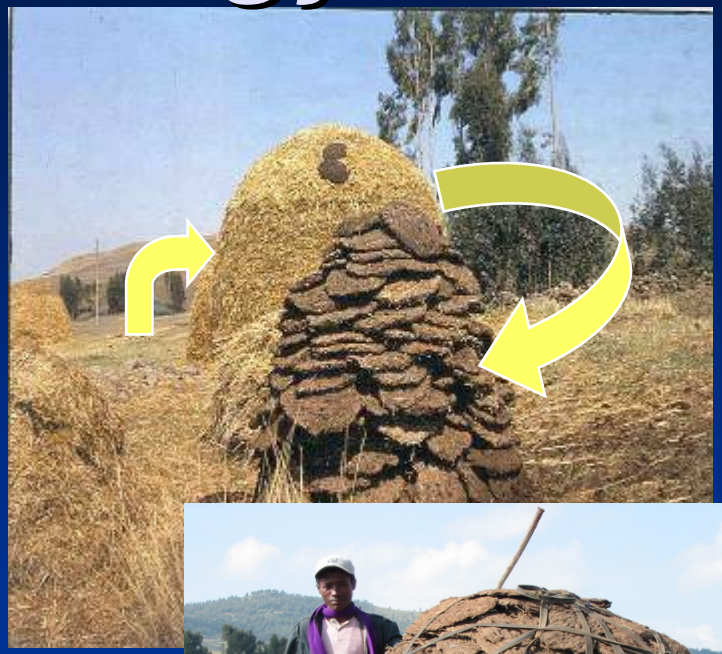
(Slide adapted from Gete, 2007)

Disaster

(Gete, 2007)

Access to Energy

- Nearly 95% HH energy in Ethiopia is generated from biomass
  - Rural - 81 % from fuel wood, 10% cow dung, 9% crop residue and the rest other sources
- This kind of removal of biomass resulted in:
  - Deterioration in soil chemical and physical properties
  - High soil loss by runoff
  - Reduction in soil productivity
  - CO_2 emission
  - Enhance land degradation of diff. forms
  - Poor carbon sequestration
- Aggravates climate change!



(Slide adapted from Gete, 2007)

So what do we need to do?

Comply with International conventions

- UNFCCC
- UNCCD
- CBD…

Adapt to Climate Change

Ongoing Efforts on CC

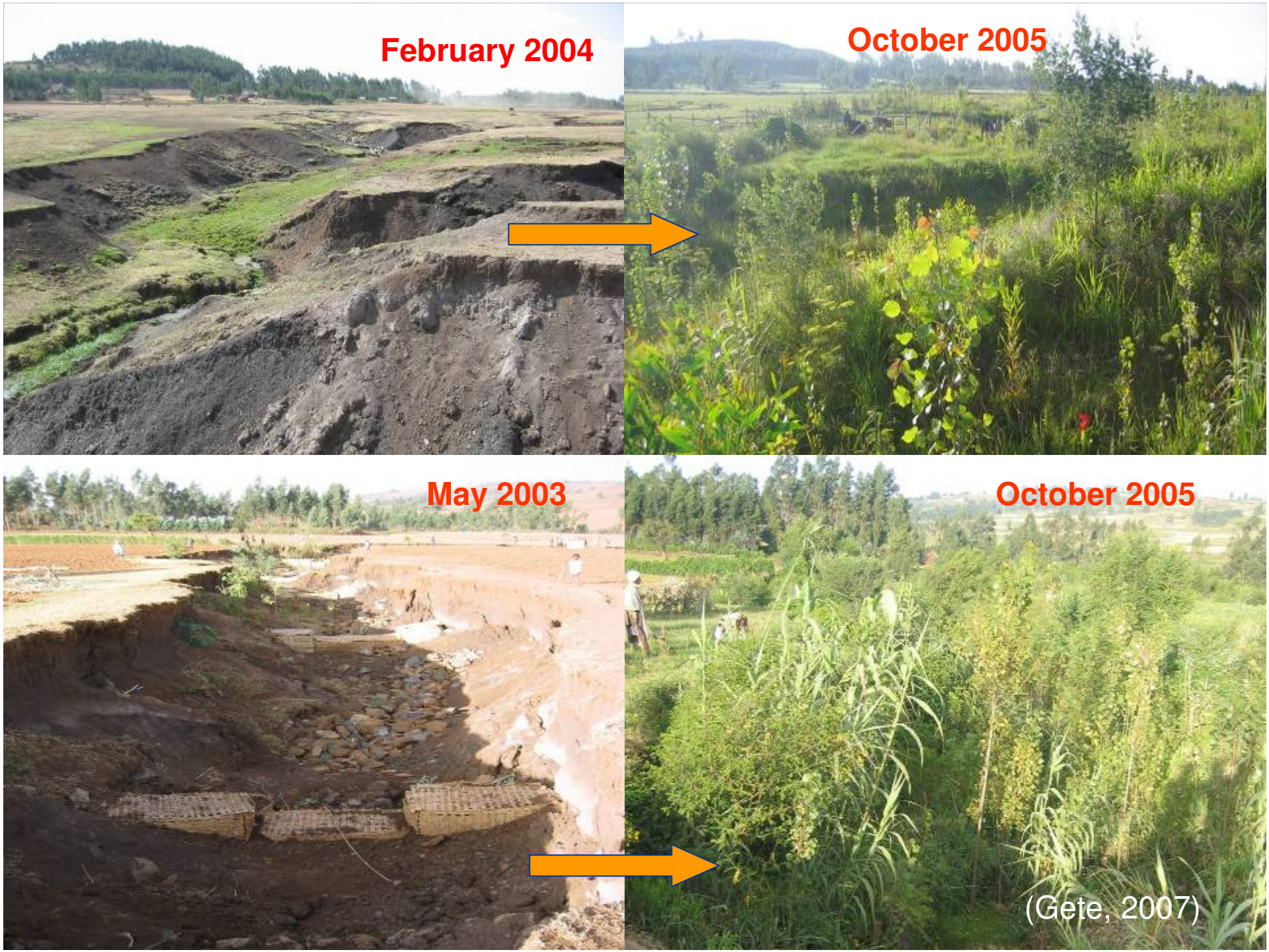
- Efforts towards addressing some of the drivers of Climate Change both in Research & Development,
- Global Change Research Network for African Mountains is established in July, 2007 at Kampla,
- Establishment of high altitude observation system and research network in Ethiopia, January 2008
- Some actions by continental and sub-regional organizations of Africa

Initiatives in African to Address Climate Change

- The African Monitoring of the Environment for Sustainable Development (AMESD) is a joint AU-EU initiative to help African countries manage their natural resources by providing them with timely information on their environment
- The New Partnership for Africa's Development NEPAD environment action plan has it fifth Programme Area dedicated to combating climate change in Africa. With projects in the Agriculture, Capacity building for Observing systems Climate Change, on water and climate in the Sahel region, adaptation to climate change in the Sahel, impacts to climate change.
- The Africa Environmental Information Network (AEIN) is a multi-stakeholder capacity building process that aims to harness and enhance access to information and knowledge to support the management of Africa's environmental resources as assets for sustainable development
- Climate Information for Africa's Development (ClimDev-Africa) is an African development programme to integrate Climate Risk Management (CRM) into pertinent policy and decision processes throughout the continent
- Special Climate Change Fund and the fund for Least Developing Countries (collectively known as the Clean Development Mechanisms) of Kyoto Protocol which will help promote conservation and encourage use of cleaner technologies

Research

- Numerous measures for mitigating the negative impacts of global change have been developed by research programmes
  - Land Management
  - Crop / livestock productivity
  - Water management
  - Protected area management
  - Biodiversity conservation and management, etc
- different kinds of land management interventions by development groups, with success.


February 2004
October 2005
May 2003
October 2005
(Gete, 2007)

Adaptation

- As our climate changes in response to rising temperatures, adaptation will be vital to reduce the impact of climate change,
- key to food security and livelihoods.

Adaptation:

- In human and natural systems,
- Technological (agricultural water management, IWRM, NRM), livelihood diversification, institutions/ governance, etc.

Adaptation…

- Develop and/or adapt technology for alternative sources of energy – biofuels, renewable resources, efficient cooking stoves,
- Adopting Agricultural Systems to climate change,
  - Adapting crops to changed conditions
  - Drought resistant root crop for food security – e.g. Casava plant
- Afforestation - The Ethiopian Millennium “Two Trees for Two Thousand” campaign,
- Conservation of Wetlands,
- Soil Conservation,
- Forest Conservation – mitigate soil degradation and help manage water runoff

Adaptation…

Rainwater Harvesting

Plastic lined pond

Cylindrical tank

(Bewket, 2007)

Adaptation…

Rainwater harvesting &
drip irrigation

Implications for adaptation to cc:

- cheaper construction by households,
- privately owned-maintenance and management,
- food and nutrition security

(Bewket, 2007)

IWMI in CC

- As climate change poses an ever-greater threat to water systems and agriculture, flexibility in choosing from a variety of water storage systems will become an increasingly important mechanism for adaptation.
- Farmers have always relied on the water stored in rivers, lakes, floodplains and wetlands.
- Groundwater is other major store of water.
- One third of the Earth's freshwater supply is thought to be stored as groundwater and provides most of the water used for irrigation.
- groundwater includes the moisture stored in the soil,
- Soil conservation is important, especially in areas where there is little water or rainfall.

(IWMI Water Figures Newsletter, 2009).

IWMI in CC

- we can expect increased rainfall variability and an increase in average temperatures.
  - rainfall will decline, which means there will be less water in rivers and it will take longer to recharge groundwater aquifers.
  - total precipitation may increase, but it will all fall within a shorter period of time and annual dry spells will be longer
- Higher temperatures will increase the amount of water plants require for growth.
- We need to store more water, not just for irrigation, but also for domestic, industrial and environmental uses

(IWMI Water Figures Newsletter, 2009).

IWMI in CC

- Understanding how we adapt to our current state of climate variability is the key to adapting to future climates
- Water storage is one option for adaptation

(IWMI Water Figures Newsletter)

Traditional stonelined artesian well, Ethiopia.

IWMI in CC

Figure 1. Options for Adaptation

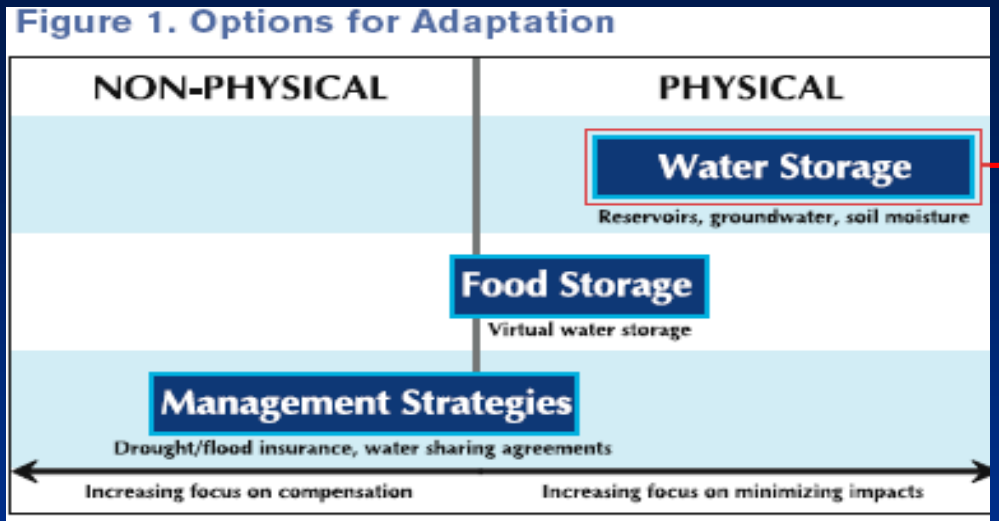
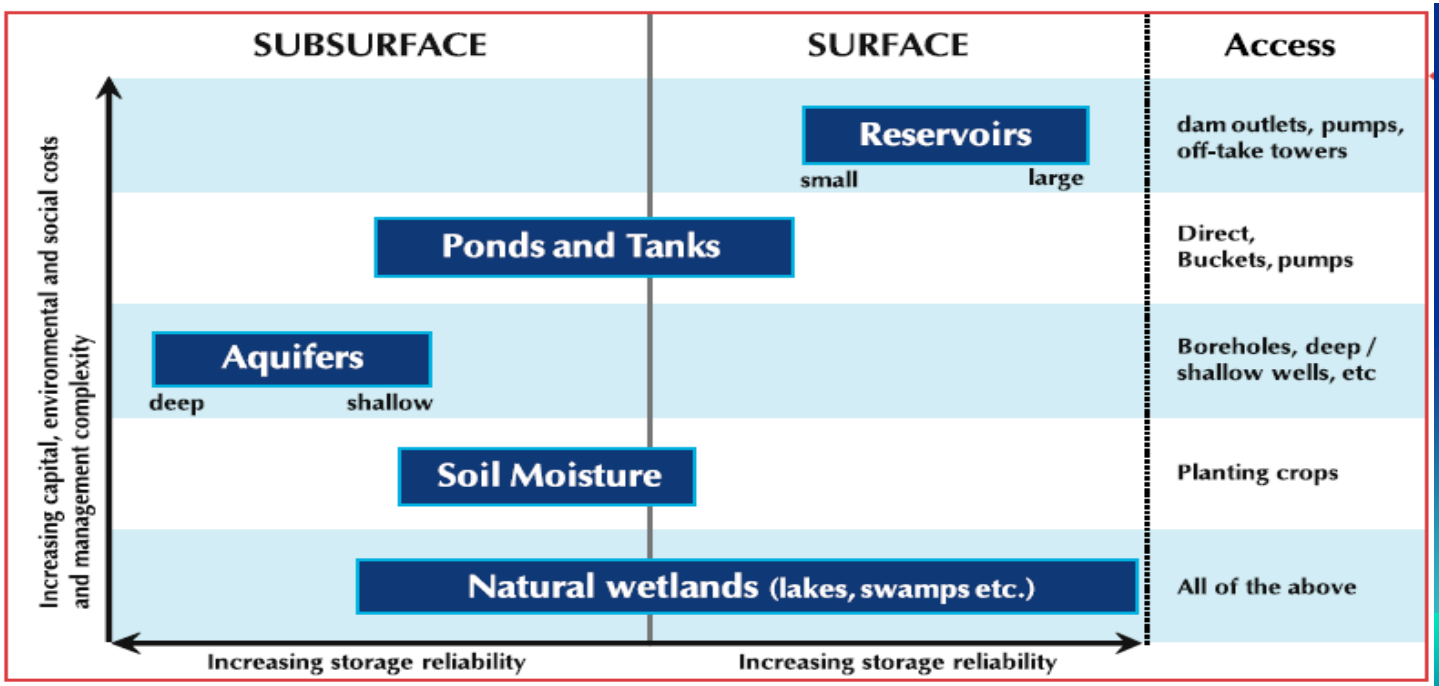


Figure 2. Water Storage Options



(IWMI Water Figures Newsletter)

IWMI in CC

- Natural wetlands are by far the least expensive to maintain and the most reliable.

  i.e. it will be far cheaper to conserve existing wetlands
- large-scale dams are the most controversial
  - large dams have contributed significantly to economic development.
  - long-term consequences of changing river flow patterns downstream,
  - negative social and environmental impacts

IWMI in CC

- need for a better understanding of the impacts of increased investments in water storage on the environment and long-term feasibility of larger scale interventions.
- The right investments in agricultural water storage and management can significantly lessen poor people's vulnerability to climate change by reducing water related risks and creating buffers against unforeseen changes in rainfall and water availability.
- An appropriate water research agenda will help guide those investments by filling the knowledge gaps between water, food and climate change (IWMI Water Figures Newsletter, 2009).

Conclusion

- Climate change is one more challenge to reducing poverty, hunger, disease and environmental degradation.
- With increasing extremes in rainfall patterns and rising temperatures, it is even more important to manage wetlands in a sustainable way instead of the uncontrolled exploitation of their water resources. Protecting and restoring wetlands is one of the solutions to adapt to climate change in Africa.
- Providing access to commercial fuel and efficient stoves would have highly positive impacts on human development. In developing countries, efficient cooking stoves that use clean biomass fuels are an important option.
- It is time to rethinking the best coping strategy to minimize the impact of climate change in Africa.
- Need for more research to assess the level of degradation on land and water resources, and device mitigation measures and adaptation strategies. And improve the understanding of the impacts of climate change and to make informed decisions on practical adaptation actions and measures.
- Use of space technology is inevitable in Research & Development efforts to mitigate the impact of climate change.

References:

- Dagnachew Legesse, 2008, Climate Change and the Ethiopian Mountains, Presentation in Planning Workshop on Establishing Climate Change Research Network and High Altitude Climate Observatory Systems in the Ethiopian Highlands – Towards Better Knowledge Base for Informed Mitigation Actions, Addis Ababa, Ethiopia, January 2008
- Drought in eastern Africa worsened by wetland loss, Wetlands International, September 2009, http://www.wetlands.org/NewsandEvents/NewsPressreleases/tabid/60/articleType/ArticleView/articleId/1871/Default.aspx
- Gete Zeleke, 2007, workshop on Global Change Research Network in African Mountains Kampala, Uganda, July 2007
- Hillary Mayel, 2001, Shrinking African Lake Offers Lesson on Finite Resources, National Geography News, http://news.nationalgeographic.com/news/2001/04/0426_lakechadshrinks_2.html
- Turning Research into Development, IWMI Water Figures Newsletter Issue 2, 2009
- *Woldeamlak* Bewket, 2008, Climate Change and the Ethiopian Mountains, Presentation in Planning Workshop on Establishing Climate Change Research Network and High Altitude Climate Observatory Systems in the Ethiopian Highlands – Towards Better Knowledge Base for Informed Mitigation Actions, Addis Ababa, Ethiopia, January 2008


Thank you!