Ethiopian Central Rift Valley: Current status, developments and policy implications

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Content

- Introduction to Central Rift Valley
  - Current problems, general information
- Resource use in the CRV
  - Water and land use
- Developments
  - Climate change, land use, expansion Sher-Ethiopa
- Policy implications

Interrelated problems

- Poverty
- Lack of employment opportunities
- Deforestation (charcoal, land clearing)
- Intrusion of people in NP Abijata/Shala
- Overgrazing
- Low agricultural productivity
- Groundwater of low drinking quality
- Over-fishing of lakes
- Etc, etc. but most prominent…..

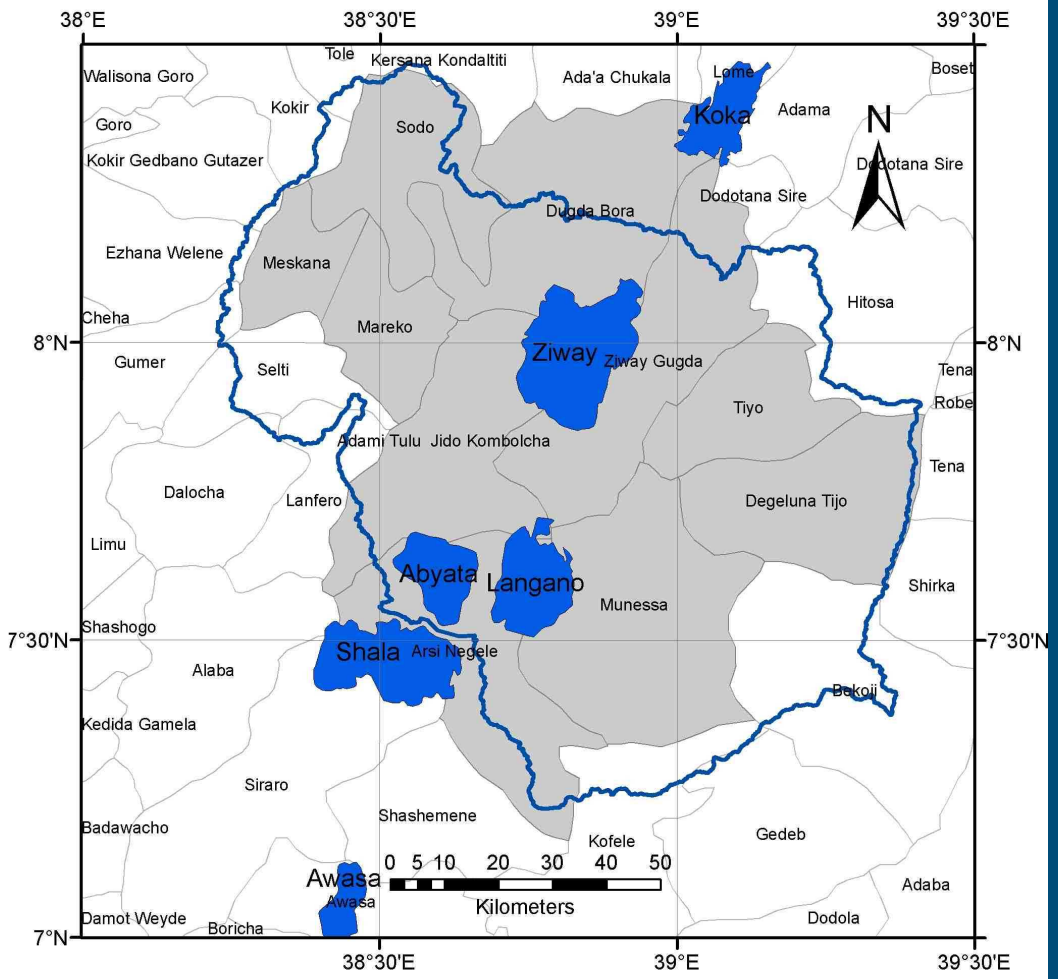
Falling water table Lake Abijata

Objective of study

Development of knowledge base to strengthen local authorities in the field of environmental management enabling a sustainable development of the CRV.

- Clarify interrelated problems
- Identify options for improved resource use
- Contribute to research and policy agenda

Study area



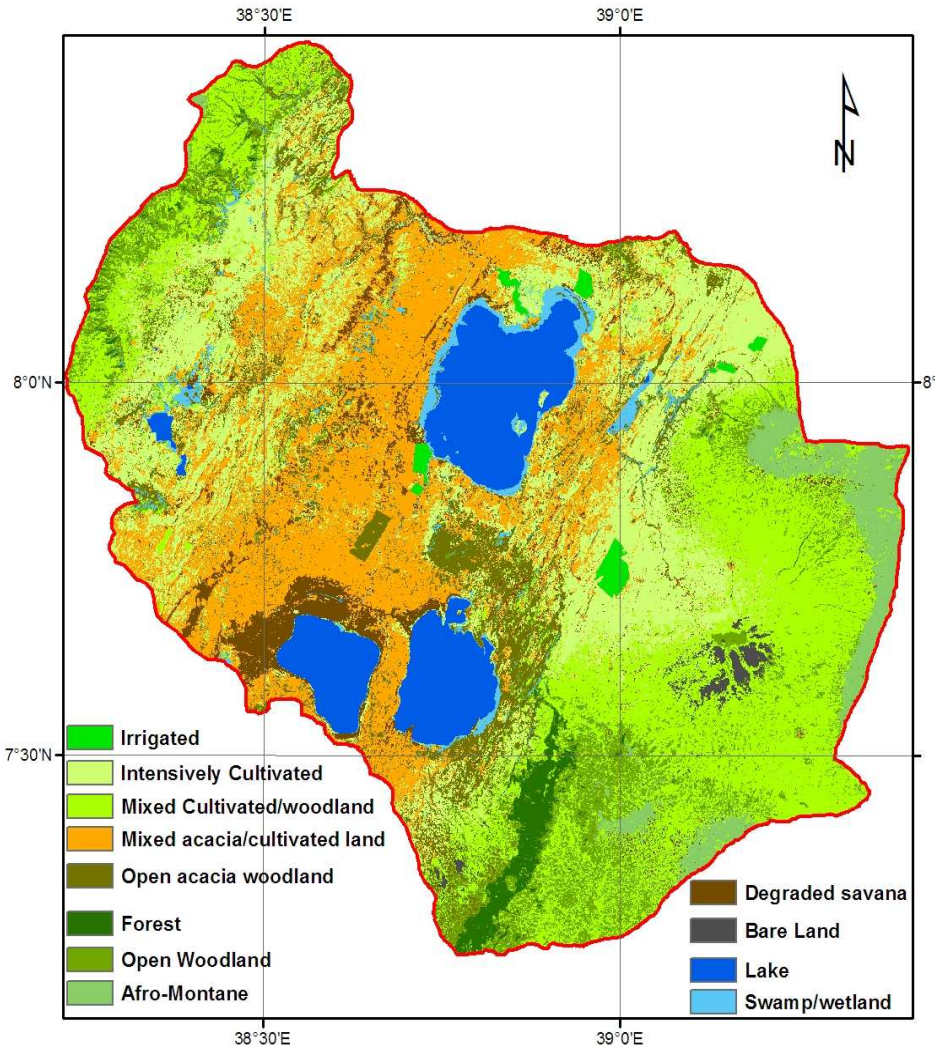
Data limitations:

- Hydrological area ≠ administrative area
- Lack of data
  - e.g. use of irrigation water
- Inconsistent data
  - e.g. boundaries of woredas
- Variability/dynamics
  - e.g. livestock population

Therefore, shown numbers are indicative, but do not affect conclusions

General characteristics Central Rift Valley

- Catchment area: 1.0 Mln ha
- 10 Woreda's in catchment: 0.86 Mln ha
- Human population: 1.5 Mln
  - growth rate: ± 3%
  - average family size: 5.3-7.5 persons
- Livestock population: 0.86 Mln TLU

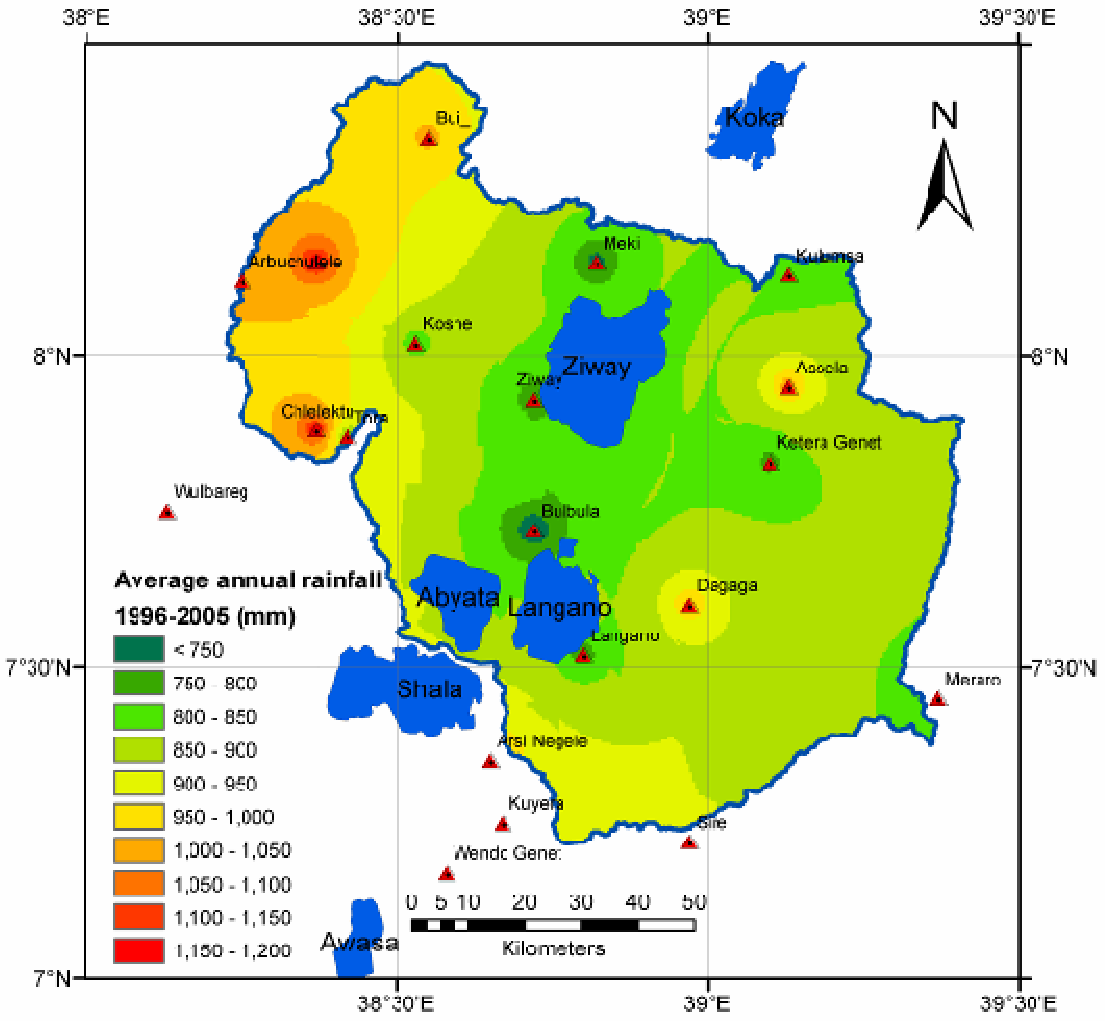


Land cover map of CRV, Ethiopia based on Landsat MSS image, 1999

CoverType	In ha:	
Irrigated land	6600	0.6%
Intensively cultivated	218440	20.8%
Open acacia woodland	88493	8.4%
Swamp/wetland	21706	2.1%
Lake	82611	7.9%
Forest	17249	1.6%
Afro-Montane	38633	3.7%
Degraded savanna	43847	4.2%
Open woodland	82443	7.9%
Mixed cultivated/wood land	231185	22.0%
Bare land	6984	0.7%
Mixed acacia/cultivated land	212898	20.3%

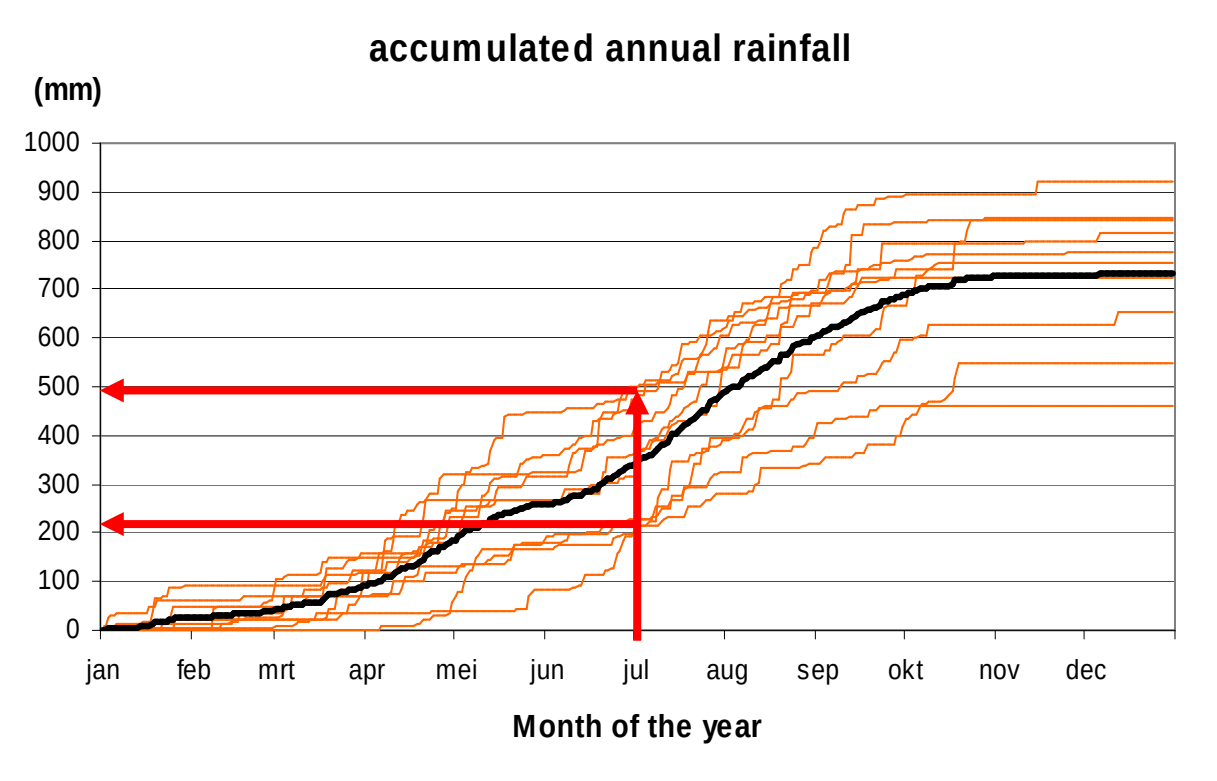
Land use 1999

Average rainfall 1996-2005 (17 stations)



- Total annual rainfall in CRV: 8900 Mln m^3
- Coefficient of variation rainfall:13 – 25%

Rainfall in Ziway (1996-2005)



- Distribution within year highly variable
- Risk for rainfed production

Resource use in the CRV

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Water users

- People
- Livestock
- Soda Ash plant in NP Shala/Abijata
- Sher-Ethiopia
- Irrigated smallholders and state farm

Water use: Domestic & livestock

- Human population: 1.5 Mln
  13.3 l/d/pers (average domestic use Ethiopia)
  Total water use: 7.2 Mln m^3

- Livestock population: 0.85 Mln
  15 l/d/TLU in wet season, 30 l/d/TLU in dry season
  Total water use: 7.7 Mln m^3

Water use: Abijata soda ash plant

Soda-ash (Na_2CO_3) process:

1. NaCl is extracted from lake water by evaporation
2. Chemical process: $NaCl + CaCO_3 \rightarrow Na_2CO_3 + CaCl_2$

Assuming (needs check!):

Annual production of Na_2CO_3: 10.000 ton

NaCl concentration lake water 7 g/l (seawater 24 g/l)

Total water evaporated: 1.5 Mln m^3

Water use: Sher-Ethiopia

- Average use: 25000 m^3/ha/year
- Current area, ±50 ha:
  1.2 Mln m^3
- Target area 1st phase, 250 ha:
  6.2 Mln m^3
- Target area 2nd phase, 450 ha:
  11.2 Mln m^3

Water use: Irrigated smallholders and state farm

- Uncertainties:
  - Total irrigated area
  - Number of crops per year
  - Growing period
  - Crop types / duration (annual or perennial)
  - Irrigation water use efficiency
- Heroic assumptions:
  - Total irrigated area: 8000 ha
  - Average use: 20000 m^3/ha/year
  - Total water use: 160 Mln m^3

Current water use: In summary (Mln m^3)

Domestic use	7.2
Livestock	7.7
Soda ash plant	1.5
Sher-Ethiopia	1.2
Smallholder + state farm	160

Relation between irrigation water withdrawls and water table of lake Abijata?

Irrigated area in CRV: 8.000 ha

Total area CRV: 1.0 Mln ha

→ < 1% of CRV is irrigated

Water use irrigated smallholders & state farm: 160 Mln m^3

Total rainfall in area: 8.900 Mln m^3

→ < 2% of total rainfall is used for irrigation

Conclusion: No relation between irrigation water withdrawls and water table of lake Abijata???

Lake Abijata depends on rainfall & water from catchment (a.o. Bulbula river)

Water deficit Abijata (evaporation – rainfall): 180 Mln m^3

Estimated water extraction along Bulbula: 25 Mln m^3

10-15% of annual water requirements of Lake Abijata is extracted from the Bulbula

Resource use: Value of irrigation water (Birr/m^3)

(income – costs) / withdrawn irrigation water

	(Birr/m^3)
Roses	23
State farm: grapes	- 0.4
State farm: tomatoes	0.8 (5.5)
Smallholder production	???
Soda ash production	???

Value of irrigation water

Improvements through:

- Increased yields
- Crops with higher added value
- Reducing costs
- More efficient water supply

Resource use: Labour requirements

	(pers/ha/y)
Roses	35
State farm	7
Smallholders	2 ?
Soda ash production	??

Resource use: Land

- Animal husbandry farming

Livestock density: ± 1 TLU/ha

Feed requirements: 3 t dry matter/ha

Result: overgrazing

- Rainfed arable farming (± 400.000 ha)

Low yields (± 500-1000 kg/ha maize) associated with low external input use

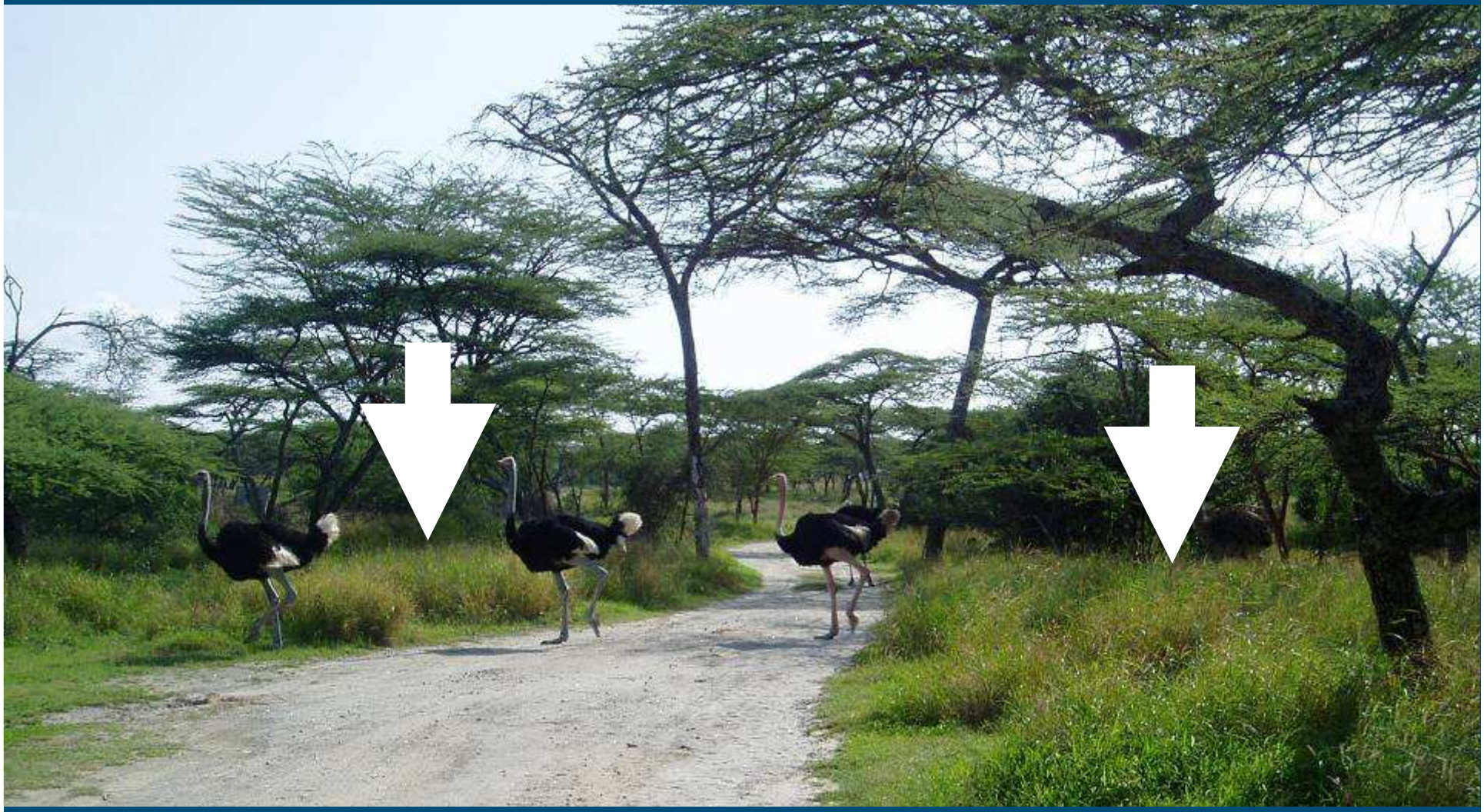
Result: soil nutrient depletion and land clearing

- Animal husbandry and rainfed arable farmers: food insecure

Result: deforestation for charcoal production

- Overall effect:

Overgrazing + deforestation + soil depletion ➔ land degradation



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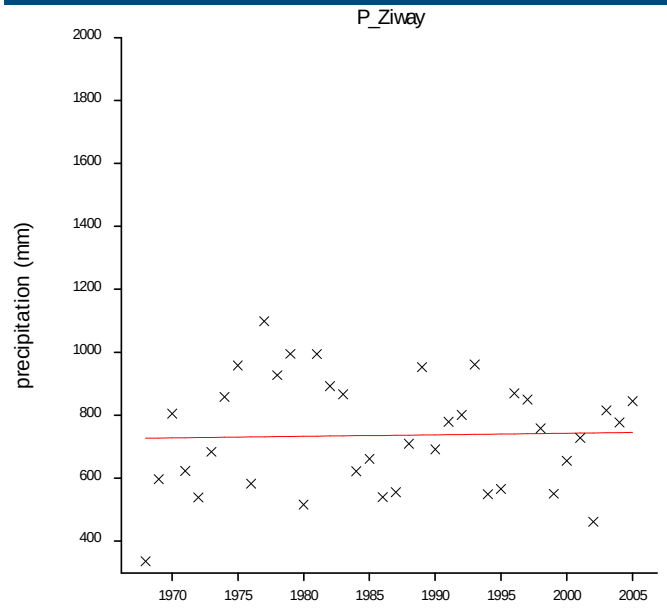
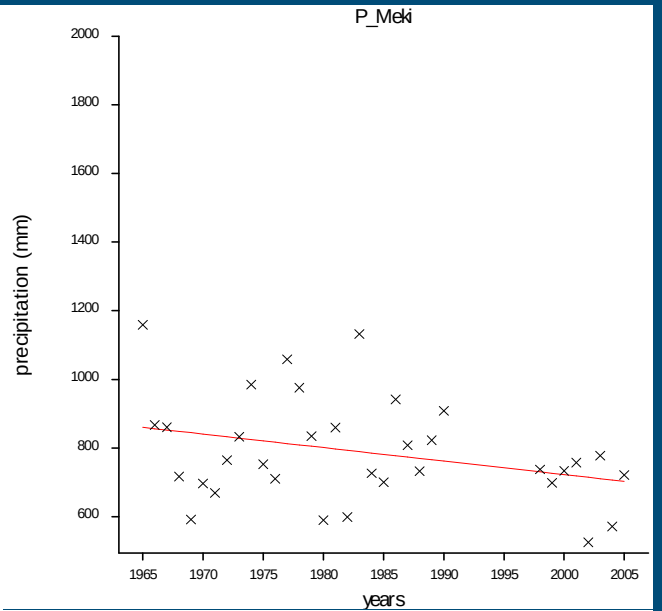
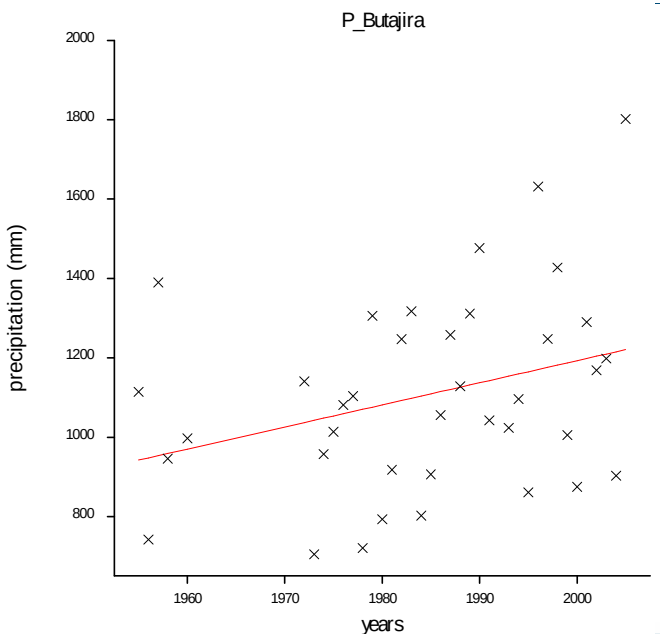
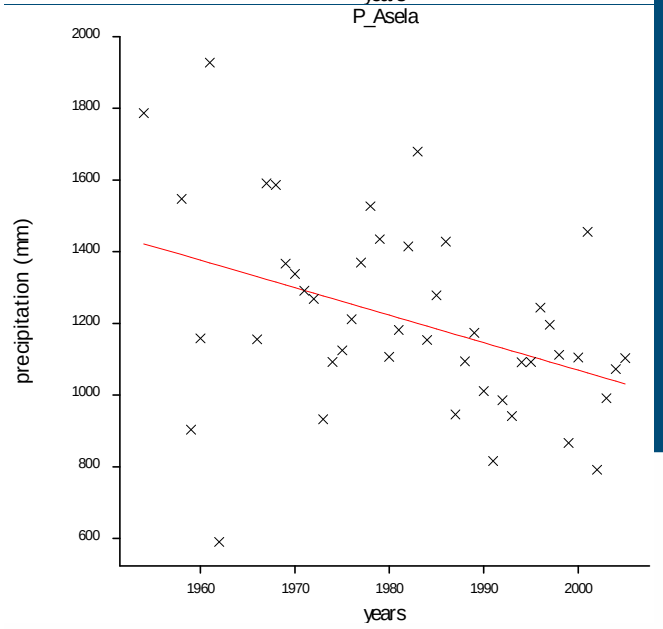
Developments

Climate change: Annual rainfall 1968-2005



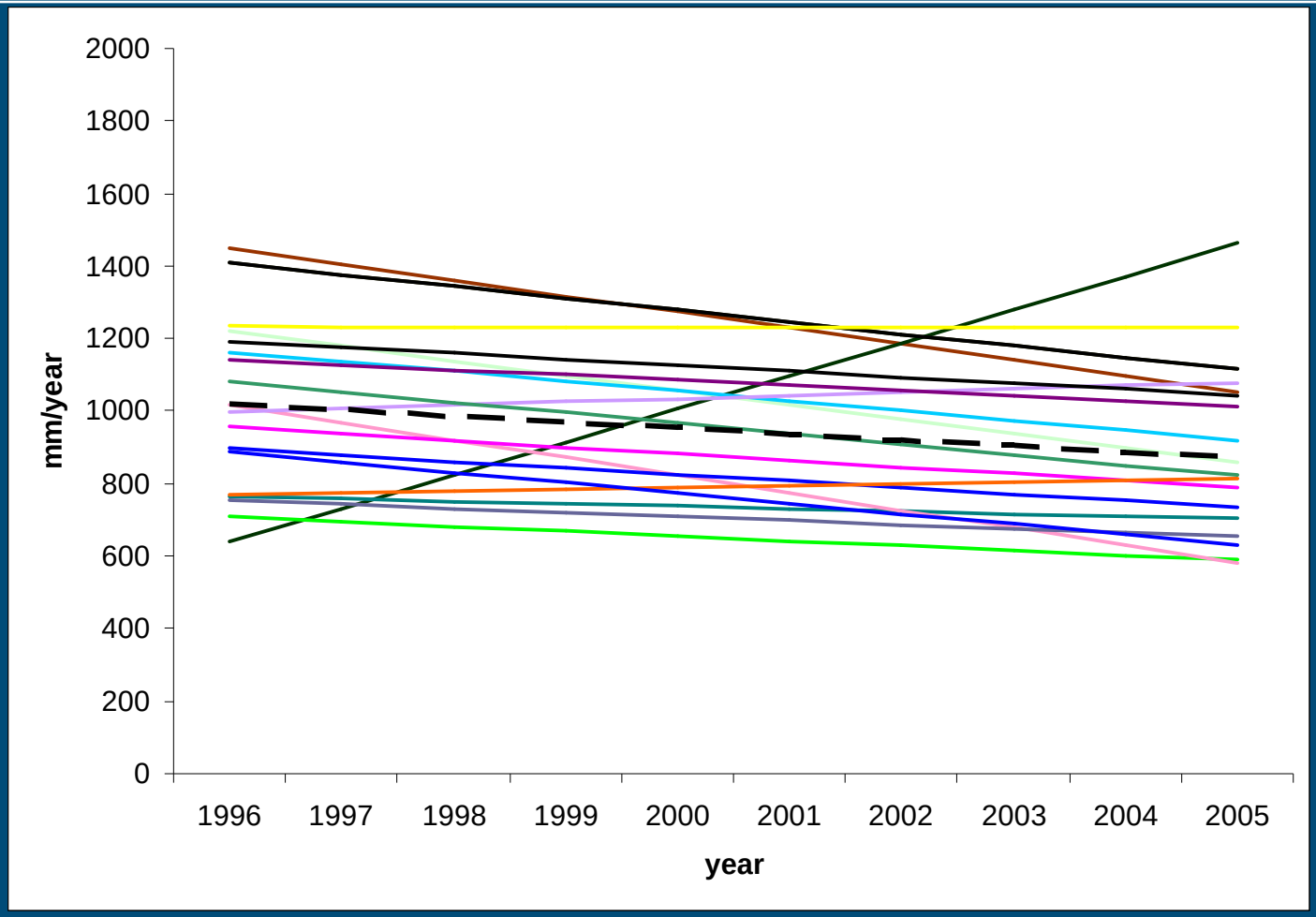






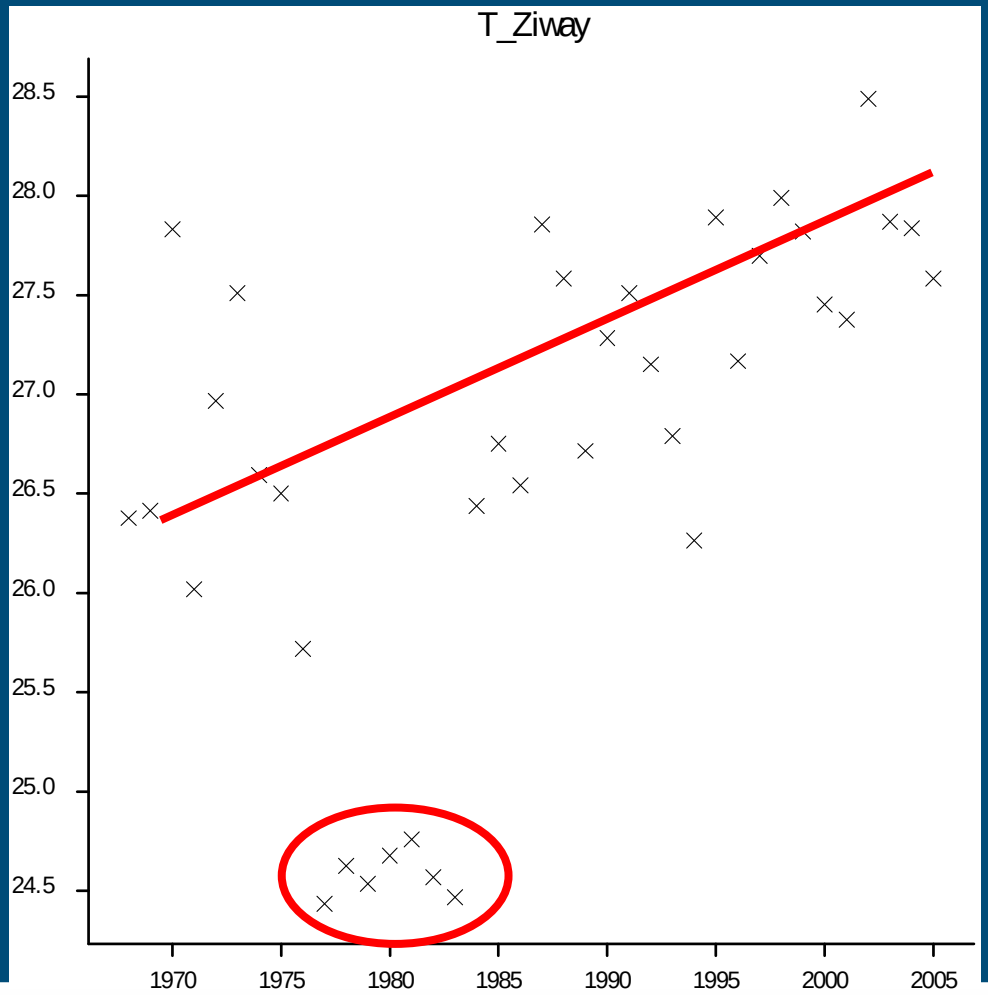
- No consistent trend
- Distribution within year?
- More station data available?

Climate change: Short-term annual rainfall trends (21 stations)



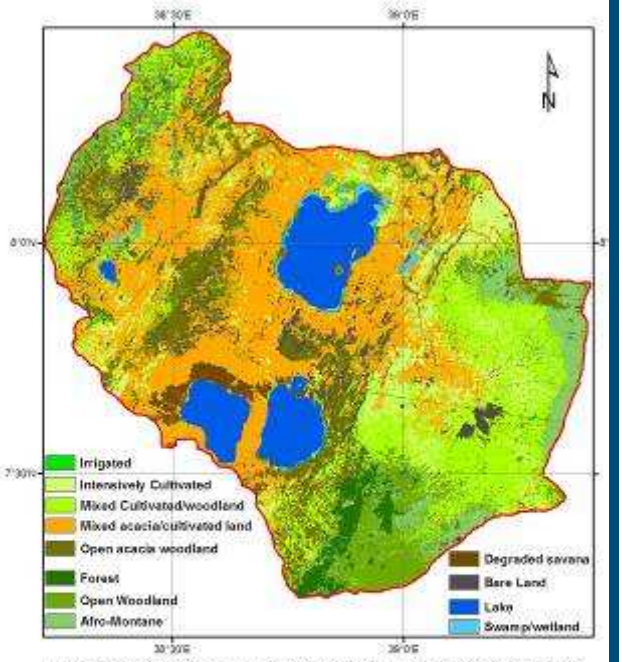
Decreasing rainfall trend (- 10-15%)

Climate change: Max daily temperature (1968-2005)

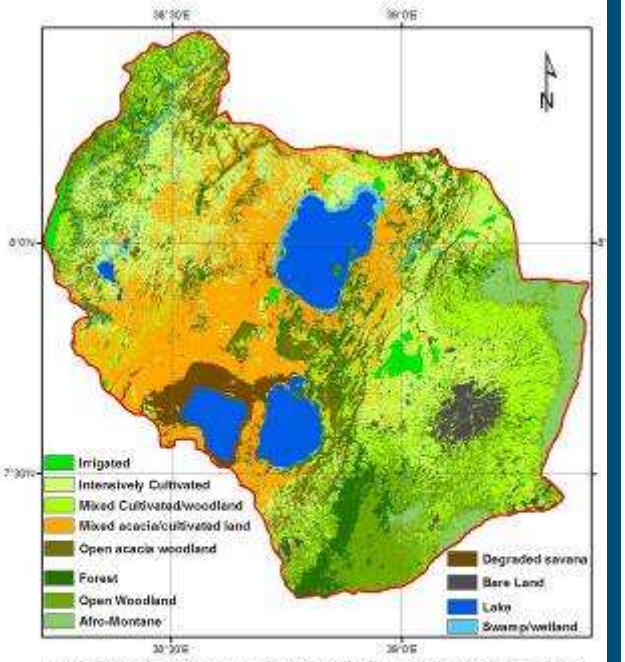


- Consistent trend except for period around 1980s (measurement error?)
- Consequences: Increased evapotranspiration?

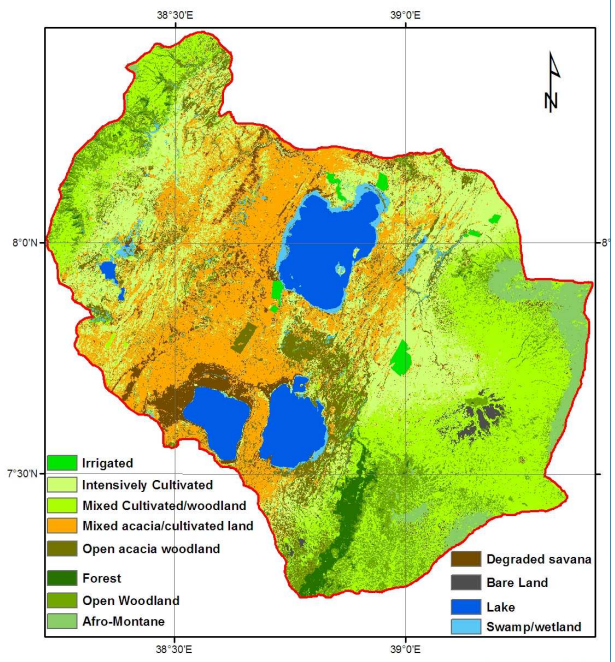
Land use 1973-1986-1999



Land cover map of CRV, Ethiopia based on Landsat MSS image, 1973



Land cover map of CRV, Ethiopia based on Landsat MSS image, 1986



Land cover map of CRV, Ethiopia based on Landsat MSS image, 1999

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Land use 1973-1999 (in ha)

	1973	1999	
Degraded savanna	14.500	44.000	+300%
Intensively cultivated land	100.000	220.000	+220%
Open acacia woodland	120.000	88.000	-27%
Irrigated land	0	6.500	

Expansion Sher (based on 450 ha)

- Water quantity: ± 11 Mln m^3

➔ Substitutes past water use of state farm

- Water quality: In general, nutrient and pesticide emissions are high in rose cultivation.

➔ Consequences unclear, but Sher is close to Bulbula river…….

- High demand on labour: > 15.000 people employed.
  Number of relatives that join migrants?

➔Enormous pressure on urban and social infrastructure of Ziway.

Policy implications

1. CRV is extremely vulnerable from a hydrological point of view.
2. Current water extraction along the Bulbula is relatively small but it has (had) an impact on the Lake Abijata water table.
3. Pollution risks associated with Sher-Ethiopia needs attention (e.g. risk assessment of emissions, urban planning).
4. Expansion of irrigated agriculture should take into account associated environmental consequences.
5. Climate variability and change and their consequences needs to be addressed in policy as well as research.
6. Land degradation needs urgently attention as it is a large problem in terms of ecosystem functioning as well as people involved.

Work in progress

- Hydrology of sub-catchments (Ketar,Meki)
- Relation among land use, river discharge and lake levels
- Review land use classification of land use maps ('73-'99)
- Land use map of 2006 (other satelite)
- Long-term rainfall and temperature (9 stations)
- Update estimation water use by soda ash plant
- Value of irrigation water used by smallholders


Thank you