

Ecosystems for water, food and economic development in the Ethiopian Central Rift valley

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Introduction

The Central Rift Valley (CRV) in Ethiopia totals an area of about 1.3 Mha and encompasses four large lakes, Ziway, Abijata, Shala and Langano (Fig. 1). Within the valley two saline lakes, Abijata and Shala and the surrounding woodlands, form a National Park. The lakes have been submitted by the Ethiopian Government to the Ramsar Convention on wetlands to be recognized as an international Ramsar site.

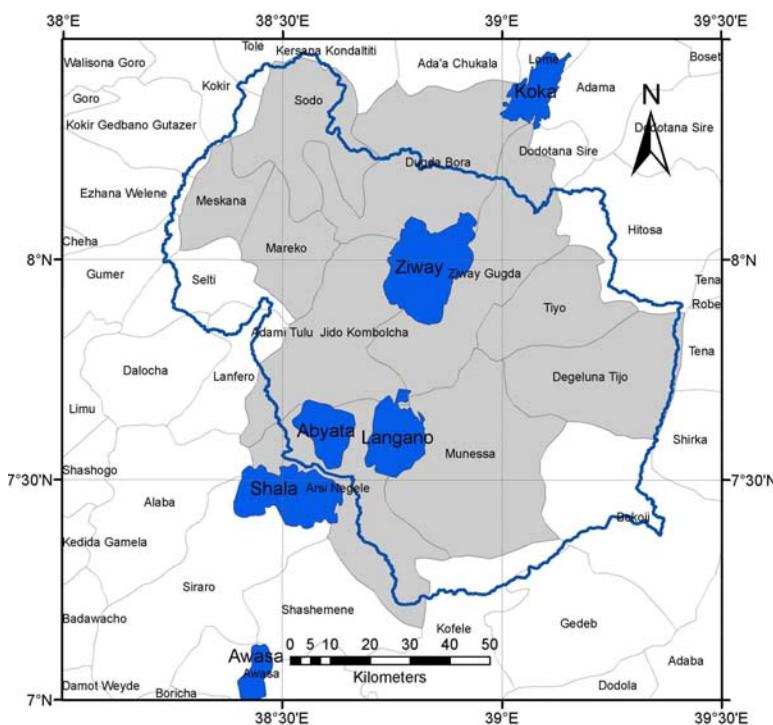


Figure 1. The Central Rift Valley with Lake Ziway, Langano, Abijata and Shala. The blue line indicates the hydrological boundary of the study area, and the grey areas represent administrative units.

Water resources in the CRV are increasingly over-exploited due to water extraction for agriculture and industry (soda ash production). The water level of lake Abijata has dropped about 5 m since the late 1960s and its shore has retreated 5 to 6 km, thus reducing the lake's size to about half of its original size (Fig. 2). In addition, land resources in the CRV are visibly over-grazed by an abundant livestock population while productivity of rainfed cropping is very low. Part of the local population depends structurally on food aid.

Recently, part of an irrigated state farm was turned into a large scale horticulture and floriculture greenhouse complex (with Dutch owner) in the upstream CRV providing employment opportunities to the local population. So far water extraction for irrigation was mainly the domain of state farms and smallholders, either organized in peasant associations or acting individually. The introduction of greenhouses will add to the pressure on local water

resources as these greenhouses depend on surface water for irrigation while other inputs (fertilizers and biocides) may increase the risk of water pollution.



Figure 2. The degraded area which was formerly Lake Abijata.

Policies of the Ethiopian government strongly support export-oriented irrigated horticulture and floriculture as a means to increase foreign exchange earnings and employment opportunities. Similarly, poverty will remain a major driver for exploiting (water) resources by smallholders as long as no alternative livelihood strategies are available and no regulatory framework is in place to manage water extraction in the CRV. Inadequate pro-poor development strategies and the lack of management capacity and government support with respect to nature conservation has resulted in the large scale intrusion of local poor in the National Park Abijata/Shala. As a consequence large areas in the park have been cleared for agriculture and cattle ranching, jeopardizing the carrying capacity of the ecosystem and biodiversity of the park area.

Problem statement

The issues at stake in the Central Rift Valley are complex and strongly related. Therefore, only an integrated analysis of the multi-faceted issues at stake will help to gain insight in the relationships among the different issues and provides options required to improve current management of water and land resources in the CRV.

To guarantee that results of the study are firmly embedded in a local structure the project collaborates closely with a platform of stakeholders (CRV Working Group) professionally involved in water related development in the area. This group is the main problem owner and counter part to identify key issues to be analysed and to support the identification of policy options and local initiatives. During discussions with stakeholders among others the following research issues were identified that needed special attention during the study:

- What is the relationship between upstream water extraction for irrigation and the drop in water table of Lake Abijata?

- What is the effect of (change in) climate on the water table of Lake Abijata?
- What is current water use by the different water users in the area? More specifically, what is the water use of the soda ash plant near Lake Abijata?
- What will be the effect of the large scale horticulture and floriculture greenhouse complex along lake Ziway on the local hydrology?
- What is the economic value of water extracted for irrigation purposes?
- Is (eco-)tourism an economically viable livelihood strategy, which could reduce the expansion of irrigated agriculture?

Approach

Based on the research questions identified by the stakeholders local information was collected and analysed. More specifically research focused on:

- Resource availability and quality, land use, agricultural production, productivity and input use, population, water use by different stakeholders, etc. (Baseline study).
- Past and recent spatial distribution of irrigated areas in the CRV.
- Spatial and temporal variability of rainfall in the CRV, and in long-term trends of rainfall and temperature.
- Valuation of irrigation water of different agricultural activities in the CRV.
- Formulation of scenarios for sustainable natural resource management in the CRV as input for the participative decision-making.
- Input use of the floriculture sector.
- Land use change using times series of remote sensing images.

Summary of results

Although not yet all collected data and information have been analysed, insight has improved considerably for most of the identified research issues:

- Although water extraction for irrigation purposes is relatively small compared to the total rainfall in the area and the irrigated area is small compared to the total agricultural area, irrigated agriculture has an effect on the water table of Lake Abijata. Rough calculations show that annually about 10% less water flows into Lake Abijata due to (irrigation) water extraction along its major contributor, the Bulbula river. Since Lake Abijata is a terminal lake even small reductions in annual water supply have major repercussions for the water table of Lake Abijata in the long-term.
- Estimation of the consumption of water for domestic use, livestock, open field irrigated agriculture (state farm and smallholders), the recently established greenhouse complex and the soda-ash plant showed that the open-field irrigated agriculture is by far the largest water user in the region. Even when the greenhouse complex will expand in the future from the current 50 ha to 450 ha, total water extraction by open field irrigated agriculture is more than 10 times higher. Water use by the soda ash plant is low compared to the water use by other users.
- Analysis of rainfall over the last 10 years of about 20 meteorological stations throughout the CRV suggests that the amount of rainfall has dropped with about 10% during this period. A long-term analysis of rainfall over more than 25 years of four meteorological stations provided mixed results. Long-term average daily temperatures of one meteorological station showed an increase of 1.5 °C over the last 30 years.
- The economic value of irrigation water for the production of cut-flower roses and horticulture crops grown at the state farm showed that it is in rose cultivation 4 to 30 times higher than in open-field production of tomatoes. In addition, rose cultivation provides per hectare 5 to 20 times more employment opportunities than the state farm and smallholder farming, respectively.
- Although only qualitatively assessed in this study, expansion of the greenhouse complex along lake Ziway will have major repercussions for urban development and associated environmental issues (urban waste management). A full operational greenhouse complex will

- provide direct work to about 15.000 people, which will need housing in the vicinity. In addition, potential water pollution associated with greenhouse production (discharge of pesticides and nutrients) needs to be addressed in the future.
- Based on the previous result, (eco-)tourism may contribute to the creation of employment opportunities and local income but probably does not generate as much employment and income as the intensive floriculture and horticulture sector.
- Productivity (and the derived income) of rainfed agriculture is very low, both in arable and animal husbandry. On the one hand this results in land clearing for new plots and on the other hand in overgrazing of the fragile Savanna vegetation. Since arable farmers as well as animal husbandry farmers are food insecure the production of charcoal is an important source of additional income of many smallholders. The overall effect of soil (nutrient) depletion, overgrazing and deforestation is increased land degradation and intensification of remaining land over time, which is supported by time series of remote sensing images. The degraded area increased with 300% from 1973 to 1999, and the intensively cultivated area with more than 200% during the same period.

Lessons learned

The Central Rift Valley (CRV) in Ethiopia forms a complex and vulnerable hydrological system with unique ecological characteristics. The hydrological feature of the terminal Lake Abijata makes it extremely sensitive to changes in water supply, whether caused by upstream water extraction (for irrigated agriculture) or by reduced rainfall.

Many developments in the Central Rift Valley can be directly or indirectly linked to poverty: Land degradation born out of necessity by poor rainfed smallholders, expansion of the irrigated area by smallholders to increase their low income, while national policies support export-oriented irrigated floriculture as a means to increase foreign exchange earnings and employment opportunities for the local poor.

Following general conclusions can be drawn with respect to the studied research issues and the research process followed:

- Ecosystems with terminal lakes, such as Lake Abijata in the Central Rift Valley are extremely vulnerable for changes in water supply, whether caused by upstream water extraction or by changes in rainfall pattern.
- Climate variability and change, and their consequences needs to be addressed in the analysis of ecosystems as well as in the development of options to improve water management in (semi-) arid areas as the Central Rift Valley.
- Planning of irrigated agriculture in fragile ecosystems as the Central Rift Valley should take into account related potential environmental implications. This also needs to involve indirect effects such as the consequences of migrating population in the vicinity of labour-demanding horticulture and floriculture enterprises.
- In a relative short period (< 6 months), the performance of the CRV could be analysed using a quick scan approach aimed at issues identified by stakeholders. This quick scan identified some important trade-offs but other potential trade-offs are more difficult to determine. For example, between the development of the floriculture sector and water quality, and between upstream land degradation and water availability downstream.
- Least but least, collaboration with stakeholders is a prerequisite to initiate a broad policy dialogue and raise awareness but may contribute to biased perceptions of research issues that need to be addressed. In the CRV, research needs as identified initially by stakeholders focussed mainly on hydrological issues. During the analysis it became clear that land degradation (and associated poverty) may be more relevant in terms of people and area affected. In addition, land degradation is a major driver for irrigated agriculture, while its consequences for ecosystem functioning including local hydrology and food production are (yet) unknown.