

Supplementary material for the paper “Voices in Shaping Water Governance: Exploring Discourses in the Central Rift Valley, Ethiopia”

Amare Bantider ^{1,*}, Bamlaku Tadesse ², Adey Nigatu ², Gete Zeleke ², Taye Alemayehu ², Mohsen Nagheeby ³ and Jaime Amezaga ³

¹ College of Development Studies, Addis Ababa University, Addis Ababa P.O. Box 3880, Ethiopia

² Water and Land Resource Centre, Addis Ababa University, Addis Ababa P.O. Box 3880, Ethiopia

³ Water Security and Sustainable Development Hub, School of Engineering, Newcastle University, Newcastle NE1 7RU, UK

* Correspondence: amare.b@wlr-eth.org or amare.bantider@aau.edu.et

1. Focus group discussion and Key Informant Interview results

For this research several field visits conducted and three of them are pertinent. Namely: a) Reconnaissance survey of the Central Rift Valley Basin: Natural (biophysical and hydrologic) and governance aspects of the Ziway-Shalla sub-basin water resources system held from March 23 to March 27, 2021; b) Field work to conduct focus group discussion held between July 27, 2021 and August 20, 2021) and c) Field work held between May 25-27, 2022 to assess the link between topography, geology and hydrology and to assess the irrigation water uses and governance.

Figure S1 below shows the route map where the writers of this paper conduct field visit, made observations and conducted different sorts of discussions in the study sub-basin.

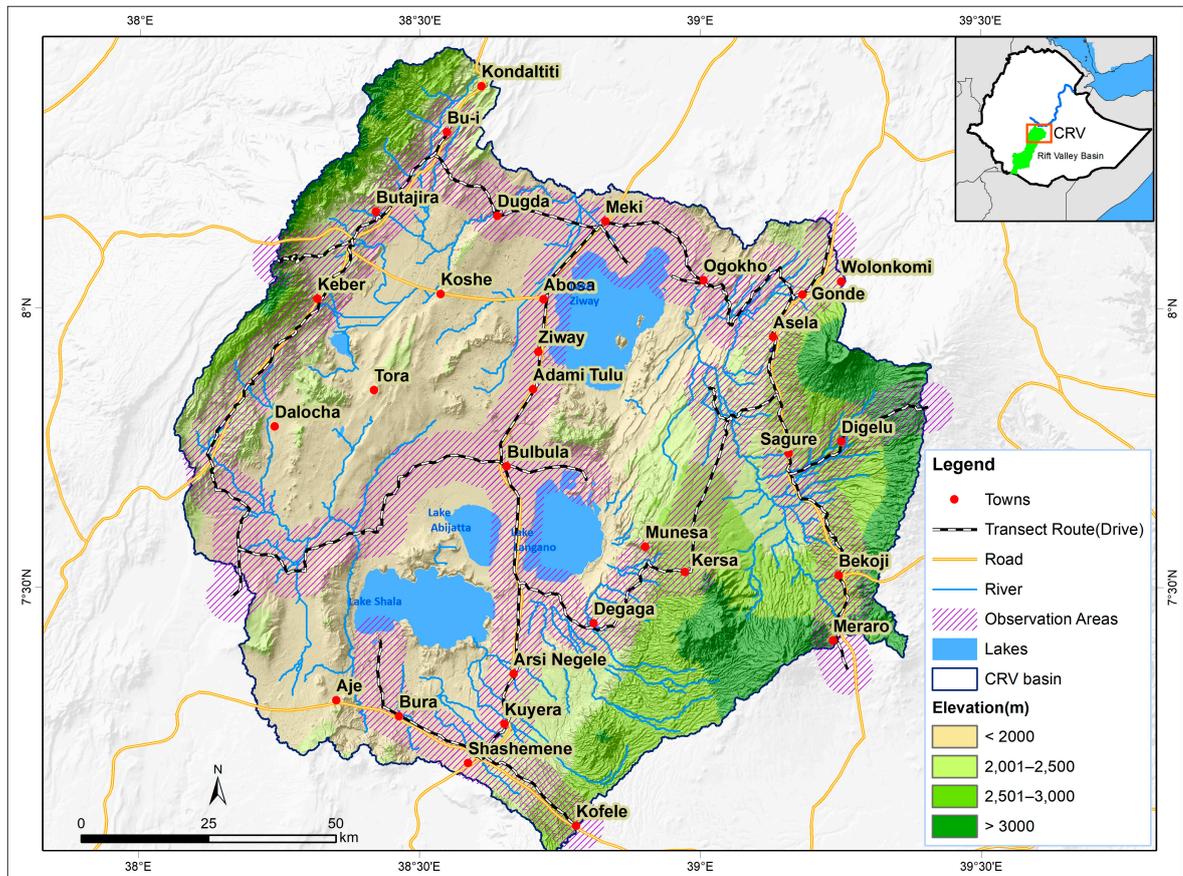


Figure S1. Rout map where field work (FGD, KII, observation) made in the Central Rift Valley, Ethiopia.

1 **Table S1. Lists of participants in the Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) held from July 27, 2021 to August**
 2 **20, 2021). This list doesn't include discussions held with Rift Valley Basins Development Office and Oromia Bureau of Water and Energy**

S/N	Name of the FGDs and KIIs	Themes Discussed	Excerpts and summary of perspectives on some of the discourses (water pollution, degradation, water scarcity, competing uses, etc.)
A	Lists of Focus Group Discussions (FGDs)		
1	Ziway Dugida woreda community elders	Roles of customary institutions in water governance including distributions, their environment	The presence of weak institutions to govern/manage effective water use leads to water insecurity and water crisis
2	Ziway Dugida woreda women representatives	Women's role in WUAs, water governance	It deals with the existence of weak institutions in addressing women's rights when there are scarce water resources and fair distributions
3	Ziway Dugida woreda youth representatives	Water governance, youth's participation and their environment	Focuses on the decentralized water resource development narrative that promotes equity and fair distributions of resources
4	Munisa woreda community elders	Roles of customary institutions in water governance including distributions, their environment	Resource degradation and climate change discourse and how weak institutions (both customary and statutory) are unable to address water governance problems in the CRV. Women FGD participants of this woreda stated that "women do not have the right to land certificate on their own names. If they don't have land certificate, they are not entitled to be member of WUAs because one of the main membership criteria is having land certificate by one's own name. It is only the first wife in a polygamous marriage and female headed household have the right to land certificate by their names."
5	Munisa woreda women representatives	Women's role in WUAs, water governance	In the water scarcity narrative, due to the growing multiple uses and competing claims in water uses the marginalized groups like women (particularly women headed households) are highly affected in the distributions of water for irrigation
6	Munisa woreda youth representatives	Water governance, youth's participation and their environment	Deals with the decentralized water resource development narrative with fair distributions water resources and equal participations of all stakeholders in water governance systems
7	Adamitulu Jidokombolcha woreda community elders	Roles of customary institutions in water governance including resource distributions, their environment	Resource degradation and climate change discourse and how weak institutions (both customary and statutory) are unable to address water governance problems in the CRV. Elders in this woreda explained that "due to the weakness or ignorance of institutions, key natural resources such as land and water are becoming scarce due to their mismanagement. There is no any rules to regulate and monitor on how to use water from rivers and lakes for irrigation as well as for factories. Everyone is simply pumping water for their own individual purpose and the volume of water in rivers and lakes are gradually declining not only in quantity but also the decrease in the quality of water. We are worried about the decline in the quality of aquatic species like fish due to the pollution and misuse

			of Lake Ziway mainly by the flower farms. There are variations in the quality/taste of fish from the ziway town side compared to the other side of lake ziway (in the countryside of the lake). Their perceived that lake ziway is heavily polluted by the mismanagement of waste disposal by factories including flower farms to the lake and it has its own impact on the community's health. Many people in Ziway town are now cautious to feed the fish from lake ziway because of the fear of the impact of pollution on the fish"
8	Adamitulu Jidokombolcha woreda women representatives	Women's role in WUAs, water governance	Weak institutional setup particularly customary institutions and also the ineffectiveness of statutory institutions affect women's rights in resource ownership and access particularly water for irrigation
9	Adamitulu Jidokombolcha woreda youth representatives	Water governance, youth's participation and their environment	Weak institutions to govern effective water distributions among different water users
10	Misrak Meskan woreda community elders	Roles of customary institutions in water governance including distributions, their environment	Environmental/land degradation narrative and weak institutions aggravates resource competitions in a growing water demand. Though the institutions (customary and statutory institutions) are weak to address the felt needs of the community in Misrak Meskan, it is still the customary institutions like Jefor are able to manage resource related conflicts in the woreda compared to statutory institution. A case in point is the conflict between east Meskan communities with Mareko bete-Guraghe conflict was addressed very recently through the Jefore customary institution. It is composed of 15 community elders' representatives from Mareko and east Meskan each plus elders from other community such as Arsi and Gona Oromo community representatives, Sodo, Siltie (six in number including the two conflicting parties) tried to address their conflict on the 5-7 th of Tire 2014 E.C. after a four years of prolonged and intractable conflicts (in which 42 people from each were killed by the conflict).
11	Misrak Meskan woreda women representatives	Women's role in WUAs, water governance	The shift from vegetable production to wheat in irrigation during the dry seasons due to the prevalence of food insecurity- water centered development narrative.
12	Misrak Meskan woreda youth representatives	Water governance, youth's participation and their environment	Weak institutions to govern effective water distributions among different water users. Misrak Meskan woreda youth representatives pointed that "there are recurrent water related tensions and conflicts between the upstream and downstream water users of the Akameja river. Previously it was the role of the customary institutions who were very active in regulating and managing such conflicts, but this day's neither the customary nor the statutory institutions are not active enough to govern such conflicts between the upstream and downstream water users."
13	Siltie woreda community elders	Roles of customary institutions in water governance including distributions, the ecology	Weak institutions particularly customary institutions to govern effective water distributions among different water users (gender issues are not addressed)

14	Siltie woreda women representatives	Women's role in WUAs, water governance	Weak institutions particularly customary institutions to govern effective water distributions among different water users (gender issues are not addressed)
15	Siltie woreda youth representatives	Water governance, youth's participation and their environment	The decentralized water resource development narrative
B	Lists of Key Informants (KIIs)		
1	Water Users' Associations (in 5 woredas)	Roles of customary institutions, Water allocations, water governance, multiple uses and competing claims of water	Transition from subsistence to market-based water resource development (market-led water resource development) discourse
2	Sher Flower Farm	Waste disposal management, Water allocations, water governance, multiple uses and competing claims of water	Transition from subsistence to market-based water resource development (market-led water resource development) discourse
3	Soda Ash Factory	Waste disposal management, Water allocations, water governance, multiple uses and competing claims of water	Transition from subsistence to market-based water resource development (market-led water resource development) discourse
4	Woreda Department of Agriculture (in 5 woredas)	Agricultural practices, Water allocations, water governance, multiple uses and competing claims of water	Transition from subsistence to market-based water resource development (market-led water resource development) discourse
5	Woreda Department of Water Resources (in 5 woredas)	Water allocations, water governance, multiple uses and competing claims of water	Land/water resources degradation and climate change discourse
6	Woreda Department of Irrigation (in 5 woredas)	Irrigation practices, Water allocations, water governance, multiple uses and competing claims of water	The water scarcity narrative (The Aral Sea syndrome in CRV). They argued that due to the unregulated and unmanaged water pumps by every water user (at individual, associations and factory levels), the problem of water scarcity is becoming very acute. It needs proper attention from the government and implementation plans on water use regulations including water tariffs and revenue collection systems from the water users."
7	Woreda Department of NRM (in 5 woredas)	Natural resource management practices, Water allocations, water governance, multiple uses and competing claims of water	The decentralized water resource development narrative, the resource scarcity narrative. "Resource governance including water is decentralized following the implementations of ethnic based federal system in 1991. However, there are problems in the governance of water bodies like lakes and rivers of trans-regional level. There is the lack of coordinated efforts among the regional states in the management of natural resources."
8	Cooperatives/unions (in 5 woredas)	Bylaws, Water allocations, water governance, multiple uses and competing claims of water	The water scarcity narrative (The Aral Sea syndrome in CRV), weak institutions. Woreda level cooperatives and unions argued that "there is the flourishing of multiple and competing water users of varied nature on the limited water resources (lakes and rivers) in an alarming rate. If this continues unregulated and unmanaged it will be a severe problem for the community at large to the extent

			of unable to access water not only for irrigation but also water for their basic amenities such as water for domestic use including water for livestock."
--	--	--	---

2. Field Observations

2.1. *Reconnaissance survey of the Central Rift Valley Basin: Natural (biophysical and hydrologic) and governance aspects of the Ziway-Shalla subbasin water resources system (March 23-27, 2021)*

Meetings conducted with:

- Hawassa – Rift Valley Lakes Basin Development Office (RVLBDO)
- Abijata Soda Ash Factory visit and discussion with experts and management
- Ziway Dugda Woreda office of Agriculture, accompanied with field visit in to irrigation farms through pumping of Lake Ziway
- Share Ethiopia Flower farms and office
- Guraghe Zone- Meskan woreda office of agriculture accompanied by field visit into ground water based horticultural farms Castel Winery Ethiopia - Vine farms

Major Observations made

- Lake Abijata has experienced significant recharge in the wet seasons of 2020 - This is the maximum surface area coverage since 27 years ago.

- Water abstraction from Lake Ziway is increasing year after year, increasing number of unlicensed/non-registered water users from Lake Ziway are observed;

- Meki river almost run out of water at this time of the year because over abstraction using pumps and is unregulated

- Unprotected buffer zones and river sides

- Emergence of water hyacinth becoming an alarming issue at the shore of Lake Ziway

- Soil-based horticulture industries and their intensively cultivated farms Vs controversial water treatment and pollution control systems

- Predominant and uncontrolled use of groundwater for irrigation – with no water fee at all, E.g., in East Meskan woreda

- Severe land degradation with aggravating situations

- Big gullies formation (Reaching irreversible conditions within a small period as 5 years)

- Diverse system of irrigation methods and practices

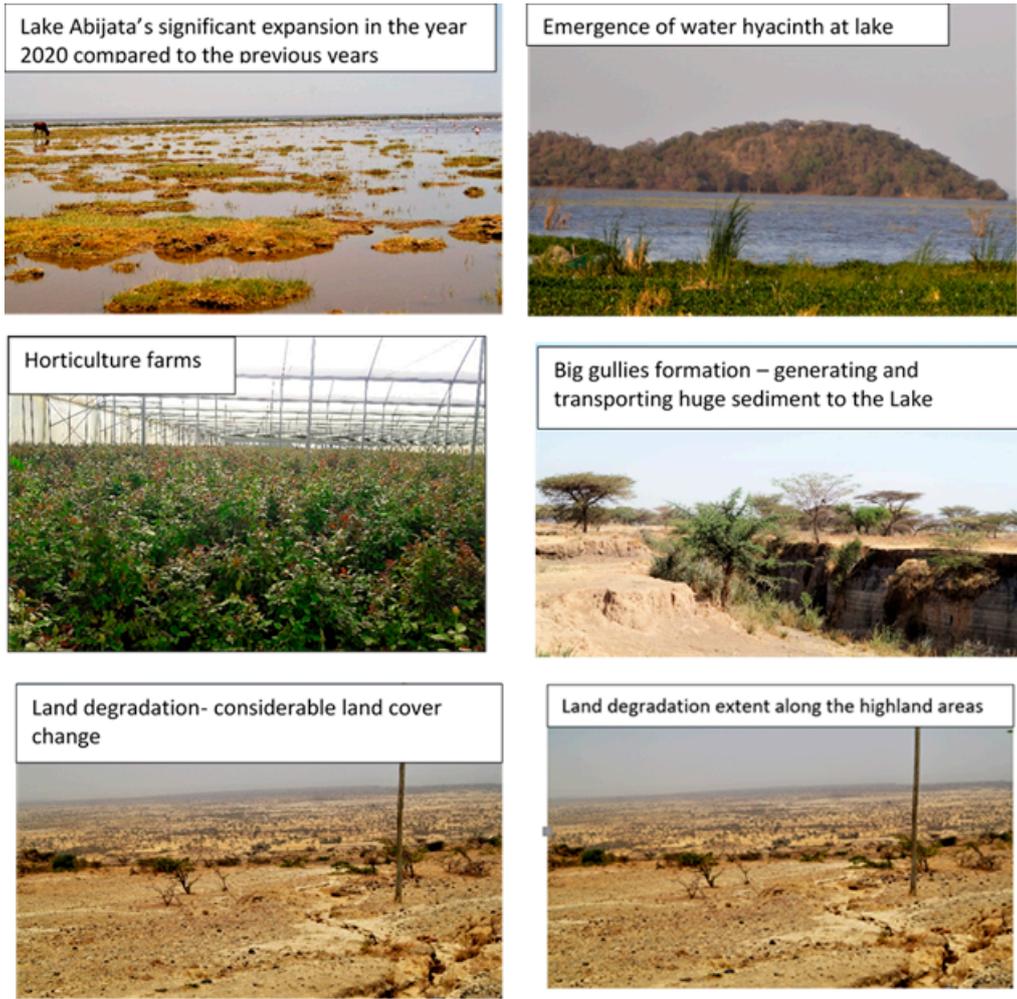


Figure S2. Photographs showing the different facets in Centra Rift Valley, namely Lake Abijatas expansion in recent years compared to the previous several years, expansion of horticultural farms mainly for export market, threatening land degradation that include gully, deforestation of acacia woodland and expansion of cultivated land.

3. Field work held from May 25 to 27, 2022:

Objectives were A) Topographic assessment in order to understand agro-ecological variations and the nature of hydrogeological formations across the Central Rift Valley sub-basin and their implication to surface water-groundwater interactions and water availability. B) Assessment of irrigation water use and governance in topo-sequence from water recharge areas to downstream water resource utilization

Observation route:

- Drive to Assela town to meet with the experts’ team
- Drive through observations across the eastern part of the basin, along the vast peripheral highland areas, up to the valley escarpments and the water divide that separates the rift valley basin with the adjacent Wabi Shebele basin.
- Geo-diversity observations in terms of exploring a range of geological, geo-morphological and soil features as well as agro-ecological belts and the respective agricultural practices
 - Water use: Highland-to lowland irrigated agricultural developments
 - Rivers: Katar and major tributaries such as Ashebeka, Harata and Bosha rivers as well as water abstractions and the surrounding irrigation developments and predominance

Interviews of local community members on the challenges and opportunities with regard to irrigation water use and agricultural productivities.

Meeting and discussion with a well-established water user association among the irrigation water users within the Katar sub-basin

Major observations

As per the experts' views, areas along mount Chilalo and Galema, the adjoining panoramic mountain chains, successive ridge lines down the gradient and the varied agro-ecological belts along the drainage terrain were asserted to be the potential groundwater recharge zones to the CRV sub-basin, and Katar sub-catchment and river system in particular.

Existence of wetlands (of small to large expanses), changes in river flow patterns and routes, localized existence of evergreen indigenous tree species often revealed in lines and clusters were also considered to be manifestations of the underground patterns of water flow.

Areas of relatively lower altitudes such as the Katar valley plains were designated as groundwater discharge areas, constituting areas of higher potential ground water sources for use by local communities.

Accordingly, a series of agro-ecological belts and zones ranging from: Wurch, Dega, Woina Dega, and Kolla (according to the general classification in Ethiopia) were also observed, along with the subsequent diversity in the nature of vegetation cover and agricultural practices. Major crops/vegetation cover corresponding to the agro-ecological zones are including: Typical conifers along the chains of mountains as the eastern water divide of the CRV, and high altitude ridges (sub-afro alpine and alpine belt) are dominated by *Erica arborea*, *Helichrysum citrispinum* and other afroalpine species; the mid altitude is dominated by cultivated land and Eucalyptus plantation with remnant indigenous tree species including *Juniperus procera*, *Podocarpus falcatus* and *Olea europaea*; the predominant lower altitude woina Dega belt constitute: wheat, teff, barley, maize, sorghum, chickpeas, haricot beans, and the lowest valley floor areas are characterized to have wheat, maize and irrigated agriculture mainly producing vegetables, fruit crops, and newly introduced irrigated wheat production.

Among the challenges related to irrigation development and water resources management are unprotected buffer zones of water sources, wetlands and river sides leading to wetlands encroachment, big gullies formation and sedimentation; lack of water sharing mechanisms and allocation plan; lack of capacity of local farmers and water users' associations on water use and management (training needs)

Below are some pictures



Figure S3. The Galama mountain area and its surroundings as groundwater recharge zones, and rich biodiversity mountain ecology.



Figure S4. Mid-altitude agricultural fields.



Figure S5. Lower plains as ground water discharge zones and low land irrigated agriculture.