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Research article

Water Governance and Water Management Systems in the Tekeze River Basin

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Abstract. The fact that a lot of fresh water resources in Ethiopia are shared between several sovereign states creates a difficult situation in terms of water governance and management. Since there is no central agency that can regulate the utilization of water, the autonomous riparian actors pursue their respective interests. Water is shared at local, national and international levels; and difficulty in water supply management arises from lack of coordination between local, national and international authorities. Most of the Ethiopian rivers are trans-boundary, i.e. shared by several sovereign states. The purpose of this paper is to examine water governance and management systems in the Tekeze River basin. The author uses the qualitative research method to critically examine the existing scarce literature sources and governmental policy documents. The findings of the study revealed the absence of any kinds of bilateral agreements among the riparian states of the Tekeze River basin. As the water governance system in the region is highly politicized, there exists a certain clash of interests between the Tekeze River nations. The constant conflict in the region disrupts cooperation needed for facility maintenance in the Tekeze River basin. The problems in the area arise due to the following factors: no demarcated boundaries between the basin states; no effective water governance system, and, as a result, no efficient and cooperative utilization of fresh water resources; lack of institutional and legal arrangements between the major riparian states.

Keywords: water governance, water management, Tekeze River, riparian states, conflict and cooperation

Introduction

Numerous rivers, lakes, basins, and aquifers extend over more than one African state. Consequently, the situation when crucial freshwater resources are shared by several sovereign states calls for a necessity to establish effective water resource management. As was noted by Yacob in this respect, national interests often clash, management approaches often differ, and international relations sometimes deteriorate [1. P. 22]. The author points out: "While the need for and dependence on the shared water resources are on the increase, the pattern of unsustainable utilization and management of the water resources has not yet been changed" [1. P. 22].

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Ethiopia has been described as the "water tower" of Northeast Africa. The country has twelve river basins and twenty natural and artificial lakes¹. Four of the twelve rivers are local and the remaining eight are trans-boundary rivers, including the Tekeze River². The riparian states of the Tekeze River basin are Ethiopia, Sudan and Eritrea [2]. However, between the three countries there exists no legal and institutional framework in regards to the utilization and management of the basin. Moreover, there are no studies conducted in the area, except for a few governmental reports and proposals.

The key objective of this paper is, therefore, to examine water governance and management systems of the Tekeze river basin. To this end, the central concern of the study is to explore hydrological and riparian peculiarities of the Tekeze River, conflict and cooperation between the riparian states, specificity of the local water management system, legal and institutional issues related to the joint management, as well as the economic significance of the basin.

Methodologically, the study is both descriptive and interpretative. It does not try to provide an extensive account of the issue at hand. Rather, it is a desk research that reviews authoritative works with the aim to understand the peculiarities of the Tekeze river water governance. With this object in mind, we searched for and reviewed relevant literature and secondary sources, such as government documents, books, and journals.

1. Geographical/Environmental Description of Tekeze River

Relevant to the climate differences, the Tekeze basin can be divided into two areas [2]³. First, the region west of Simien Mountain, which has two types of climate: the wet season, lasting for about four months, from June to September, and the dry season that lasts for the rest of the year. Second, the region east of Simien Mountain, characterized by three seasons: the dry season (from October to February), the short rainy season that covers a period from mid-February to mid-May, and the long rainy season that lasts June through September [3]. The water balance in the basin is maintained by means of water available from rainfall and return flow. Water supply and irrigation accounts for less than 1% of the whole water mass, and 12 to 13% flows out of the basin in the form of surface water. The remaining 87 to 88% is lost through evaporation [2].

2. The Hydrological System of the Tekeze River Basin

The Tekeze River basin is situated in the northwest of Ethiopia, between latitudes 1140 and 1512 north and longitudes 3630 and 3950 east [2]. The Tekeze basin includes the smaller Angereb (an area about 13,327 km²) and Goang (area about 6,694 km²) basins. Both rivers cross Sudan's border to the south of the Tekeze River and join the Tekeze River downstream in Sudan to form the Atbara River, one of the Nile's tributaries. The area of the entire Tekeze basin is about 86,510 km². The Ethiopian area

¹ National Water Development Report for Ethiopia. *UNESCO World Water Assessment Program.* 2004.

The Ethiopian Name for Atbara River in Sudan.

³ Classification is based on the mean monthly rain patterns.

of the Tekeze is about 82,350 km². A relatively small part of the basin constituted by minor streams is situated along the Sudanese border, which covers an area of 3,023 km², and the rest of the basin is located in Eritrea [6].

The length of the Tekeze River, from its source at the springs near Lalibela to the Sudan border, toward which the Tezeke flows, mostly in the western direction, is about 600 km. The main tributaries of the Tekeze, which originate in the highlands on the east side of Simien Mountain, are the Zamrta, Tserare, Geba, and Wori [6]. The Tekeze River is a major tributary of the river Atbara that, in its turn, flows into the Nile's downstream, the confluence of the Blue and White Niles at Khartoum. The river slope is quite steep in the mountain stretch, more than 1.5%, further gradually decreases to 0.3% and finally to 0.1% near the Sudanese border [6].

The Ethiopian part of the Tekeze River Basin has an average elevation of 1850 masl. About 70% of the basin lies in the highland at an altitude of over 1500 masl. The upper reaches of the Tekeze are surrounded by mountain ranges, the elevation of which is over 2000 m. 40% of the total basin area has an elevation of over 2000 masl. The elevation of the basin in the lowland ranges from 1000 to 500 masl. In the west, with an area of about 5000 km² (1500 km² lies in Ethiopia), the basin almost completely runs through flatland [2].

3. Economic Significance of the Tekeze River

3.1. Economic Significance of the Tekeze River to Ethiopia

According to the Tekeze River Basin Integrated Development Master Plan Project's Main Report (1998) [6], there are different potential areas of economic activities along the basin. Yet, the river is completely undeveloped. According to the source, the major development potentials of the basin include: hydropower development (due to the presence of favorable natural conditions, such as deep gorges and steep slopes), large-scale irrigation potential, fish production (possible in the river channels), farm forestry practices (currently underway in the basin), such as growing incense and gum trees in the low-lands. The closure of degraded lands is welcomed.

The small-scale mixed farming is the dominant economic activity in the whole Tekeze river area. It accounts for more than 97% of farm households. Although the proportion of livestock farmers in the whole basin is low, in the lowlands of the northwest of the basin there are farmers who own cattle and goats in large numbers and totally depend on livestock production. In the highlands, on the other hand, there are farmers who completely lean on crop production. Similarly, the river fishery is not well developed in the Tekeze basin for a number of reasons. The rugged nature of the land-scape coupled with the seasonal flow of many streams makes it difficult to develop the sector in the highlands. However, in the lowlands, some of the rivers and streams flow all over year round creating a potential fish production increase [2].

Moreover, the construction of a hydroelectric dam on the Tezeke offers another economic potential for Ethiopia. The Tekeze Dam is a double-curvature arch dam in the Tigray region of northern Ethiopia on the Tekezé River, a Nile tributary that flows through one of the deepest canyons in the world.

At the time of completion, the 188 meters (617 ft) high dam was Africa's largest arch dam. It was Ethiopia's largest public works project. The dam helped to reduce power shortages as Ethiopia's power demand increases.

According to the Tekeze River Basin Integrated Development Master Plan Project's Main Report (1998), the major limitations or constraints for development of the Tekeze basin include: absence of steep drops and high flow for short periods associated with rain, annual variability of river flows, insufficient quantity and poor quality of food supply, infectious diseases and parasites, shortage of skilled manpower, undeveloped livestock selection and breeding practices, lack of pricing and marketing policies, and weakness of government organizations at local level to organize forest protection and management.

3.2. Economic Significance of the Atbara River for Sudan

The Khasm el-Girba dam is the major project in the Atbara river basin. The dam was built in 1964 on the Atbara in order to provide irrigation water for the Khashm el-Girba agricultural scheme, as well as hydroelectricity⁴. The agricultural scheme was developed partly for resettling Sudanese Nubians (whose land was flooded after the building of the Aswan High Dam that submerged 500 kilometers of the Nile Valley in Egypt and Sudan) and partly for nomads that were encouraged to become sedentary. However, the dam has not functioned as planned. Siltation and subsequent loss of storage capacity is now a well-known problem for dams on the Nile, with both economic and ecological implications.

The annual siltation rate in the reservoir is estimated at 40 million m³ yearly, and the storage capacity of the dam was severely reduced only seven years after the dam was completed. For this reason, the reservoir has been flushed annually since 1970. This is naturally causing mass extermination of fish. The original capacity of the dam was 1.3 billion m³, which has now been reduced to less than half, with bad implications for both storage of irrigation water and electricity production. One of the aims of the new dam projects on the Upper Atbara and Setit is to reduce the siltation of the Khashm el-Girba reservoir.

Moreover, currently, Sudan is building a dam complex comprising the Rumela Dam at the Upper Atbara River and the Burdana Dam at the Setit River in Eastern Sudan. The site of the twin dam is located 20 km upstream from the junction of the Atbara and Setit rivers and about 80 km to the south of the Khashm el-Girba Dam. The Rumela Dam on the Atbara will have a height of 55 meters and the Burdana Damon on the Setit will have a height of 50 meters. The two dams will be connected and have a total length of 13 kilometers. The project includes the construction of hydropower stations on both the Rumela and Burdana Dams with a total installed capacity of 135 MW, which should be capable of producing 380 GWh per year. The objective of the project is to support the development of Eastern Sudan, through enhancement of agricultural production,

⁴ Archaeology, Dams, and Politics. Again... *Preserve the Middle Nile*. 19.11.2012. Available from: http://preservethemiddlenile.wordpress.com. Accessed: 24.06.2017.

generation of hydropower and potable water utilizing locally available water resources from the Atbara and Setit rivers. The project also aims to increase agricultural production in the New Halfa area currently irrigated by the Khashm El-Girba Dam. Additionally, the plans are to start the development of new land 150,000 ha in area in the Upper Atbara.

4. Water Management System and Legal/Institutional Issues

It is widely recognized that efficiently functioning institutional structures at the national, cross-national and regional levels are indispensable for sustainable development and management of transboundary waters and for lasting cooperation among the riparian states [4]. Effective transboundary water management starts at the national level, where coordination and cooperation between different ministries and water-related institutions are needed, as are sufficient financing and political commitment [12]. From the entire area of the Tekeze river basin, which is about 86,510 km², Ethiopia owns about 82,350 km² [6]. The importance of Ethiopia in the regional fresh water distribution is undeniable, therefore, we will look into the water management system, legal and institutional issues in the country.

4.1. Institutional Arrangements for Water Resources Management in Ethiopia

Institutions carrying out water resources development and management in Ethiopia function on different levels. At the federal level, the Ministry of Water and Energy (hereafter the ministry) is the sole federal government institution established to manage the country's water resources⁵. The ministry has mandates to formulate policy and legal frameworks, establish relevant institutions, set standards, commission studies, as well as plan and develop water supply and sanitation, irrigation, hydropower, and other energy forms. It is also responsible for water resource administration, protection, monitoring, and allocation. Moreover, the ministry deals with trans-boundary water issues. Consequently, the Ministry of Water and Energy bears a special responsibility for water resource development and planning in the Tekeze river basin.

At the regional level, a number of River Basin Organizations (RBOs), such as Basin High Council and River Basin Authorities (RBAs), have been established in order to ensure integrated water resources management between the riparian countries. To date, there are three RBAs for the Abbay, Awash and Rift Valley Lake basins. A regional water resource bureau in each state deals with the development of water resources for domestic water supply, either directly for larger borehole drilling programs, or indirectly through funding for the local Woreda government and their water offices (tasked with planning, implementing and/or backstopping spring development, lower-cost wells and sanitation). The regional bureau also plans, finances and implements small-scale irrigation projects.

⁵ See Proclamation No. 691/2010.

4.2. Legal Framework for Water Resource Management in Ethiopia

The legal framework for water resource management in Ethiopia covers policy, strategy, proclamations, regulations, and directives. The Ethiopian Water Resources Management Policy, formulated in 1999, is in line with the principles of integrated water resource management. The policy framework covers four major domains: domestic water supply, sanitation/hygiene, irrigation and drainage, and hydropower development [11]. The Ethiopia Water Sector Strategy is the implementation roadmap for the policy. The Ethiopian Water Resources Management Proclamation No. 197/2002 provides a legal basis for water resource administration. The Proclamation sets out allocation priorities, permitting or denying arrangements, and regulates the broad framework of rules for water resource development and management⁶. In addition, Ethiopian Water Resources Management Regulation No.115/2005 offers a detailed description of implementation procedures and arrangements. A Basin High Council and Authorities Proclamation (No 534/2007), as well as subsequent regulations that have established RBAs and RBOs, together with the Irrigation Development Incentive Proclamation, provide the main legal basis for water resource development and management in Ethiopia. On the other hand, there is a lingering paradox between the need to utilize the huge potential of the water resources for much-needed development and the lack of economic and institutional capacity at the national level compounded by the absence of cooperation at the sub-basin level [1].

4.3. Water Management, Legal and Institutional Issues in the Region

The cross-national status of many freshwater resources requires from the states that share them to establish effective water resource management. In this respect, the existence and the role of institutional structures at the transboundary level remains critical for sustainable development and management of transboundary waters and for lasting cooperation among the riparian states [4]. However, legal and institutional arrangements for water utilization and management have yet to be established in many of the Tekeze/Atbara River states, particularly in Ethiopia and Sudan [2].

The lack of water management, legal and institutional arrangements between the major Tekeze river basin riparian states has been hindering the process of sustainable water development and management. The fact that the Tekeze river basin is one of the sub-systems of the Nile water system [1] calls for the necessity to examine the basin's hydro-politics in a broader context. In this regard, in his analysis of the regional aspect of water utilization in the Eastern Nile basin, Yacob stated the following:

At present, there are no legal or institutional arrangements to harmonize upstream-downstream water utilization interests at sub-basin or basin levels. Nor are there any mutually acceptable customary modalities, which might be acceptable for inter-riparian water utilization and management. The lack of active engagement to mitigate the numerous water-related problems interests at sub-basin or basin levels. Nor are there any

⁶ Ethiopian Water Resources Strategy. *MoWE*. Addis Ababa; 2002.

mutually acceptable customary modalities, which might be acceptable for inter-riparian water utilization and management [1. P. 30].

However, a sound legal framework is essential for stable and reliable cooperation. At the global level, the 1997 Convention on the Law of Non-Navigational Uses of International Watercourses signified an important step forward. The Convention, adopted by the United Nations General Assembly, provides a legal framework for inter-state cooperation on international watercourses. However, it has not yet come into effect. Although, the "equitable and reasonable utilization" and the "not causing serious harm" rules are already part of the international customary law.

5. Riparian Issues of the Tekeze River Basin

According to the 1994 population census results, the settlement patterns along the Tekeze river basin were the following: approximately 6.4 million in the economic basin area and 4.7 million within the hydrographic boundaries. The difference of 1.7 million people, representing 27% of the economic basin area population, lives in the border *woredas* outside the basin boundaries. The total population of the border *woredas* amounts to 61% of the people living in the economic basin area. Population densities vary widely within the basin. The western half of the basin consists of lowlands, which are sparsely populated, with densities of 0—25 inhabitants per km² [5].

On the other hand, the eastern side of the basin consists of highlands showing much higher densities in the range of 100 to 120 inhabitants per km². The highest population densities, locally up to 200 inhabitants per km², are found in a narrow ring around the eastern highlands. The population is largely rural. The urban residents constitute 12% of the total population with reference to the economic basin area and 10% with regard to the hydrographic basin area. In general, about 56% and 46% of the basin is situated in the Amhara (4 zones) and Tigray (4 zones) regional states, respectively. There are two large, one medium, and 12 small towns, as well as 34 rural centers in the basin. The population of the basin is estimated to be 4,724,164. The rural population (93%) is expected to increase threefold in the next 50 years and the urban population is supposed to grow tenfold.

6. Conflict and Cooperation among the Tekeze River States

The Tekeze River basin is one of the sub-systems of the Nile water system whose upper streams rise in northern Ethiopia [1]. The sub-system contributes 8.2 Bcm to the total annual flow of the Nile waters [6; 1. P. 85]. Thus, as a sub-basin of the Nile, the Tekeze River is also shared by the Nile basin states, particularly by Ethiopia, Sudan and Eritrea.

Sudan and Ethiopia share the longest border and the largest number of people living along it. On top of that, the major rivers of Sudan, including the Atbara, originate in Ethiopia. Irrespective of this fact, however, water appears to be as a source of tension rather than a reason for cooperation between the two countries [8].

Sudan is the only country in the Nile basin which signed the 1959 agreement with Egypt. Moreover, Sudan and Ethiopia have agreed on several gestures of goodwill, including the 1980 and 1991 protocols of cooperation in the Nile basin. Yet, there has not been a known bilateral or multilateral water development venture between Ethiopia and Sudan. Furthermore, according to Yacob, "In the present conflagration of upstream-downstream confrontation Sudan generally behaves like a downstream state, although its relations with Egypt have been not so friendly from time to time" [1. P. 196].

On the other hand, Sudan and Ethiopia can increase cooperation through carrying out joint 'win-win' projects [4]. There is a pressing need for cooperation between the two countries in order to reduce sediment transportation and increase the recharge of ground-water going to the Nile [11]. However, all these joint projects have to be negotiated and integrated in regards to hydropower generation, irrigation, watershed management, navigation, fishing and flood control. Thus, unless Sudan works jointly with Ethiopia, its fields and plains will never cease to be flooded and its dams will continue to be filled up with silt and pebbles carried down from the Ethiopian highlands. Moreover, the quantity and quality of the waters Sudan receives may not be sustainable [4].

Through the joint projects between Ethiopia and Sudan, which would include building dams and constructing irrigation projects, the countries of the Nile basin can promote peace and stability in the region. Unless collaboration is established, primary needs of the present and coming generations of locals will not be met [2]. The benefits of joint projects include maximizing water resources, establishing supranational organizations, improving the use of technology, providing basin-wide environmental conservation and combating drought. What is more, joint projects will have a positive effect on political relations of the riparian nations [4].

In fact, compared to the other riparian countries, Ethiopia has a significant advantage ecologically and economically: its hydropower capacity allows it to potentially generate up to 45,000 megawatts of electricity [3]. Thus, there is a strong opportunity for building regional economic cooperation around an energy deal (exchanging Sudanese oil for Ethiopian electricity) and constructing a new framework for improved political relations [10]. Joint energy initiatives could provide a greater, cleaner and more reliable power supply for both Sudan and Ethiopia, as both countries struggle with providing jobs for burgeoning populations and services to marginalized areas [4].

Conclusion

The study has examined the water governance and management systems in the Tekeze River basin. It has unequivocally demonstrated the crucial role of effective water governance and management among the riparian states. Regardless of the increasing dependence on the shared water resources, the utilization of the water in the region remains poorly managed. Particularly, the cross-boundary status of the Tekeze River basin complicates the issues. Lack of legal and institutional mechanisms of water governance and cooperation among the riparian states, as well as the absence of joint hydropower and other water development projects contribute to the complicated situation in the region.

The Tekeze River basin states have numerous opportunities for economic development. The huge economic potentials of the Tekeze River allowed by its natural conditions (deep gorges and steep slopes necessary for hydropower development) and its large-scale irrigation potentials are not being taken advantage of by the Ethiopian government. On the other hand, small scale mixed farming remains the dominant economic activity in the whole Tekeze River area. Short-term high flow associated with rain shortage, lack of skilled manpower and annual variability of river flows are some of the major limitations for the development of the basin. Speaking about of the role of Sudan in the matter, the Khasm el-Girba dam remains the major project in the Atbara River basin.

In Ethiopia, institutions carrying out water resource development and management function on federal, basin and regional levels. The legal framework for water resource management in Ethiopia is comprised by policy, strategy, proclamations, regulations, and directives. Yet, at basin level, there exists lack of legal and institutional arrangements for water utilization and management. In this regard, the Tekeze River basin proves to be a source of tension rather than cooperation between the riparian countries, namely Ethiopia, Sudan, and Eritrea. On the other hand, there is a great need for cooperation between Ethiopia and Sudan.

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Научная статья

Системы управления водными ресурсами в бассейне реки Текезе: политические аспекты

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Аннотация. Тот факт, что основные ресурсы пресной воды в Эфиопии распределяются между несколькими суверенными государствами, создает сложную ситуацию для управления водными ресурсами. Большинство рек Эфиопии являются трансграничными, то есть разделяются несколькими суверенными государствами. Поскольку в настоящий момент в регионе нет центрального органа, который мог бы регулировать использование воды, автономные прибрежные субъекты преследуют свои интересы. Водоснабжение распределяется на местном, национальном и международном уровнях; и трудности в управлении водоснабжением возникают из-за отсутствия координации между местными, национальными и международными органами принятия решений. Целью настоящей статьи является анализ систем управления водными ресурсами в бассейне реки Текезе. Автор использует качественный метод исследования для анализа источниковой базы и правовой базы государственной политики в сфере управления водными ресурсами. Результаты исследования показали отсутствие каких-либо двусторонних соглашений между прибрежными государствами бассейна реки Текезе. Автор приходит к выводу о том, что, поскольку система управления водными ресурсами в регионе сильно политизирована, наблюдается определенное столкновение интересов между странами бассейна реки Текезе. Постоянный конфликт в регионе подрывает сотрудничество, необходимое для развития и обслуживания инфраструктуры в бассейне реки Текезе. Отмечается, что политические проблемы в районе возникают из-за следующих основных факторов: отсутствие разграниченных границ между государствами бассейна; отсутствие эффективной системы управления водными ресурсами и, как следствие, отсутствие механизмов эффективного и совместного использования запасов пресной воды; отсутствие институциональных и правовых механизмов взаимодействия и сотрудничества в данной сфере между основными прибрежными государствами.

Ключевые слова: управление водными ресурсами, река Текезе, прибрежные государства, конфликт и сотрудничество

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