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SPECIAL ISSUE: ADVANCING SOCIO-HYDROLOGY

The dynamics of farmer migration and resettlement in the Dhidhessa River Basin, Ethiopia

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ABSTRACT

The Dhidhessa River Basin (DRB), in the Abbay River Basin in Ethiopia, is undergoing large-scale dam construction for sugarcane irrigation. We focused on the dynamics of population migration, settlement, relocation and water resource development in the DRB using primary and secondary data. Two major migration waves were observed in the basin: the first in 1984–1986 during a severe drought and the second during 2005–2017. Most rural migrants were "pulled" by government initiative in the period 1984–2017, while a few migrated of their own accord due to famine. We found that the first migration wave from eastern Ethiopia (Harar) to DRB was due to scarcity of water, land and rainfall and the migration positively affected migrant livelihoods. In the second phase, dam construction displaced settled farmers and migrants, adversely affecting their livelihoods. Analysis is needed that considers the wellbeing of the displaced agrarian society and the migrant population in the dam-affected area.

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1 Introduction

The human demand for water has been increasing due to factors such as population growth and climate change. Water demand and the interaction between humans and water is likely to be amplified in the future (Sivapalan *et al.* 2012). This can adversely impact society's welfare through water infrastructure development and consequent environmental degradation (Kandasamy *et al.* 2014, Roobavannan *et al.* 2017). Inclusive water resource development and management are therefore of paramount importance to enhance food production and subsistence farming. Sivapalan *et al.* (2012) introduced the new science of water and people – socio-hydrology – in which they argue that human actions have altered the hydrological cycle and thus constrained their own future. Therefore, understanding the fundamentals of water threats of anthropogenic origin that affect humans and their activities is of utmost importance and this includes the endogenous features and bi-directional interactions through societal activities such as water for personal needs, food and energy and consequent environmental degradation (Sivapalan *et al.* 2012, Gober and Wheater 2014).

Migration has often emerged as one of the key mechanisms in diverse coupled human water systems studied by socio-hydrology (Pande and Sivapalan 2017, Roobavannan *et al.* 2017, Lyu *et al.* 2020). For example, the movement of population in and out of flood plain in response to flooding events and conditioned by the memory of past events is one such example (Di Baldassarre *et al.* 2013, Viglione *et al.* 2014). Roobavannan *et al.* (2017) argue that the Murrumbidgee river basin was successfully able to navigate a change in water policy towards increased environmental flows partly due to the movement of farmers out of agriculture to other sectors outside the basin.

Human migration occurs quite often and it is one of the responses to climate change and water scarcity (Akay *et al.* 2012, Gray and Mueller 2012, Chen and Qian 2017). These occurrences need attention because they increase the migration of human groups, especially rural communities, which are dependent on agricultural production (Akay *et al.* 2012, Xie *et al.* 2017). Indeed, reasons for migration may differ, depending on the needs for survival (Massey *et al.* 1993, Gray and Mueller 2012, Chen and Qian 2017). The unreliability of rainfall and climate change in addition to water scarcity is one reason behind the migration of rural communities that mainly depend on agriculture (Akay *et al.* 2012, Gray and Mueller 2012). Migration of populations first along water bodies and then forced resettlement elsewhere by the government is one example of where understanding the underlying dynamics can allow for the success of water development plans and to forecast future migrations (Sima 2011, Sivapalan *et al.* 2012, Kandasamy *et al.* 2014). Low-income rural people experience a capacity gap, which prevents them from engaging in profitable work and investigating better choices (Gollin *et al.* 2013, Bryan *et al.* 2014, Tanguy *et al.* 2014, Chen *et al.* 2019). Unless supported by the government, the cost of migration can be as high as annual incomes of households who are often dependent on rain-fed agriculture. This deters vulnerable households to migrate from low-income rural areas to areas that are more profitable. On the other hand, unsustainable government policies may make government-supported migrants

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Supplemental data for this article can be accessed here.

vulnerable to government subsidies and unhappy as pioneer migrants often lack the safety nets of their communities in destination areas (Heitmueller 2005, Andersson 2014).

In Ethiopia, water resources and stakeholder livelihoods have been affected by population migration and relocation along the country's rivers. A government mandated resettlement has been done by the Chinese government with little attention to sustainable water resource development (Heming *et al.* 2001), similar to the resettlement along with the Arjo-Dhidhessa large-scale dam development. Even though Ethiopia is rich in water resources with an estimated annual surface flow of more than 122×10^6 m^3/year, water is a matter of life and death in the Ethiopian context. Climate change, population growth and deforestation have significantly affected water resources management and the development of the country (Tena *et al.* 2015). Studies in Ethiopia, Mexico's Pacific coasts and elsewhere in the world have shown that large-scale dam and irrigation projects usually cause serious environmental and social consequences (Tilt *et al.* 2009, Eguavoen and Tesfai 2012, Ezcurra *et al.* 2019). Though such water resource development schemes are intended to bring economic and social benefits, their construction and operation are usually followed by flooding, degradation, environmental change, loss of land and economic instability to the communities living, for example, around the Arjo-Dhidhessa large-scale dam in the Dhidhessa River Basin (DRB) (Tena *et al.* 2015). This especially hits hard on migrant households with little or no social safety nets of their own communities.

The DRB, located in the southwestern part of the Blue Nile River Basin (BNRB) (Sima 2011, Gebre *et al.* 2015), is one of the major water sources in Ethiopia. The basin contributes about 67% of the total streamflow of the BNRB (Bastawesy 2014, Gebre *et al.* 2015). This indicates that the Nile River flow is highly dependent on the DRB. However, the DRB has encountered multiple water security issues, which have been discussed by Sima (2011) and Gebre *et al.* (2015). Recent population migration and resettlement in the country has taken place due to the occurrence of drought and famine in the eastern part of Ethiopia (CSA 2012) to locations such as DRB, initiated by the Ethiopian government to relieve drought-affected households. Compensation policies are often critical to foster migration (Randell 2016). The DRB was one of the basins chosen for population migration and relocation to resettle hundreds of people mainly from the Hararghe region in 2001 during the first round of migration (ICPSR 2013). However, the remedies instituted by the Ethiopian government were not sufficient. For example, the Gibe III large-scale dam development along the Omo-Turkana River Basin disrupted the livelihoods of many farming households, plunging them into food insecurity (Hodbod *et al.* 2019). The narrative underlying the socio-hydrological dynamics of the DRB is summarized in Table 1 and is based on diverse secondary sources.

Newton (2008) has reported on this paradox of dam development. Dam construction is expected to bring development and modernization in the long term. However, it may forcibly displace its potential beneficiaries from the dam site. The river on which the ongoing Arjo-Dhidhessa large-scale dam is being constructed improved the livelihood of the farmers. The construction however will now benefit local sugar cane plantation projects at a socio-economic cost to many migrant residents in the basin (MoA 2017). These include the migrant households that came from Hararghe region in 2003/04 (second round of migration), who have benefited from the river and consistently produced sufficient food as well as generated incomes from their crops, vegetables and fruits. The re-settlement of these families farther away from river water may threaten not only their newly found economic wellbeing but also their emotional wellbeing (Newton 2008, Hodbod *et al.* 2019).

This study aims to comprehensively assess the dynamics of the migration, relocation, settlements and water resources development (Arjo-Dhidhessa Dam) and the impacts on the society based on the census (secondary) and household surveys (primary) within Ethiopia. Therefore, the specific objectives of this study are to a) assess the migration and settlement rate in the DRB; b) identify and understand the main drivers of migration to the study area and c) discuss implications of Arjo-Dhidhessa Dam construction for displaced agrarian society at large and migrant population in particular.

2 Study area

The DRB is geographically located between 36°02′–36°46′E and 7°43′–8°13′N (Fig. 1). The mean annual rainfall of the basin ranges from 1200 to 2200 mm/year (MoA 2017). The majority of the area is characterized by a humid tropical climate with heavy rainfall. Most of the total annual rainfall is received during a single

Table 1. Main timeline summary of the Dhidhessa River Basin, Blue Nile tributary, Ethiopia.

Period	Status of natural resources	Reference
Pre-1960	Most of the Dhidhessa River regions covered by forests.	O'Brien *et al.* (2018)
1960–1974	Large amounts of forest were available owned by landlords (Phase 1).	Sima (2011)
1974	Land ownership changed by Government: from landowners to government, followed by instability.	Gebrehiwot *et al.* (2014); MoA (2017); Mowie (2017)
1975–1990	Deforestation took place due to population growth and searching for agricultural expansion (Phase 2).	Mccann (1995)
1980	Resettlement from dry regions of the country to the northern part of the Dhidhessa River Basin.	O'Brien *et al.* (2018)
1984–1986	Derg (the then Ethiopian ruling party) undertook migration and resettlement of rural people due to drought.	ICPSR (2013); Gebrehiwot *et al.* (2014)
1990–2003	Government change and reforestation (Phase 3)	
1991	Government change followed by instability.	O'Brien *et al.* (2018)
2001	Migration and resettlement of farmers designed by Government and people's willingness due to drought and famine happened in Hararghe.	Sima (2011), Mowie (2017)
2003	Resettlement by Government from affected regions of the country to the Dhidhessa River Basin.	MoA (2017)
2009	Water resource development (dam construction) took place on the Dhidhessa Sub-basin starting from 2009 onward.	FDRE MoWR (2002); Adgolign *et al.* (2015); MoA (2017)
2010	Resettlement due to water resource development.	O'Brien *et al.* (2018)
2017	Arjo-Dhidhessa large-scale dam and the sugar cane irrigation implementation are ongoing.	Mowie (2017)

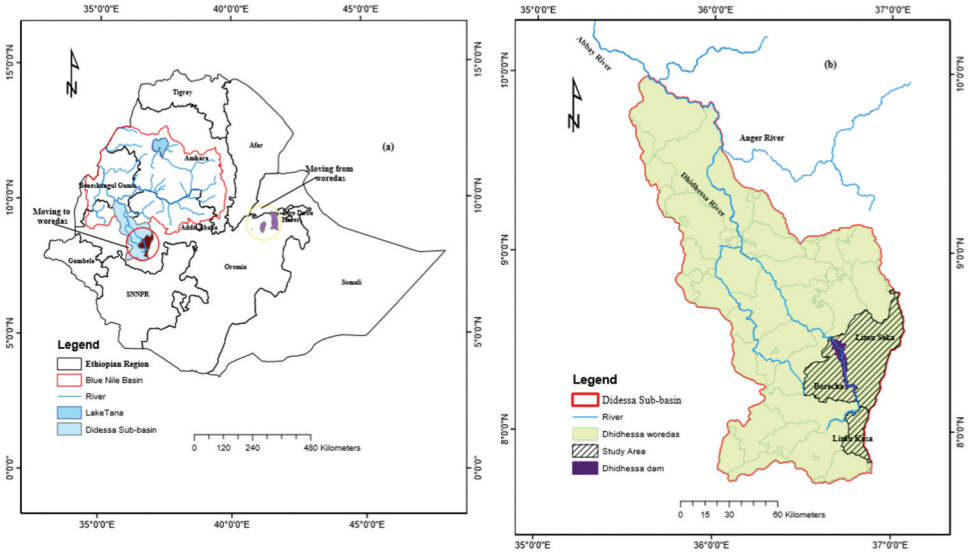

Figure 1. (a) Geographical location of the migration and settlement area. (b) Dhidhessa River Basin (DRB), dam location and study area woredas for farmer survey.

rainy season called *kiremt*. The Dhidhessa River flows from the mountains of Gomma at a maximum elevation of 2620 m a.s.l. to the Kemashi and Bologiganfoy districts, which are called *woredas*, with a significant decrease of 1620 m to an elevation of about 1000 m a.s.l. (Sima 2011). The water resource development and agricultural production in the area are closely related to the Dhidhessa River. The potential irrigable area is situated along the Dhidhessa River adjacent to the town of Arjo. It extends upstream on both sides of the Dhidhessa River at about 32 km from the Bedele-Nekemte Road Bridge.

In 2007, the Ethiopian government decided to construct the Argo-Dhidhessa Dam, which could have the capacity to irrigate about 80 000 ha, mainly to supply a sugarcane factory. At the upper part, it is located about 39 km from the Gechi settlement area. The rural population living alongside the Arjo-Dhidhessa Reserviour (see Fig. 2(a)) has mainly migrated from other regions due to the Government initiatives prior to the dam development (MoA 2017).

3 Methodology

3.1 Primary data collection

The study was conducted using diverse techniques for data collection, including interviewing the stakeholder groups and key informants, in which three villages, i.e. Limu Kosa, Borecha and Limu Seka, were selected from the study area (see Fig. 2(b) for detailed village location). Most of the households in these locations are migrants. The study also involved a survey of 120 households, 40 from each of the three villages. The households were sampled based on purposive sampling (Tongco 2007). Individual key informants were selected from the sample on the basis of their relationship with migration and settlement in the DRB by the snowball sampling method, as recommended by Ananda and Herath (2003). The site observations were done before the data collection and the interviews were held in the local language of the region (*Oromiffa*). The details collected included occupation, income, reasons for migration, their perception regarding the changes in livelihood before and after migration and related information. The selection of individual households and key informants from each village for the interview was done using snowball and purposive sampling. It included both male- and female-headed households that had migrated under the government initiatives. The interviews were conducted to understand the migration process, such as conditions before and after migration. The survey and focus group discussions were conducted using a semi-structured questionnaire. The questionnaire took about 2.5 hto complete for each individual household. However, the focus group discussions were undertaken for 3 h, which involved key informants from each village using the local language and considered the opinion of the respondents in addition to individual household interviews. The whole field campaign was held from July to September 2018, i.e. for two months. A schematic representation of the process is given in the Supplementary material).

3.2 Secondary data collection

The secondary data were from the Ethiopian Central Statistical Agency (CSA 1984, 1994, 2007, 2012) and the Ministry of Water Resource, Irrigation and Agricultural Offices (MoA 2017).

The official total population census in Ethiopia, which covers both the rural and urban populations, is taken every 10 years. The census data started in 1984 and, for this study, the statistical data from 1994 to 2017 were used. The population projection by the Ethiopian Statistical Agency, which started in 2007 considers the growth rate and also includes the migration of the population. For the years 2005–2010, the number of the migrated rural population was taken from the Zonal Administration Office (Table 2). These official migration data are available at the local level, which is not specifically addressed in the total census data available every 10 years.

4 Results

The sample household age ranged between 17 and 80 years and the average age of the household was about 35 years. In terms

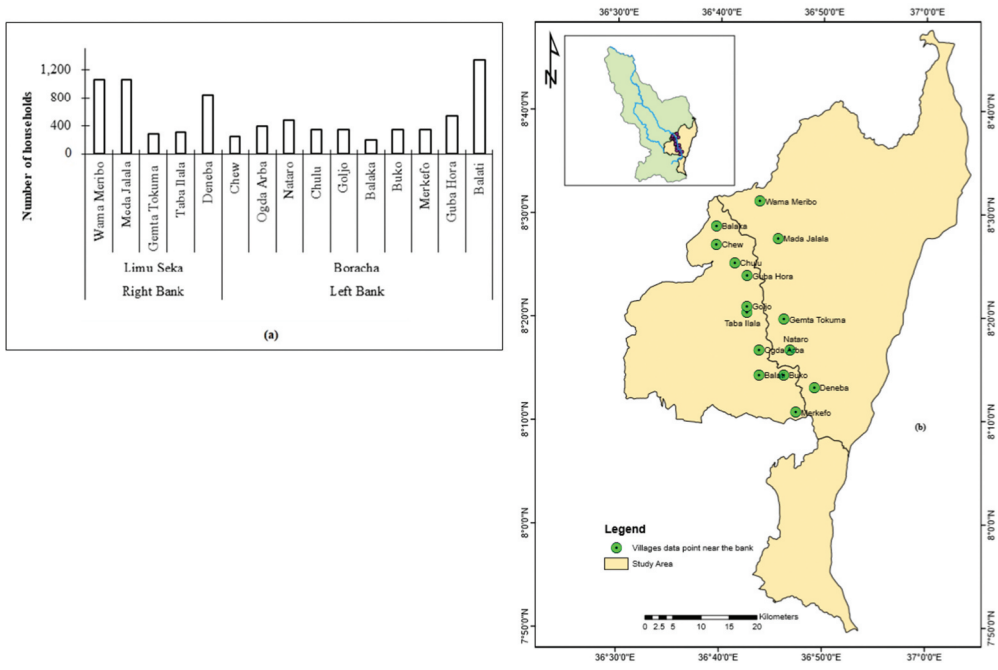

Figure 2. (a) Households within a 3-km radius of the proposed Arjo-Dhidhessa large-scale dam and (b) village location near the left and right banks of the reservoir (Mowie 2017).

Table 2. List of secondary data used.

Data type	Data information
Census	• Number of the population at the regional, zonal, village and household level, which includes the level of education • Census data were collected from the Ethiopian Central Statistical Agency from 1984 to 2012 (CSA 1984, CSA 1994, CSA 2007, CSA 2012)
Arjo-Dhidhessa Large-Scale Dam and Structures Design study	• Phase II and Phase III report from Oromia Water Works Design Office (Mowie 2017)
Population data of migrants	• Number of migrants in each village from the Zonal and Woreda Administration Office (MoA 2017)
Arjo-Dhidhessa Large-scale Dam Design study	• Number of farmers to be resettled because of Dam Construction • Hydrogeological and dam feasibility study report (OWWDSE 2007, MoA 2017).

of religion, about 60% of the sample households were Muslim, about 37% were Christian, while the remaining 3% did not respond to this question. The majority, about 77%, were married. The majority (90%) of the households belonged to the Oromo ethnic group, in which approximately 7% were from the Amhara ethnic group, while about 3% did not respond to this question. The average family size was about 5.1, of which 49% were male and 51% were female. The family age structure was about 52% under 15 years of age, about 45% between the ages of 15–64 years and about 3% were above 64 years of age.

4.1 Occupational choices

The survey result of all respondents finds that the major economic activity in the study area is agriculture and subsistence farming is the dominant means of earning a living. They practice a mixed type of farming system where crop cultivation is very closely associated with animal husbandry and all rely on traditional farming methods including manual and animal (oxen) labour. The use of agricultural chemicals such as fertilizers and pesticides is very limited. The crops cultivated in the project area are dominated by cereals, the predominant being maize. Other major crops include sorghum and teff. Cattle and goats are the dominant livestock in the area.

Figure 3 shows the distribution of occupational choices based on the survey of households. While nearly half of the respondents engage solely in farming, many combine farming with other activities. Of interest is that a more enterprising farmer (who is both a farmer and a businessman or both a farmer and cattle fattener for sale later) is most well off, while a farmer who is a sharecropper earns the least (Fig. 3). The analysis of variance (ANOVA) was performed and the difference between various occupational groups found to be statistically insignificant for both the annual income and expenditure. Although statistically similar, the differences observed from Fig. 3 are indicative of the differences in well-being of the occupation groups. All their expenditures closely match their respective incomes, indicating that households adapt their expenditures based on the income earned. The difference between income and expenditure corresponding to each type of occupation may be indicative of the overstatement of income earned by the respondents.

The farmers utilize the land for crop production and irrigate their crops through water diversion and pumping from the DRB. The farmers produce maize, onions, carrots, cabbages and many other fruits and vegetables throughout the year. More than 60% of the land is covered by crops (Fig. 4). They also preserve for household consumption and sell the extra crops yield to generate an income. Risk diversification (multiple occupations but with crop production as the key occupation)

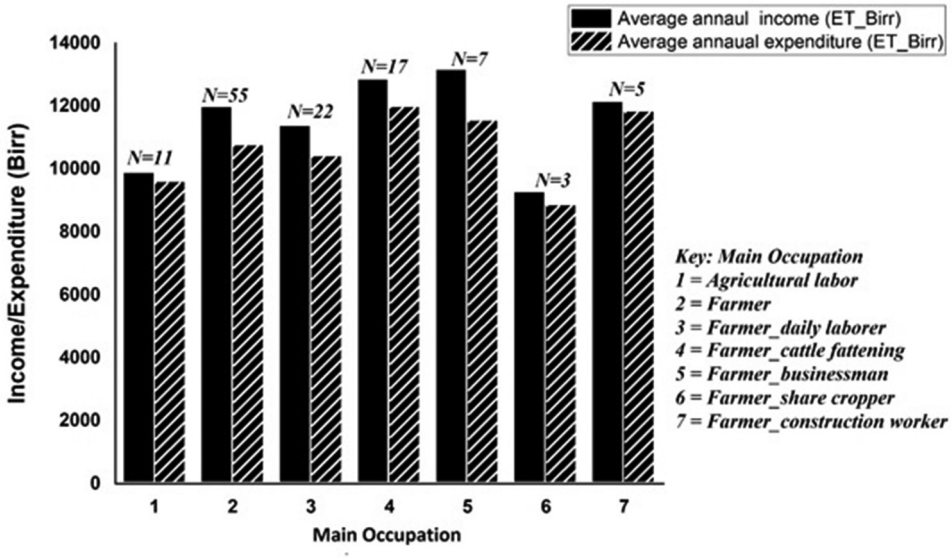

Figure 3. Average annual income and expenditure at household level. Occupational choices are shown on the right. "Farmer" means that the respondent is only engaged in farming, while "Farmer_occupation" means that the respondent is engaged in both farming and casual labour. *Birr* is the Ethiopian currency.

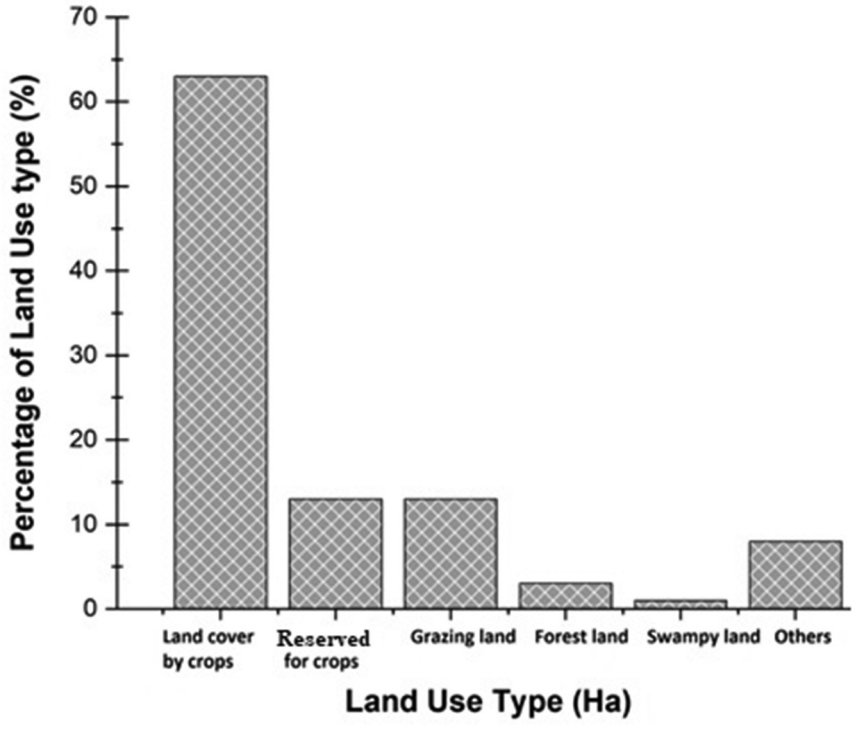

Figure 4. Proportion of land-use type in terms of land coverage by crop, reserved for crop, grazing land, forestland, swampy land and others (sourced from primary data).

appears to be a prevalent strategy in the basin (Fig. 3). This may be indicative of dynamic economic activities in the basin as a result of agriculture being a less reliant source of income.

4.2 Waves of water migrants to DRB

The rural migrants (80% of the respondents) were also mostly dependent on agricultural production. Thus, three factors related to this dependence on agriculture were the main drivers for the farmers to migrate and leave their original homes in the first place. These factors are the unreliability of rainfall, land (small agricultural area per household) and drought (Fig. 5). In addition to drought, studies have found that this migration has been further accelerated by climate change and related environmental challenges (ICPSR 2013). The census and survey data show that the change in rural population numbers was during the years that farmers migrated from the Hararghe region under the government initiation (Fig. 5). More than 80% of the respondents migrated from another region and only about 20% were from the native community. About 81% of those who migrated were

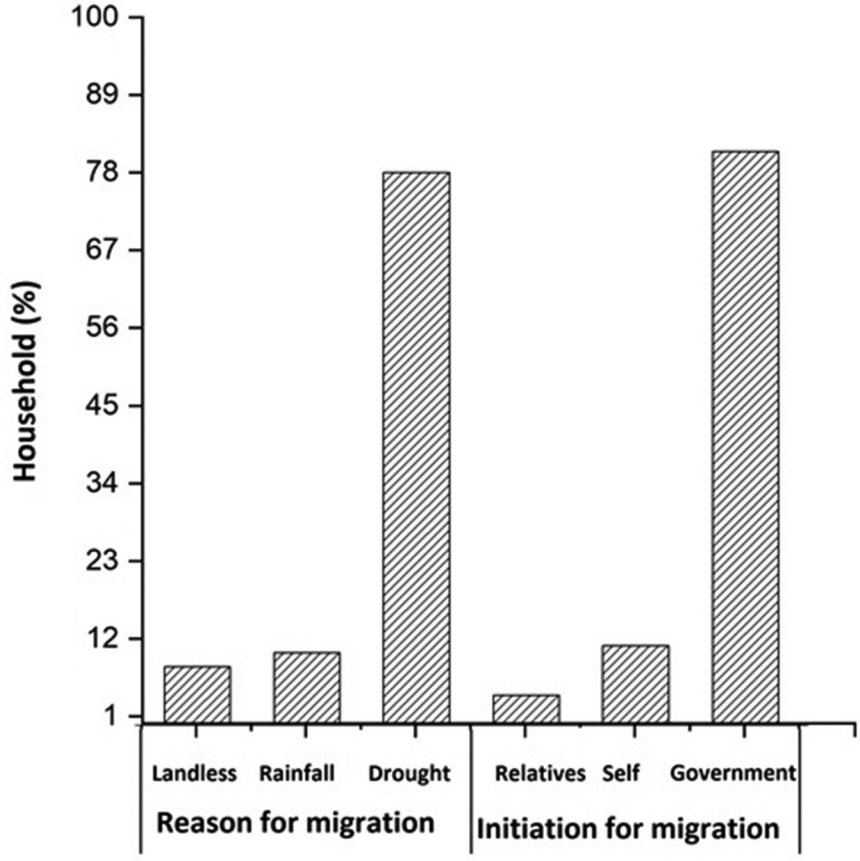

Figure 5. Factors (drivers) for rural population migration along the Dhidhessa River Basin during both the first and the second migration cycles.

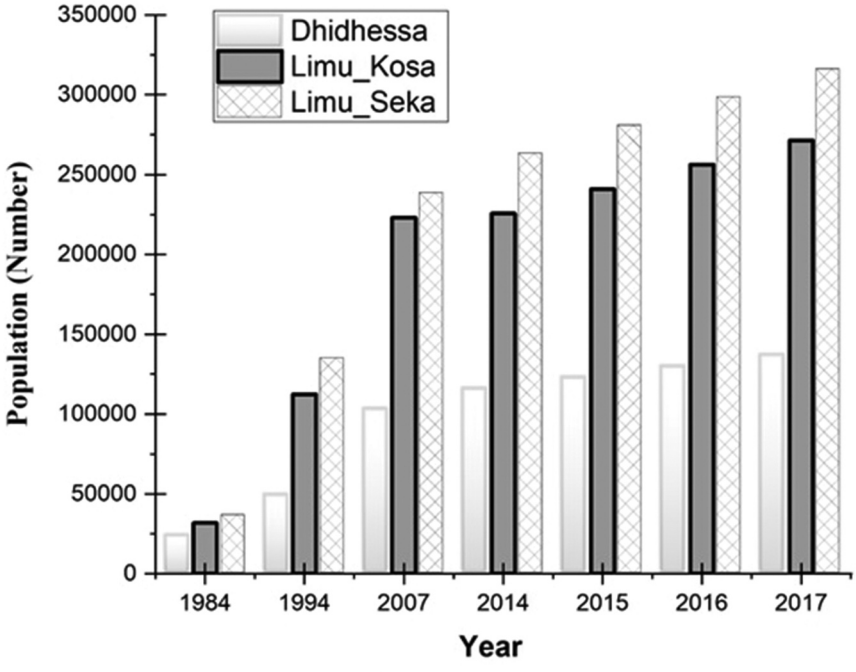

Figure 6. Trends in rural population statistics.

because of water scarcity, about 8% was due to a lack of farmland and about 10% was due to unreliable rainfall. About 84% of those migrated was facilitated by the government initiative, 11% were helped by their relatives/friends and about 4% migrated on their own initiative (Fig. 5). Figure 6 also shows that the average growth rate before 2007 was higher than the growth rate after 2007.

In Ethiopia, the migration and resettlement programme, which was forced by the urgent desire to search for water resource

and land availability, was started in the 1960s (Table 1). The Ethiopian Federal Government established a national programme for migration and resettlement in selected regions of the country in the mid-1980s such as in 2001 in the Dhidhessa River Basin (DRB), which was forested with reliant water supply. The main aim of the programme was to fight drought and famine, particularly in Wello in the Amhara region and Hararghe in the Oromia region (CSA 2007). About one million people were forced to migrate between regions (Amhara to Oromia, north to south and southwest) between 1982 and 1983 during the Derg regime of the country. The resettlement programme brought environmental change and economic and socio-political impacts (CSA 1984). For example, in 1984 and 1986, the occurrence of a major drought caused about 1.5 million people to migrate and relocate from drought-prone areas of the country to different parts of the Oromia region (ICPSR 2013). The DRB was one of the sites used for population migration and resettlement at that time (as seen by significant increases in population prior to 2007, see Fig. 6). This basin was selected due to its suitability for irrigation and animal-rearing practices (Sima 2011, Mowie 2017).

4.3 Role of government migration initiative

The residents of the Dhidhessa River who migrated under the Ethiopian Government migration and resettlement programme witnessed that the programme considerably improved their livelihood and living status (Focus group discussion, July/2018). It is also evident from Fig. 5 that a major driver of migration has been the drought that destroys agriculture-based livelihoods. However, most migrations were facilitated by the government (Fig. 5). This is also corroborated by the census (Fig. 6), which shows the number of migrants (responsible for the high population growth rate before 2007) dropped after the government initiation. About 61% of the households randomly sampled in the survey migrated as a result of government intervention. This suggests that the direct involvement of the government in resettling citizens played a key role.

The estimated transportation cost was compared with the yearly income of the farmers to assess whether high transportation costs hindered the households to migrate even when they have dire reasons to move out of drought-prone regions. We find that the average household income per year is almost equal to the migration cost (about 9000 ETB/household). After the migration was initiated by the government, there were no trains as a means to transport and so, people could only use public buses for migration on their own initiation. The resulting transportation cost was very high and it cost 900–1000 ETB per individual and 6000–9000 ETB per household. This indicates that the opportunity costs of migration are very high, which may force farmers to stay in their native areas in spite of a dire shortage of water resources.

4.4 Future prospects

The residents of the DRB, who were moved by the Ethiopian Government migration and resettlement programme have considerably improved their livelihood and living status (interviews held in July 2018). The surveyed results show that about 73% of the migrated farmers have increased their crop production (Fig. 7). Moreover, the interviews indicated that about 2.72 ha was given to each household migrant by the government and the farmers used more than 68% of their land for crop production. Consequently, the migrated households were better off than the native dwellers because the water resource was more properly utilized by the migrants (interviews held in August 2018). This demonstrates the value of migrating to the DRB, especially when facilitated by the government, since otherwise these migrants would not have had the chance to migrate.

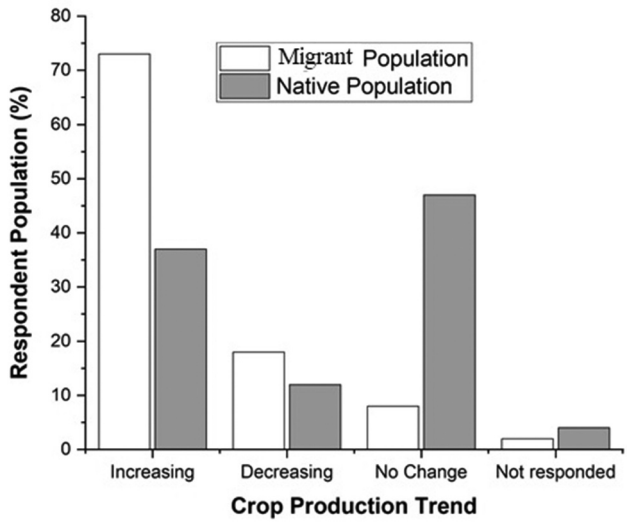

Figure 7. Trends in farmers' crop production.

However, the ongoing Arjo-Dhidhessa large-scale dam construction (see Fig. 1(b)) and the sugarcane irrigation project have forced the migrants, who were settled around the dam, site to relocate elsewhere (Focus group discussion, August 2018). According to the opinion of migrated farmers living alongside the basin, the dam project will negatively affect the livelihood and emotional wellbeing of the farmers, even though it may have positive impacts on the regional economy in the long run. The residents have responded that their living conditions have already been reduced by the dam construction due to the loss of their land and assets (Interviews, July/2018). The farmers located downstream of the dam also expressed their worries about the flooding, especially during the rainy seasons. The seasonal flooding has damaged their plantations, crops, animals, as well as harmed their children and family members. Attacks by wild animals, such as crocodiles and snakes, have increased in the post-dam construction era. Since most of the displaced farmers are migrants who were resettled in 2004/05 by the government and lack social safety nets, they likely may resort to desperate measures in order to survive yet another relocation to less productive lands. This also has implications for worsening living conditions for others not directly affected by the construction of the dam.

5 Discussion

The survey analysis highlights potential linkages of migration with the socio-economic capability and environmental factors, such as water availability, lack of farmland and rainfall variability. The results show that more than 95% of farmers were migrated under the government initiative. This is in contrast to voluntary migration often observed in more economically

developed basins, such as the Murrumbidgee River basin, Australia (Kandasamy *et al.* 2014, Roobavannan *et al.* 2017). The driving force in the Murrumbidgee River basin was self-initiated due to the attractiveness of the water resource development in that basin and that migration costs compared to annual incomes are small. Minimal set-up costs to migrate, i.e. costs incurred to embark on migration including opportunity costs, have also been observed in rapidly growing economies, such as China (Akay *et al.* 2012, Long *et al.* 2010, Liu and Shen 2017).

Similar potential reasons exist to migrate to the DRB from regions other regions of Ethiopia, such as Hararghe, Amhara and Arsi (e.g. lack of agriculture production due to drought or poor land). However, the number of farmers that migrated to the study area after the government initiation was insignificant, i.e. self- and relative-initiated migrations were limited. This is indicative of certain set-up costs that deter households from migrating.

Farmers' annual income was found to be equal to the cost of transportation to migrate to the study area, in the case of farmers wanting to migrate by self- and relative-initiation. High set-up costs have been found to deter migration in other places, such as Bangladesh (Gray and Mueller 2012). The trend of giving incentives, by subsidizing transportation costs, was shown to support seasonal migration in Bangladesh (Gray and Mueller 2012, Bryan *et al.* 2014). This appears to suggest that set-up costs of migration are an important consideration for households in developing countries.

At the same time, while the migrants resettled by the government struggled to survive in the first 1–3 years, they managed to have a better life thereafter. However, when, after a few years, the government started to construct the Argo-Dhidhessa Dam, a new challenge was brought for the migrants (see Supplementary material). These migrant farmers who were living alongside the dam project had to resettle again, after getting used to higher incomes (so-called "habit formation" phenomenon, see Fig. 7). Our survey reveals that they do not want to return to their original location because they have a better life than before and it would be hard to get back the farmland that they left. The same set-up costs that would have deterred them from migrating to the DRB without the government support, are now deterring them from moving to further new locations. This makes them vulnerable to both economic and psychological stress, negatively influencing their well-being, and has implications for the sustainable development of the basin.

6 Conclusion

This paper assessed the dynamics of population migration and resettlement from the Hararghe region of Ethiopia to the DRB in the context of water scarcity based on extensive literature review and primary and secondary data. The study also analysed the expected impacts of the currently developing Arjo-Dhidhessa Dam project on the local communities.

The migrated farmers have benefited from the resettlement programme set up by the Ethiopian government. A government-sponsored initiative enabled the vulnerable population to migrate from the Harerghe region to the DRB, where high transportation costs would have financially deterred them from doing so otherwise. It was found that by diverting the Dhidhessa River and utilizing it for irrigation, the farmers are able to practice sustainable agricultural productivity, such as growing maize, onions, carrots, cabbages and many other fruit and vegetables. These crops have also helped the farmers to generate income and thus improve their livelihoods. Nevertheless, while the migration and resettlement programme has alleviated the impacts of drought and famine on the population, the native forests have been converted to agricultural land, which is a continuing process. This may alter the hydrological and environmental conditions of the basin. For example, some of the farmers who reside downstream of the dam described their concerns about floods during the rainy season. Floods damage their plantations, crops, animals as well as their families. Moreover, due to the Arjo-Dhidhessa sugar-cane project, the government has relocated the farmers to other nearby villages. This is heavily contested by local inhabitants with the potential to destabilize local economies and undo the gains made by the pre-2005 planned migrations into the basin.

Such local crises are in urgent need of attention by the Ethiopian government, especially regarding the impact and consequences of migration and how water resource development has affected the society, the environment and influenced river flow. Given the high migration costs and habit formation of the migrant population, socio-hydrological studies are needed to carefully assess human–water interactions and the ecosystem balance of the basin, while taking into account the local human realities.

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