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Research article

Impact of land use land cover change using remote sensing with integration of socio-economic data on Rural Livelihoods in the Nashe watershed, Ethiopia

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ABSTRACT

Land use/land cover is an important component in understanding the interactions of human activities with the environment and is necessary to recognize the changes in order to monitor and maintain a sustainable environment. The main objectives of this study were to analyze changes in land cover in the Nashe-watershed for the period 2010–2020, analyze household demographic and livelihood characteristics and identify the impact of the construction of the DAM and changes in land cover on the environment. Since the dam of the Nashe watershed was built in 2012, the socioeconomic characteristics of the area were used to interpret the causes of land use and land cover changes, which cause changes in their life and environment. Purposively 156 households were selected who were more than 40 years old from the total households (1222) in three kebele and for land use land cover of 2010, Land sat 7 were used whereas for 2020, land sat 8 was used. The socioeconomic data were analyzed with Excel and integrated with biophysical data. The 2010–2020 ten-year period showed that cultivated land and forest land were reduced from 73% to 62% and 18%–14%, respectively, and swampy areas fully converted to Water Bodies, alternately increasing Water Bodies and grazing land also converted from 43.9% to 54.5% and 0.04%–17.96% respectively. The reason for this change was the construction of dams, human encroachment, and expansion of cultivated land which were bringing LULCC in study area. However, government could not gave these people adequate compensation for their lands, properties that conquered by water. Hence, the Nashe watershed is identified as an area highly affected by land use and land cover change, the livelihoods were suffered by Dam construction, also environmental sustainability is hindering still now. Therefore it is necessary to closely monitor land use/land cover, giving consideration for HHs who affected by Dam, and to maintain a sustainable environmental resource for the future sustainable development is a critical issue in the Ethiopia in general, particularly in the study area.

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1. Introduction

1.1. Background of the study

Land is the primary resource for human beings and the use of land resources fluctuates spatially-temporally based on production objectives [1,2]. But, the value of this land is affecting due to land use land cover change (LULCC) that is the main environmental challenge and ecological problem in the world, especially in developing countries like Ethiopia [3]. Change of land use/cover due to dams and reservoirs is the most common type caused by human-induced activities, and humans build dams as an important way to use water resources and avoid natural challenges in the watershed [4,5]. These phenomena cause biodiversity loss and alteration of essential natural resources [6].

Sub-Saharan Africa is experiencing steady agricultural expansion, but at the same time around 65% of Africa's agricultural land is too degraded for sustainable food production, discouraging a growing population dependent on agricultural land and it is a serious problem to support them [7,8]. Most of the time more biodiversity has been observed in wetland and forestland than in other land use types [9]. Recently, a study focused on sub-Saharan Africa, showing a decrease in land covered by the natural environment, mostly due to anthropogenic activities such as population growth, economic development, urbanization, and globalization [10].

In Ethiopia, increased population pressure and related food needs are the basic drivers for the alteration of natural forests to grasslands and cultivated lands that bring total environmental change [11]. In developing countries like Ethiopia, it is better to integrate programs, projects, and activities with environmental resources that ensure sustainable development [8,12]. Sometimes today a watershed is missed for conservation at some place. However, watershed resources make available vital things and amenities on which living organisms rest, such as provisioning, regulating, and supporting functions and services [6].

In rural areas, abundant and fertile land is the most potential for agriculture with a diverse climate and plentiful rainfall [13]. Most of these study results indicated that deforestation and expansion of cultivation to peripheral areas such as steep slopes were the main causes of land degradation, especially in the highlands of Ethiopian country [14,15]. In particular, its effects are more visible in developing countries, where the economic activity of farmers depends on watersheds [8]. Some studies suggested that the main drivers of land use and land cover are demographic dynamics, economic factors, socioeconomic factors, and cultural factors in the rural area. Research carried out in Ethiopia such as [4,16–18] (Halefom et al., 2018) [19,20], showed that LULC changes are visible in the country due to different economic activities. For example [21,22], reported a serious trend of land degradation resulting from the expansion of cultivated land at the expense of forested areas in Dembecha in northwestern Ethiopia and in the Derekoli watershed in southern Wollo.

In contrast [22,23,23] have reported an increase in forest plots (eucalyptus tree plantations) and arable land at the expense of grazing land in both the Sebat-bet-Gurage country of south-central Ethiopia and in the river divide Chemoga in northwestern Ethiopia. These reports have revealed heterogeneity in changes in the type, pattern, direction, and magnitude of LULC across the country and highlighted the difficulty of extrapolating the known trends to unstudied areas. Therefore, region-specific information on such changes in the LULC is essential for land-use planning aimed at wise resource management and maximizing the productivity of both agricultural and non-agricultural land at regional and national scales [10].

1.2. Statement of problems

Environmental change is the currently scenario due to climate change, which is the outcome of an increase in temperature and erratic rainfall in place and time worldwide. Ethiopia is one member of the developing countries and also there is socio-economic and environmental challenging at different places among stakeholders, rising conflict among farmers with the Government and pastoralists due to inadequate potential land availability in this country among local people. Similarly, a lot of projects have got permission with and without environmental impact assessment (EIA) in case of social, economic and environmental perspective due to poor plan projects [12]. However, the study area is based on rain-fed agriculture with irrigation potential, especially during the winter season when the amount of natural rainfall was scarce and all people lived by crop cultivation and rearing livestock in this watershed. Although due to different factors Land use land cover change (LULCC) happened and also Nashe Dam was constructed without environmental impact assessment in case of social, economic and environmental in both positive and negative impacts.

However, different scholars conducted around the Nashe watershed like the Fincha'a-Amerti-Nashe river basin as conducted by Ref. [5] on the title of impacts of hydropower dam construction on the adjacent rural households' food insecurity in Northwestern Ethiopia, and also as studied by Ref. [10] on title of Past and Future LULCC in the Ethiopian Fincha Sub-Basin. However, no one scholar addressed the impact of LULCC using GIS with Integration of Socio-Economic on Rural Livelihoods, and as well as on the environment particularly in the Nashe Watershed western, Ethiopia. Therefore, to address this gap, this study was conducted by the objectives of analyzing changes in land cover in the Nashe-watershed for the period 2010 and 2020, analyze household demographic, and livelihood characteristics and identify the impact of the construction of the DAM and changes in land cover on the environment in the study area.

1.3. Limitation of study

This study faced by some limitations while conducting the study area. There was lack of successive and accurate resolution satellite images which prevented error in land use land cover change detection. That means, the use of Landsat 7 ETM + has the weakness of SLC Off and we preferred of Landsat 8 for land use land cover classification of 2020. The other major limitation was stems from the difficulty of classifying a swampy area and grazing land before the Nashe Dam construction. Identifying swamp areas from other LULC types is difficult because swampy areas are made up of a variety of entities that can potentially be blended with vegetation, grass, and partial water bodies. Other constraint was households of the Nashe River Basin had a scarcity of information concerning land-use/ cover change and they considered as other views. The others challenge and constraints were due to the study area being far from the center, like road availability, and there are lacks of transport for researchers to contact study are time to time during the study.

2. Material and methods

2.1. Location of study area

Geographically, Nashe watershed lies between 37°5′00″ and 37°17′00″ east and 9°36′00″ and 9°52′00″ north in the district of Horo Buluk, Horo Guduru Wollega zone, Oromia national and regional state, western highlands of Ethiopia, in the Nile basin of western Ethiopia with an elevation of 2094–2651 m.a.s.l. This watershed lays Jarte Jardaga in northern, Abay choman in eastern, Shambu Town in southern, and Habe Dongoro in west direction (Fig. 1).

The study area is characterized by a unimodal precipitation pattern, with an average annual precipitation of 1400 mm and a monthly average temperature between 14.1 and 17.3 °C. The study area covers about 22,067 ha and its main land's fall into hilly terrain (15–30%) covering about 32%, hilly terrain (8–15%) covering about 20% and undulating terrain covering about 12% covered. Only small patches of land, accounting for about 1% of the total area, were flatly covered. About 15% of the total country was covered by steeply dissected to mountainous terrain and 2% was also characterized by a very rugged, mountainous and hilly topography with steep slopes. The remaining part of the study area, accounting for 18%, was covered by water bodies (Table 1).

2.2. Methods

2.2.1. Method of data collection

In order to achieve the objective of the study, data sets from multiple sources including satellite imagery, climate data, and digital elevation models (DEM) were obtained from various sources. Data from household surveys performed on a sample of 156 household heads were selected using a multistage purposive sampling procedure because we used older people to get accurate information. Purposively 156 households were selected who were more than 40 years old from the total households (1222) in this study watershed

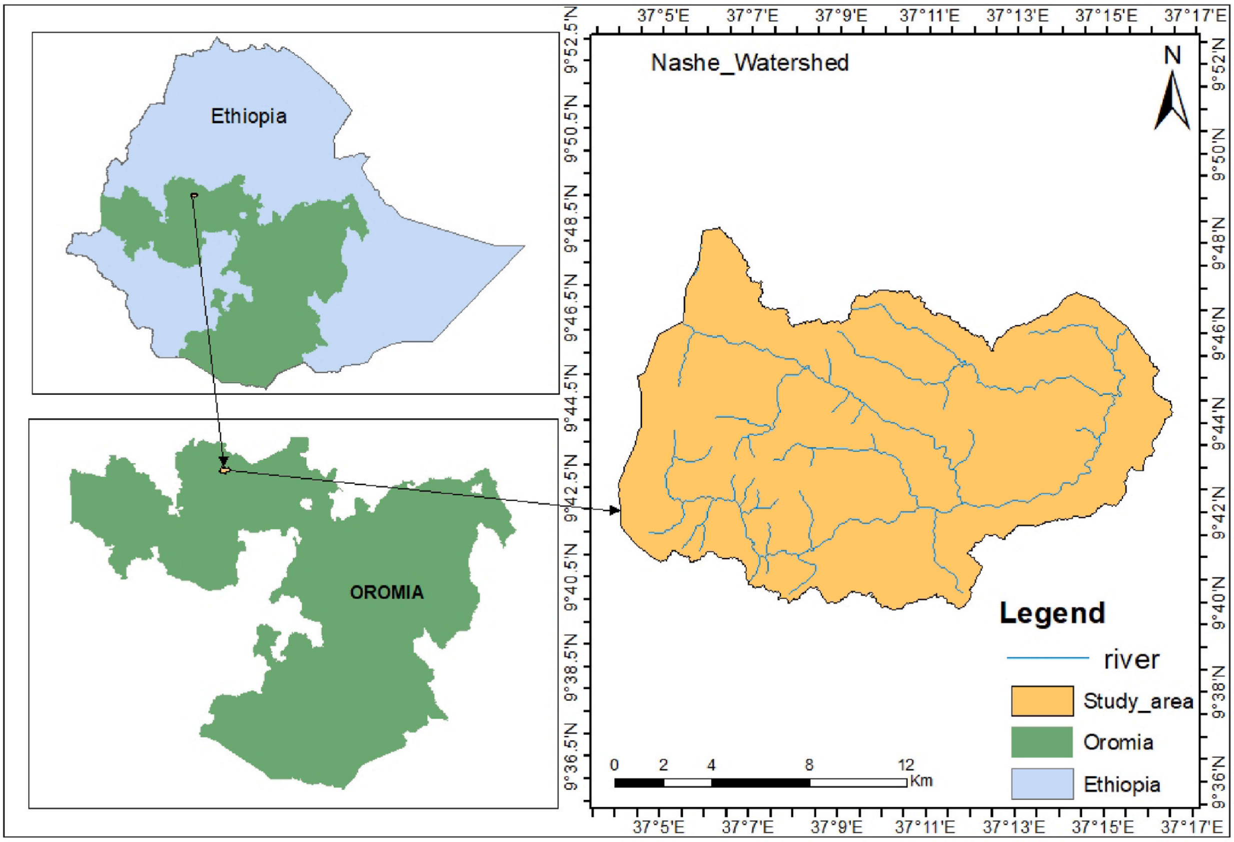

Fig. 1. Location map of study area, Ethiopia.

Table 1
Slope range of the study area in percent.

No	Slope range (%)	classes Name	Area	Slope coverage in %
1	0–2	Flat to almost flat terrain	220.6780	1
2	2–8	Gently flat to undulating terrain	2648.1595	12
3	8–15	Rolling terrain	4413.5992	20
4	15–30	Hilly terrain	7061.7588	32
5	30–50	Steep dissected to mountainous terrain	3310.1994	15
6	>50	mountainous terrain	441.3599	2
7	Water body		3972.2393	18

who have known about the Nashe watershed.

Also, field observations, on the drivers and causes of LULC variations seen in the Nashe watershed, and qualitative information of data were done. Therefore, socioeconomic data was specifically collected from households from three kebele (Alchaya Igu, Sandabo Dongoro and Ejersa Meca) within a watershed that made this paper stronger. The sample size was determined based on the age of the household head (more than 40 ages). Based on this, in Alchaya Igu the number of HHs more than 40-year-old was 68 of the total HHs (530) whereas in Sandabo-dongoro the number of HHs more than 40-year-old was 34 of the total HHs (272) and in Ejersa Meca, 54 HHs were selected who were more than 40 years old of the total HHs (420). The total sample sizes were 156 HHs (Table 2).

2.2.2. *Data collection, image processing, and classification*

In addition to socioeconomic data (Fig. 2), satellite images were used for LULCC detection of the study area through downloading from the USGS website (Fig. 3). Watershed boundary and drainage patterns were delineated using arc second (~30 m) Shuttle Radar Topography Mission (SRTM) void-filled DEM. Satellite image distortions due to different factors were corrected using radio metric and geometric correction techniques before further using images for classification (Table 3). The corrected image was projected to World Geodetic System datum 1984 (WGS84), Adindan, Zone 37 reference frame.

Image classification for both year intervals (2010 and 2020) was performed by supervised classification using a maximum likelihood classifier. The classified images were assigned to the respective classes in seven (i.e., forest land, grassland, water body, cultivated land, bare land, swampy area, and settlement). For analysis, the ground truth data were supplied as reference points (300) that were gathered using GPS and used for overall accuracy evaluation. Finally, a supervised signature extraction with the maximum likelihood technique was utilized to classify images in conjunction with a field survey and Google earth pro view (Table 4).

2.2.3. *Accuracy assessment for evaluating classifications*

After classification was completed, reviewing the classification result was done the next step in determining whether the classification was accurate since it shows how the findings correspond to the reality on the ground. Using the ground control points (GPS points) gathered during the field visit, the accuracy assessments of the classification result were carried out for this project. Typically, the assumed-true data come from ground truth data that have been chosen at random and used by the following formula [24,25]:

$$\text{Users Accuracy} = \frac{\text{number of correctly classified pixels in each category } * 100}{\text{Total number of classified pixels in that category (the row total)}} \tag{1}$$

$$\text{Producer Accuracy} = \frac{\text{number of correctly classified pixels in each category } * 100}{\text{Total number of classified pixels in that category (the column total)}} \tag{2}$$

$$\text{Overall accuracy} = \frac{\text{Total number of correctly classified pixels (diagonal) } * 100}{\text{Total numbers of reference pixels}} \tag{3}$$

3. Results and analysis

3.1. *Socio-demographic characteristics of sample households*

Table 5 shows the Households demographic, socio-economic and livelihood characteristics of the study area. The result revealed

Table 2
Number of HHs and sample size at study area.

Name of kebele	Total number of households	Sample proportion (%)	Sample
Alchay Igu	530	0.44	68
Sandabo-Dongoro	272	0.22	34
Ejersa Meca	420	0.34	54
Total		**100**	**156**

Source: From Horo Buluk district (2021).

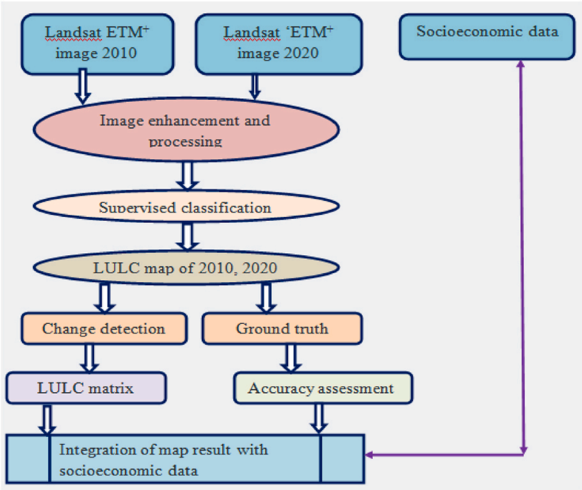

Fig. 2. Research methodology of flowcharts.

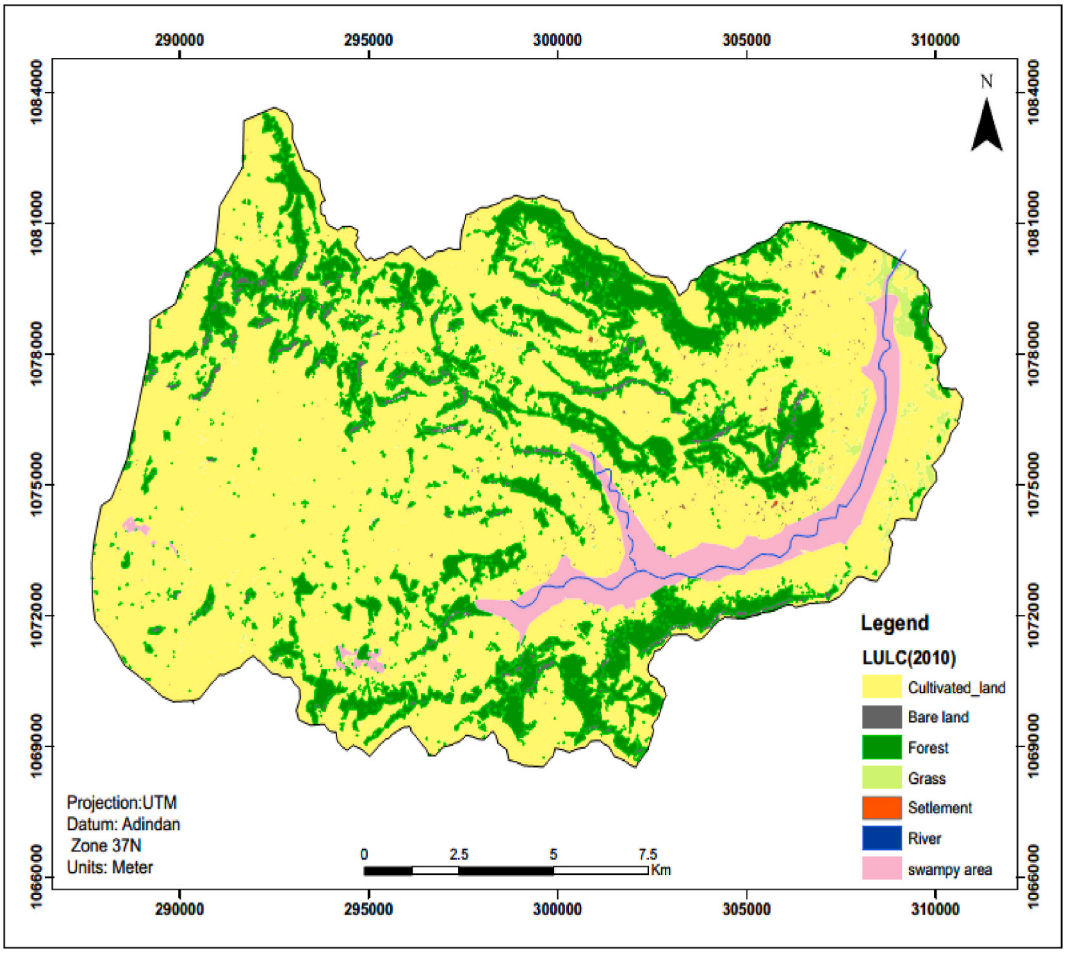

Fig. 3. Land use and land cover of 2010 Nashe-watershed before dam construction.

Table 3
Landsat images and their characteristics.

Sensor Name*	Acquisition date	Scene ID	Path, row	Spatial resolution (m)	Number of MS bands	Cloud cover (%)
Landsat7 ETM$^+$	March 30, 2010	LT07_L1TP_169053_20100314_20161017_01	169,053	30	7	0
Landsat8 OLI	March 30, 2020	LC08_L1TP_169053_20200330_20200410_01	169,053	30	8	0

Table 4
Land Use Land Cover classes and their respective description.

LULC	Description
Water body	Area completely busy by water
Cultivated land	Area used for cultivation, including fallow plots and complex units such as homesteads.
Swampy land	Flat and swampy area during both wet and dry seasons; mainly covered with grass
Grazing land	Area covered with grass, bushes, and trees, and used for grazing
Forest land	Area covered with natural and plantation trees, sometimes mixed with enrichment plantations, forming nearly closed canopies with 70–100% cover.
Bare land	Are never covered by any things
Settlement	Area occupied by peoples

Table 5
Households demographic, socio-economic and livelihood Characteristics of the study area.

Socio-demographic Characteristics		Ejersa Mecha HHs in frequency	AL/Igguu HHs in frequency	Sandabo Dongoro HHs in frequency	Total in %
Gender	Male	48	63	29	89.7
	Female	6	5	5	10.3
Age	40–50	6	9	6	13.5
	50–60	9	19	12	25.6
	60–70	25	21	8	34.7
	70–80	11	16	4	19.8
	Above 80	3	3	4	6.4
Education status	Illiterate	38	37	17	62.1
	Literate	16	21	19	37.9
	Primary	6	11	5	39.3
	Secondary	8	4	9	37.6
	Diploma $ above	2	6	5	23.1
Family size	Less than 4 persons	16	20	14	32.1
	4-8 persons	22	29	10	39
	More than 8 persons	16	19	10	28.9

that a large percentage of household heads (89.7%) were men, while women made up the remaining proportion (10.3%). Likewise, large proportions (34.7%) of the households surveyed were between 60 and 70 years old age and a minimum of 13.5% were between 40 and 50 years old age, while 25.6% and 19.8% of them were between 50 and 60 years old, 70 and 80 years or older, respectively. In terms of family size of respondents, the highest family sizes were 39% and had 4 to 8 household members. Similarly, about 32.1% of the respondents had between 1 and 4 household members, while 28.9% of them had eight or more family members. Regarding the educational status of the study area, 62.1% of the respondents were illiterate and 37.9% of the respondents were literate. Therefore, relatively speaking, a larger proportion (39.3%) of the respondents could read and write. A small proportion of heads of household (23.1%) had attended grade 10 or above the formal education status in the study area.

3.2. Change in land use, land cover

The highest land cover in 2010 was cultivated and forest land that account about 16193ha and 3911ha respectively in the study watershed whereas the smallest were water bodies and settlement that accounts about 7ha and 43 ha in respectively. Furthermore, the classified image of 2020 (Fig. 4 and Table 6) showed that a clear and strong change in land use and land cover in the study area. The greatest changes were noted in swampy area, water bodies, cultivated land, forest land and grass land. Cultivated land, swampy area, and forest area were reduced by −2470 ha (−11%), −1281ha (−6%), and −893ha (−4%), respectively, while water bodies and grassland were increased by 3954ha (+17.96%) and 843 ha (+4.23%), respectively, or in 2020 Settlement increased by only 1% in

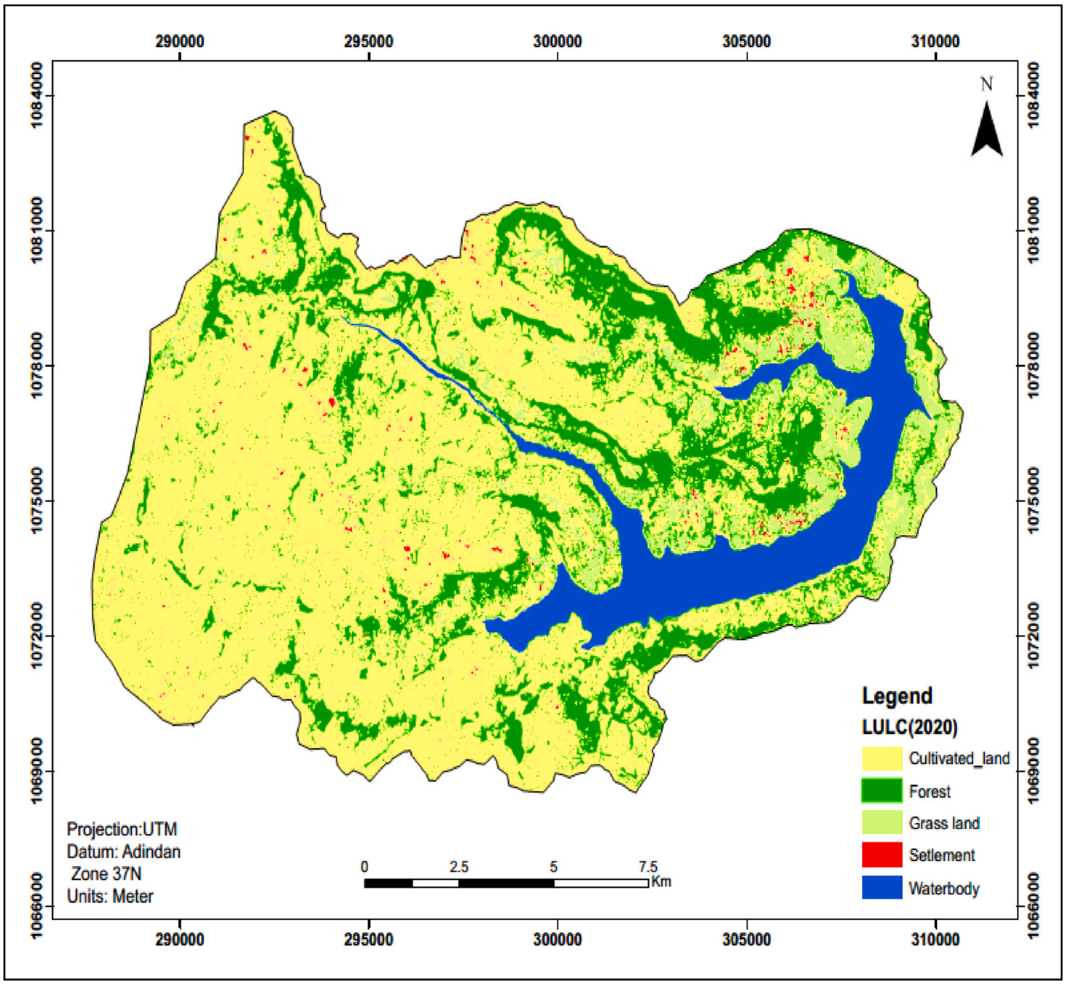

Fig. 4. Land use and land cover of 2020 of Nashe-watershed after dam construction.

Table 6
Land use and land cover change Matrix of 2010 and 2020.

LULC	Area in 2010		Area in 2020		Area changed from 2010 to 2020		Remark
Types	Ha	%	Ha	%	Ha	%	In sentences
Forest land	3911	18	3018	14	−893	−4	Decreased
Grass land	348	0.77	1191	5	843	+4.23	Increased
Cultivated land	16,193	73	13,723	62	−2470	−11	Decreased
Bare land	284	1	0	0	−284	−1	Decreased
Swampy area	1281	6	0	0	−1281	−6	Disappeared
Water body	7	0.04	3961	18	3954	+17.96	Increased
Settlement	43	0.19	174	1	131	+1	Increased
Totally	22,067	100	22,067	100			

2020.

For these reasons, different biodiversity has been migrated to other areas from this watershed due to the change in land use and land cover, and part of the livestock and wildlife that have been lived in that area were dead already due to the environment disturbances. Due to the construction of Nashe Dam and the reduction of agricultural land brought LULCC, the livelihoods were affected by migrated to other area and some of them were left on that area and clearing forests on fragile and steep slope of the land. Such activities easily impaired environment as well as making sedimentation of the dam, which affect life span of the Dam.

The difference between the land use and land cover between 2010 and 2020 is due to the alteration of the land use and land cover, particularly by the construction of the Nashe dam. Based on this, the 2020 land cover completely eliminated both the swampy area and the barren land, which observed on land use type 2010 (Fig. 3). Even when accuracy assessments were conducted, both land covers were not present, but as of LULC in 2010, they were converted totally (Fig. 4).

3.3. Accuracy assessment for land use land cover for 2020

Provides proof of for each type of land use and cover, an accuracy assessment was conducted to determine its correctness. A total of 300 points were gathered from the study area, including 65 points for forest land, 60 points for grass land, 75 points for cultivated land, 50 points for water bodies, and 50 points for settlement. Thus, the overall accuracy was thus 94.66% (Table 7).

3.4. Effect of land use land cover change on Rural Livelihoods

According to household respondents (Tables 6 and 8), land use changes occurred due to human intervention and agricultural intensification due to the construction of the Nashe Dam. Accordingly, 88.5% of all households reported the following: After the construction of the dam, wetland and the swampy area previously used for irrigation and grazing was completely converted into a body of water. Consistent with these, 94.8% of households reported that arable land total of more than 2000 ha had the water drained due to the construction of dams. The size of land holdings varied for each household both before and after the construction of the Nashe Dam. The land tenure size of households less than 2 ha before the Nashe Dam was 21.8%, while after the dam was built it was 44.3%. This implies that the scarcity of land among was increased. Similarly, 23.7% of households had an area of 2–4 ha before the dam was built, while after the dam was built, 32.7% of households were in the study area. Accordingly, 36.5% and 17.9% of households had farmed between 4 and 8 ha before and after the construction of the Nashe Dam, respectively. Finally above 8 ha of land before and after Dam construction of Households were 17.9 and 5.1% respectively.

Similarly, as revealed by household surveys, the causes of LULCC in the study area were primarily due to human encroachment (87.2%), followed by Nashe Dam construction (57.2%), which had been in place since 2010 (2002 EC), rendering LULCC completely absent in the study area. The highest average of respondents (88.5%) of the total explained that swampy areas completely converted to water bodies, and the remaining portion (11.5%) expressed the opposite view (Table 8). This implies that the extent of spatial and temporal land use and land cover change was clearly visible in the study area.

The assessment revealed that land use and land cover changes were highly developed as a result of human encroachment and the construction of the Nashe dam, with the expansion of arable land and grazing land. As a result, many (73.1%) of the households indicated that the income level of the study area's households was lower before (2010) the construction of the Nashe Dam than after 2020, which is equivalent to (Table 8). This implies that the stakeholders were negatively affected by the construction of the Nashe Dam as their farmland was affected. These people were forced to expand their agricultural lands by cutting and logging trees in order to make a living and get their basic needs met because they have no adequate food or home now, which created challenges between the government and them.

3.5. Effect of dam construction and land use land cover change on environment

Dam construction is one of human activities that exercised on the land which led to change of land use land cover our us, especially, in western Ethiopia due to FAN project (Finca'a- Amerti Nashe project) almost there is alteration of fauna and flora in this area especially native species. This alteration was happened for the reason of absence of EIA (Environmental impact assessment) before the construction of Nashe Dam construction because it was introduced during period of Derg period. However, any activities which has as positive consequences, it has adversely affected our environment either directly or indirectly on living things as well as on socio economic.

As interviewed and identified in the study area for the reason of disturbances of Nashe dam construction about 182 cows were taken by water as soon as and 65 antelopes emigrated to other areas and around 18 were killed as soon as and led to biodiversity loss due to their places especially the swampy area of Nashe watershed. Similarly, three (3) human beings were taken by water bodies and they died as soon as the Dam constructed and a lot of them were still emigration has been increasing to other areas for the reason of being landless and homeless of living communities, and most of the forest trees were lost by these activities directly because of the search of basic need. Those all phenomena were rising conflicts and crises within environment, and among different living communities.

3.6. Discussion

3.6.1. Effect of land use/cover and dam construction on rural livelihoods

Natural resource conservation is greatly influenced by the educational level of the household, the age composition, and the presence of sufficient land. However, human and natural activities, such as biophysical variables and natural processes, have contributed to changes in land use and land cover in both urban and rural [6]. Communities are influenced by local resources exists in area either directly or indirectly [26] and people who are being landless and affected with a lot by dam construction are negatively influence the status of livelihoods of farmers that agree research [5,27]. Without an EIA, a particular project dam had a significant negative impact on the environment, society, and the economy, including during preparatory activities like building a site house and shifting local workers to alternative jobs to earn a living [28]. This outcome was due to lack appropriate of stakeholder's participation and lack of problem identification during screening and scoping EIA process [29,30]. Therefore deforestation of native trees for lumber, charcoal production, and irreplaceable building materials are serious problems that lead to the loss of various forest forms and native trees in mostly in rural are due to the construction of Nashe Dam and LULCC [6,31,32].

Table 7
Accuracy assessment for land use land covers classification.

$$\text{Overall accuracy} = \frac{\text{Total number of correctly classified pixels (diagonal)} * 100}{\text{Total numbers of reference pixels}}$$

$$\text{Overall accuracy} = \frac{63 + 56 + 70 + 48 + 47 * 100}{300} = 94.66\%$$

LULC	Forest land	Grass land	Cultivated land	Water body	Settlement	Total
Forest land	63	1	1	0	0	**65**
Grass land	2	56	2	0	0	**60**
Cultivated land	2	2	70	0	1	**75**
Water bodies	0	1	1	48	0	**50**
Settlement	0	1	2	0	47	**50**
Total	**67**	**61**	**76**	**48**	**48**	**300**

Users Accuracy calculation
Forest land = 63/65*100 = 96.92%
Grazing land = 56/60*100 = 93.33%
Cultivated land = 70/75*100 = 93.3%
Water bodies = 48/50*100 = 96%
Settlements = 47/50*100 = 94%

Producer Accuracy Calculation
Forest land = 63/67*100 = 94.03%
Grazing land = 56/61*100 = 91.81%
Cultivated la = 70/76*100 = 92.11%
Water bodies = 48/48*100 = 100%
Settlements = 47/48*100 = 97.92%

Table 8
Cause of LULCC, and status of Socio-economic and impact of households of the study area on the environment.

Socio demographic Characteristics			Frequency of Ejersa Mecha HHs	Frequency ofAL/Iggu HHs	Frequency of Sandabo Dongoro HHs	Total in %
Cause of LULCC	Due to Scarcity of land		4	6	4	8.9
	Due to agriculture expansion		20	21	12	33.9
	Due to Nashe project dam		30	41	18	57.2
	Income level of Before Nashe dam (2010)		42	52	20	73.1
	Income level of After Nashe dam (2020)		12	16	14	26.9
	Human encroachment	Yes	49	57	30	87.2
		No	5	11	4	12.8
Land holding size of HHs	Less than 2 hac	Before	17	12	5	21.8
		After	27	28	14	44.3
	2-4 hac	Before	8	16	13	23.7
		After	16	26	9	32.7
	4-8hac	Before	27	18	12	36.5
		After	11	9	8	17.9
	Above 8 hac	Before	2	22	4	17.9
		After	0	5	3	5.1
Swampy area converted to water body		Yes	45	61	32	88.5
		No	9	7	2	11.5
Cultivated land converted to water body		Ye	53	63	32	94.9
		No	1	5	2	5.1
Forest land converted to cultivated land		Yes	50	54	29	85.3
		No	4	14	5	14.7

Environmental, social, economical and farm land disturbances is the most significantly affecting livelihood of people and local stakeholders due to Dam construction and lack of basic needs for life [27]. Communities that had been residing in the Nashe watershed were known as multi-incomers because they engaged in a variety of occupations, such as raising livestock and cultivating various crops for both sustenance and sale. Those resources are the main sources for income for rural peoples. They were also considered to be active people [33]. Additionally, they engaged in irrigation efforts for the production of sugarcane, potato, tomato, maize, barley, lime, and other crops, earning them money. They haven't been referred to as famine and starvation. Therefore, it would be preferable if government or non-governmental organizations (NGOs) worked on the impact of land use and land cover change on the situation and means of subsistence of farmers, locals, when any project is carried out, which causes alteration on environment. Similarly, such phenomena have been increasing the experience and benefits of socio-economic and environmental impact assessment (EIA) in country [34].

Therefore, from 2010 to 2020 forest land decreased [35], cultivated land and bare land were also decreased that confirm with research [36]. The Fincha'a-Amerti-Nashe dams, built at intervals of an average of 1 km, pose many socio-economic and environmental challenges to the region as conducted by Ref. [5]. As it known that EIA was a new instrument that started in Ethiopia in recently, in 1997 [12]. However, now a day human activities continue, they will increase deforestation to seek agricultural land on steep slopes of land, increase runoff, and eventually affect the dam itself through sedimentation [2]. As a result, without taking into account the environmental impact assessment of the environment and socioeconomic factors in western Ethiopia, they are still affecting their sustainability in all aspects, which hinders overall sustainability development. Therefore, it would be better if government will give adequate compensation for displaced people, and NGOs search solution for them by making group Work Company for create job opportunity for those farmers [37].

Different report by researcher in Ethiopia said that Dam construction has been cleaned forest resources by anthropogenic activities which agree with this study [11,35,38] studied at in the Tejibara Watershed, Ethiopia. According to research conducted [39] in A Case Study of Manwan, Lancang River, Yunnan, China, forest land decreased from 1974 to 2004, with a relative ratio of 79.91% in 1974 and decreasing to 59.06% in a 10,000 m buffer, while areas of grass, farmland, and construction land increased dramatically with the variation ratios reaching more than 155.49%, 55.60%, and 90.19%, respectively. Nowadays, people who had been living at that watershed was displaced from their area, home and suffering by a lot of problems like due to their farmland was taken by water bodies [40], lack and inadequate of compensation, absence of home and grazing land they are affecting. Also, dam construction affects the morphology of the river through human activities [36]. Such Dam construction were rising conflicts and crises within environment and among different living communities [11,12] and also, makes loss of biodiversity [8].

4. Conclusions

Using remote sensing methods, environmental resource monitoring is a crucial process. The results showed that the LULC of the Nashe watershed changed significantly within 10 years after the construction of the Nashe dam. The direct drivers of LULCC were the Dam construction, human encroachment, agricultural expansion, and lack of income of local people. After dam construction cultivated and forest land was reduced, while swampy areas disappeared entirely and were converted to water bodies. Cultivated land, swampy area, and forest area were reduced by −2470 ha (−11%), −1281 (−6%), and −893 (−4%), respectively, while water bodies and grassland were increased by 3954 (17.96%) and 843 ha (3%), respectively whereas in 2020, Settlement increased by only 1% in 2020. Since the construction of the dam was done in 2012 without EIA on the environmental and socioeconomic of the area, the livelihoods were affected simply due to this project. Therefore, the consequences of LULC change made biodiversity loss, poverty, famine, and some households landless in the study area. The resulting LULC maps from this study would be further used for government agencies for any activities not undertaken without EIA before and for stakeholders to create land use planning for watersheds to prevent natural hazard losses and to achieve sustainable development.

Ethical approval

This study was approved by the ethics committee of the faculty of resource management and economics of Wollega University. The confidentiality of all participants' information was ensured throughout the study process. There is no disagreement of interest to disclose.

Author contribution statement

Gelana Fikadu: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools; Wrote the paper.

Gamtesa Olika: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

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List of Abbreviations

GIS	eographical Information system
DEM	Digital Elevation Model
EIA	Environment impact assessment
Ha	Hectar
HGWZ	Horo Guduu Wollega Zone
HHs	Households
LULC	Land Use/Land Cover
SRTM	Shuttle Radar Topography Mission
UTM	Universal Traverse Mercator

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