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Research Article

Degradation Status and Local Community Perception towards Kadar-Basaso Wetland in Sinana District of Bale Zone, South Eastern Ethiopia

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Wetlands are valuable resources that provide a variety of functions for local populations, including environmental, hydrological, and socioeconomic benefits. Despite the importance of wetlands to humanity, they have been largely degraded and even lost in many countries including Ethiopia because they are wrongly regarded as wastelands. Some wetland conservation policies were designed not based on the perceptions of the people residing around the wetlands and lack of attention to communal areas. It is because of this gap that a quantitative analysis of physicochemical soil quality analysis and the local community's perceptions was carried out with the overall goal of analyzing the degradation status of Kadar-Basaso wetland and community perceptions. A cross-sectional research approach was used with a purposeful soil sampling from/in 6 plots sized 50 m × 50 m and >100 m apart along two transect lines, and 200 household heads chosen randomly from three villages(Basaso, Shallo, and Nano Robe) bordering the wetland. Soil sampling, questionnaires, focus group discussion, and key informant interviews were used to collect data and then examined quantitatively and qualitatively. The result shows that the Kadar-Basaso wetland was moderately degraded. The physicochemical analysis of the soil reveals that the pH was acidic, indicating the presence of acidic waste effluents. In addition, the electric conductivity was salt-free, cation exchange capacity were found to be low, the organic matter was relatively low, potassium levels vary very little, and Phosphorous variation was minimal. Expansion of farmland and Overgrazing were the most damaging elements affecting wetland biodiversity. From the analysis, it was noted that communities' attitudes influence human activities on the wetland. The study recommends that the government and wetland management authorities must establish strategies to minimize deterioration in the area and offer better infrastructure for both livestock keepers and farmers to improve the long-term usage of wetlands. The best management strategies should be devised for all sizes, types, and all site wetlands.

1. Introduction

Wetlands are defined as areas of marsh, fern, peat land, or water, whether natural or manmade, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of seawater with a depth of fewer than six meters at low tide [1, 2]. Wetlands are important resources that serve several purposes [3, 4]. They are available in many different sizes and shapes, for instance, Lakes in Ethiopia include Tana, Awassa, Abyata, and Shala [5–7]. Wetlands in Ethiopia have important ecological processes that link the highlands with the lowlands. Though wetlands cover about 6% of the world's land surface, about 50% of the wetlands have been altered in the last 50 years [8–10]. This year, the degradation of the wetland is expected to be more than this percentage which occurs due to a lack of understanding about the benefits and conservation of wetlands, lack of proper implementation of policy, and wetland management strategies that emphasize long-term benefits for future generations from wetlands. Although complete documentation is lacking, wetlands make up a significant part of Ethiopia covering an area of 13,700 km^2 [11].

However, the wetlands in the country are impacted by a combination of social, economic, development-related, and climatic factors that lead to their destruction.

Wetlands provide a wide range of services to residents, including environmental, hydrological, and socioeconomic benefits [12]. The wetlands serve as storage reservoirs for water, recharge rivers, filter, and improve river water quality [13–15]. In addition, the wetlands serve as important habitats for several birds, animal species, and a wide range variety of terrestrial and amphibious creatures [16]. This shows wetlands act as a miniecosystem, and without them, many species would face extinction. Despite their importance to humanity, wetlands have been largely degraded and treated as wastelands [17]. Wetland overuse leads to degradation and eventual extinction [18]. As a result of population growth, thousands of acres of wetland have been chopped and drained for residential and agricultural purposes [19, 20]. Overgrazing, housing building, farming, groundwater extraction, and artificial drainage are all examples of human activities that have contributed to the degradation. In addition, macrophyte exploitation, brickmaking, medicinal plant harvesting, food production, and fishing are all examples of human activities that degrade wetlands [21]. Furthermore, chemical changes in the chemical composition of wetlands result in throwing the ecosystem off balance [22].

The lack of emphasis is most evident in common settings, where studies have been too optimistic by ignoring inhabitants' viewpoints. Many people are unaware, however, that wetlands provide a variety of goods and services to a wide range of users around the world and are under threat [23]. Several people argue that everybody has the right to use wetlands because they are a common resource to exploit and plentiful. Many people, however, are unaware that wetlands have been drained or lost and need to be managed properly. According to studies, poor human perceptions of wetland ecosystem degradation have caused half of the world's wetlands to vanish in the previous century [17].

In the study area population development and rising demands are two of the difficulties that the Kadar-Basaso wetland is facing as a result of insufficient human ideas of wetland management (personal communication). The office has stated that the wetland has deteriorated and that more investigation is required. Development activities such as agricultural practice and other commercial activity, as well as a rise in population, are putting strain on Kadar-Basaso [24]. According to a report by the Sinana Agricultural Development Office in 2021 [24], certain wetlands, as well as socioeconomic benefits and environmental services, may be lost if current trends continue. Because of this discrepancy, a quantitative assessment of physicochemical soil quality analysis and local people's perceptions were important.

In light of aforementioned issues, we are interested to respond for research questions that consists the following questions: (1) what was the quality of soil physico-chemical status on Kadar-Basaso wetland ecosystem?, (2) how did the community perceive the consequences of wetland ecosystems degradation?, (3) what were the human activities affecting Kadar-Basaso wetland ecosystems?, and (4) what is the overall ecological status of the Kadar-Basaso wetland?. Therefore, the objectives of this study were to (1) analyze the soil quality parameters for determining the soil quality status of the Kadar-Basaso wetland, (2) assess the perception of the local communities on the consequences of Kadar-Basaso wetland degradation, (3) examine the impacts of human activities on Kadar-Basaso wetland, and (4) determine the overall ecological status of the Kadar-Basaso wetland in the Sinana district of Bale zone, Ethiopia.

2. Materials and Methods

2.1. Description of Study Area. The Kadar-Basaso wetland area is located in Sinana Werada, Bale Zone, and 9 kilometers north of Robe town. The wetland is located stretching between longitudes 40°03′34″ and latitudes 07°08′24″ (Figure 1). The wetland is 2410 meters above sea level and covers an area of 25.079 hectares. This wetland is also considered as SNS (sacred natural site) since this wetland is seen as the sacred natural site it is owned by the surrounding community and from other locations in the district even the zone. It is located at the borders of the following three villages: "Shalo, Nano Robe, and Besaso" peasant association. Kadar-Basaso wetland is an area made of land parcels owned by the community in common and individual agricultural tenure and used for grazing and drinking water by the community. Kadar-Basaso wetland is categorized under swampy and freshwater wetlands fed by water sourced from perennial and seasonal water sources [25].

The community has a total area of 4830.644 ha and a population of 6300 people (3304 male and 2996 female). The community features three elementary schools, one health center, and one farmers' training center in terms of infrastructure. The village is divided into three settlements and 32 development groups. The wetland is located between the Shalo, Besaso, and Nano Robe boundaries at the junction of the Kadar-Basaso wetland, sacred natural forest area, Debalo cliff, and Hadedicho hill. The area has a variety of land uses that consist of farm plots, pastures, and wetland acreage. The majority of the land in the village is utilized for grazing due to the huge livestock population and crop production in the vicinity. There are also significant sections of farmland used for crop cultivation. Agriculture is the most common socioeconomic activity of the community. The main sources of subsistence are livestock and crop farming.

2.2. Vegetation Status of Study Area. The most common plant species in the upper and lower canopy of the Kadar-Basaso Besaso wetland and nearby SNS area vegetation includes *Typha latifolia*, *Commelina forsicalia*, *Cyperus aterrimu*, *Cyperus flavescent*, *Colocasia esculenta*, *Ageratum conyzoides*, *Commelina forsicalia*, and Galinsoga. In addition plant species, such as *Commelina forskalaei*, *Leersia hexandra*, *Digitaria sanguinalis*, *Oplismenus* spp., *Digitaria temate*, *Cyperus assimilis*, *Phyllantus boehmii*, *Rumex abyssinicus*, *Cenetella asiatica*, *Eragrostis ciliaris*, *Achyranthes aspera*, *Snowdenia polystachya,* and *Polygala*

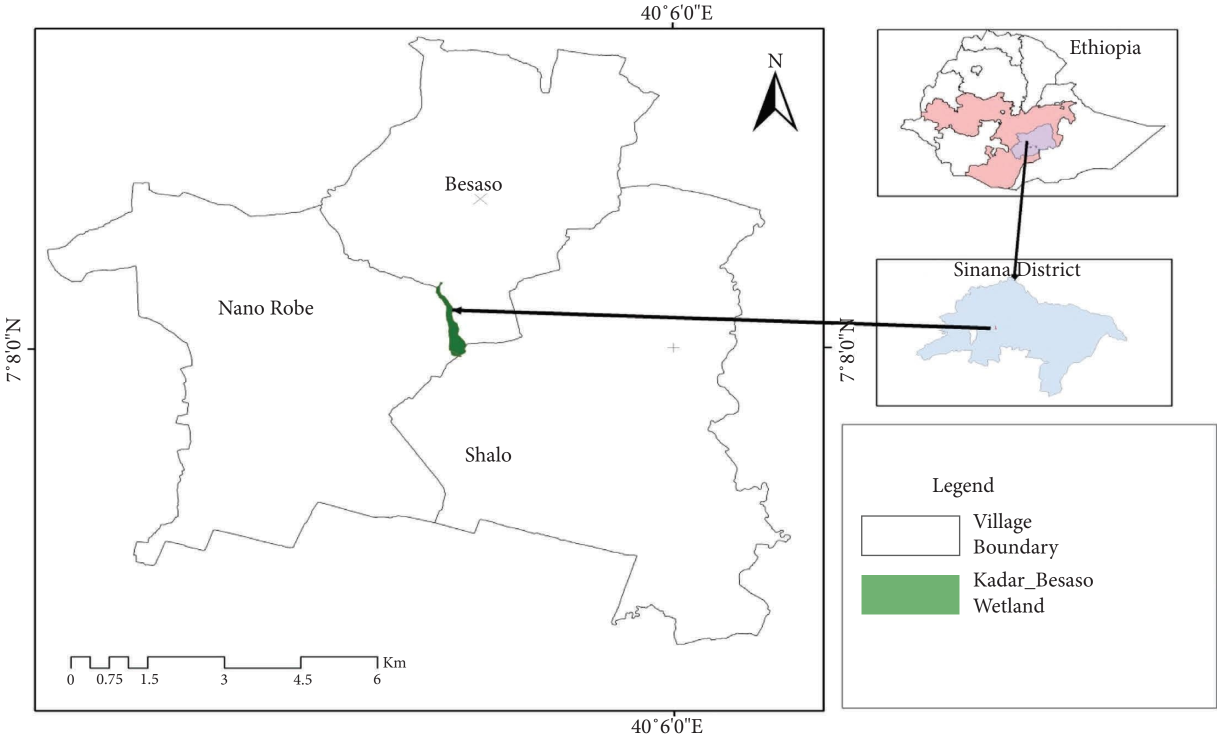


Figure 1: Location map of the study area.

petitiana, shares the plant community in the wetland and in sacred natural site which is part of the wetland, respectively. There are herbaceous and grass plant species in the Polygonaceae, Cyperaceae, Apiaceae, Commelinaceae, and Asteraceae families. There are large mature trees, some overmatured and pole-sized trees, and a few regenerating plants among the tree classes. However, the majority of plant species in the wetland were perceived as typical invasive weed species that serve as good indicators of damaged wetlands and are prevalent weeds in Eastern Africa [26]. The presence of native wetland plant species (on SNS portion) such as *Cyperus flavescent*, *Cyperus atterrimus*, and *Ludwigia abyssinica* may indicate that the area is in good wetland condition [27, 28]. The wetland's natural regeneration is moderate to high, and the crown cover is moderate to high though the presence of these weeds plants in and around the wetland, on the other hand, shows that the wetland is changing or degrading.

2.3. Site Selection. The three villages bordering (Shalo, Besaso, and Nano Robe) Kadar-Basaso wetland was selected based on their relation and closeness to the wetland after an observation was made throughout the villages. The area coverage was used as a criterion to determine the number of samples in the study wetland. Human disturbance parameters such as hydrological modifications (ditching or draining), habitat alteration (grazing intensity, buffer alteration, and the intensity of invasive plants infestation), and land use practices (crop farming and conservation practices near the wetland) were used as criteria to select the sample sites. Before the selection of sample sites, transect walks were employed with district natural resource management experts and village representatives for the assessment of the extent of human disturbance along the wetland. During the transect walks, observations of hydrological modifications, habitat alteration, and land use practices in and near the wetland were done. Finally, only in the wetland body two transect lines in the direction of south to north was laid. Accordingly the first transect line was positioned on the east side of the wetland while the second transect line was on the east side of the wetland and a total of 6 sample sites were established on both transect lines in the studied wetland.

2.4. Study Design and Sample Size Determination. A cross-sectional design was used because it is most suited for characterizing variables and their distribution patterns, as well as allowing data to be collected at a certain point in time. Primary and secondary sources were used to acquire information. Because of their proximity to the wetland and their use of the wetland environment for various socio-economic activities, three villages bordering the wetland were chosen. Beneficiary household heads were selected randomly from the three chosen villages while elders and key informants were selected purposefully from communities in Basaso, Shalo, and Nano Robe villages. Yamane's formula [29] was used to calculate the population sample size (1967). The sample size for a 95 percent confidence level and

$$n = \frac{N}{1 + N(e)^2}, \tag{1}$$

where N is the population size and e is the level of precision.

2.5. Soil Sampling Techniques and Procedure. In terms of soil sampling, soil samples were obtained using composite sampling techniques to produce a representative sample of the plots determined by predefined sampling sites. Composite sample methods were adopted for soil collecting because composite sampling units into single samples are effective ways of generating an accurate estimate of the population mean, saving cost and analytical time. In every case, the history of land management and the specificity of fertilizer application for the site where the samples are gathered have been noted. The soil samples were taken from 6 (six) plots by measuring into small blocks of 50 m × 50 m quadrant, one at the center and the other four at the corners of the quadrants of wetland fields of the area at 0–20 cm depth with help of soil augur at an interval of >100 m on two transect line [30].

The sample soil was obtained from six established plot in Kadar-Basaso wetland from the border and middle of each plot and then immediately mixed after collection to be taken as one composite sample. In addition to avoid local bias, six additional subsample plots were placed 15 cm from the central spot in a larger plot of 50 m × 50 m. To collect soil samples at a depth of 0–20 cm, grasses, litter, and other plant wastes were removed from the soil surface and soil samples were collected using 1.20 m auger soil collecting instruments. A triangular block was designated in each case, and all soil samples were gathered in a single plastic bucket that was sealed and labeled properly. When collecting soil samples, contamination has been prevented.

To collect and mix the soil sample, clean sampling equipment was employed. The samples were dried and homogenized in hot air before being sieved using 2 mm sieves to guarantee homogeneity. For analysis, the samples were kept in sealed polyethylene bags. Scanning of labeled soil sample bags was carried out. To appropriately label the sampling bag, the sample was labeled with District, ID, date of sampling, depth of sampling, and barcode. In a basket and 500 g of the soil sample, the gathered soil samples were pooled and properly mixed. For physicochemical investigation, the soil samples were air-dried and sieved at 2 mm. For analysis, soil samples were brought to the lab.

2.6. Socioeconomic Data Collection. Questionnaires, interviews, and focused group discussions were utilized to collect data from household heads to meet the study's objectives. And 226 family heads from Kadar-Basaso wetland beneficiaries (from Shallo, Nano Robe, and Basaso) received questionnaires on a random basis as all villages' residents have equal access to the wetland area. A questionnaire with mostly closed-ended items and then open-ended questions were translated into Afan Oromo language and employed. The questionnaires are intended to gather data on demographic factors, community attitudes on the effects of wetland ecosystem degradation, and human activity impacts on the Kadar-Basaso wetland ecosystem.

The replies to statements about communities' attitudes toward the implications of wetland ecosystem degradation and human activities that impact the Kadar-Basaso wetland ecosystem in Sinana district are the subject of this section and closed-ended question, such as a Likert scale, was employed. The assertions were rated as "strongly agree," "agree," "undecided," "disagree," or "strongly disagree" by respondents (Table 1). To examine the topic under research, which was measured using a five-point Likert scale, descriptive statistics (mean and standard deviation) were used.

The degree of agreement or disagreement of the respondent for each statement is also assessed by summarizing the five-point Likert scale response [31, 32]. As shown in Table 1, the mean ratings were divided into ranges to meet the five-scaled Likert level of agreement (strongly disagree, disagree, undecided, agree, and highly agree).

The interview (focus group discussion and key informant) was used to collect more supplementary and in depth opinions, to stabilize the questionnaire response, and was conducted with elders, village administrators, district agriculture, and rural development office experts (development agents). In most cases, purposive sampling is used for selecting/choosing key informants based on recommendations made by local community members on elders and other community members or government sectors that are more knowledgeable and with relevant information about the local situation, trends etc. [33, 34]. Accordingly, a total of 18 discussants representing a cross-section of the wetland beneficiary were determined. The discussant was categorized into two groups that was 9 respondent for focus group discussion and the remaining 9 mostly elders as key informant. In the group composition from each three villages six (6) discussant (3 for focus group discussion and 3 as key informant) were chosen based on the recommendations given from elders, development agents, and each village administration leaders during reconnaissance survey.

2.7. Method of Data Analysis

2.7.1. Laboratory Analysis. A soil laboratory experiment was conducted to determine the quality of soil physicochemical status on the degradation of the Kadar-Basaso wetland ecosystem, and the results were compared to the standard set. The soil pH, organic matter, nitrogen, phosphorous, potassium, cation exchange capacity, moisture content, turbidity, and temperature were assessed in the experiment part. Finally, wetland degradation levels were assessed using the Arshi et al. standard [35].

(1) Soil Chemical Laboratory Analyses

(a) Determination of soil pH:

To determine the soil pH as procedure, in a 50 ml beaker 10 g of weighted soil sample was added with 25 ml of distilled water was added (soil: water ratio of 1 : 2.5) for 30 minutes and stirred the suspension at regular intervals. Then, using the pH meter turned on at least 15 minutes ahead of time to warm up and standardize the glass electrode with normal buffers.

Table 1: Mean score range for five-scale Likert's response.

Mean	Level of agreement
From 1.00 to 1.8	Strongly disagree
From 1.81 to 2.6	Disagree
From 2.61 to 3.4	Undecided
From 3.41 to 4.2	Agree
From 4.21 to 5.0	Strongly agree

Source: Motwani et al. [31]; Ziemssen et al. [32].

The temperature compensation knob was turned to the temperature of the test solution. After each determination, the standardization procedure was validated with distilled water rinsed electrodes and water removed from the surface using blotting paper. To determine pH in 1-0 (N) KCl, 25 mL of (N) KCl was used instead of water, and the pH was recorded after one hour of intermittent stirring. For the pH measurement, the reference and indicator electrodes were immersed in a heterogeneous soil suspension including distributed solid particles in an aqueous solution.

(b) Determination of organic matter:

Organic matter was determined using standardized Kjaldahal determination and analytical procedures. Standard potassium dichromate solution (N) and ferrous ammonium sulfate red-ox indicators are examples of regents used. The procedure started after passing through a 0.2 mm sieve, 1.00 g of ground soil sample (weighted to the nearest milligram) was placed in a transparent and dry 500 ml conical flask. With a pipette, 10 mL $K_2Cr_2O_7$ was slowly added to the solution, then 20 mL concentrated H_2SO_4 was swiftly added and completely mixed by spinning softly at first and then vigorously for one minute. The flask was filled with 200 mL distilled water, 10 mL orthophosphoric acid, and 1 mL diphenylamine. The organic carbon content of the soil was expressed as a percentage of C or as organic matter, which was calculated by multiplying by 1.724, assuming that soil organic matter contains on average 58 percent carbon or 100/58 = 1.724.

(c) Determination of nitrogen:

The nitrogen concentration was determined using standardized Kjaldahal determination and analytical procedures. Combination of acid, salicylic acid, digestion mixture (10 parts potassium sulfate, 1 part copper sulfate, and 0.5 part selenium powder), standard sodium hydroxide 0.1 (N), concentrated sulfuric acid, standard sulfuric acid 0.1 (N), zinc dust, methyl red indicator, and sodium hydroxide (450 g/l) was conducted. In conducting nitrogen determination as a procedure, in a Kjeldahl flask (600–800 ml capacity), 10 g of soil sample was obtained (passed through 0.5 mm sieve), 35 ml of the sulfuric acid and salicylic acid mixture was added, stirred, and allowed to stand for 30 minutes for the nitrates to react with the salicylic acid, then 5 g of $Na_2S_2O_3$ was added, then 10 g of digestion mixture was added and chilled, and the temperature was gradually raised until the solution was clear and had a grayish blue or greenish tint (usually a total of around 2-3 hours for digestion).

(d) Determination of phosphorous:

Phosphorous was estimated in MSW by using a method based on the reduction with stannous chloride. The blue color is produced by the reduction of phosphorous molybdic acid with freshly prepared stannous chloride solution. To determine phosphorous the reagents used include Olsen's reagent; 0.5 (M) sodium bicarbonate solution (pH = 8.5), dissolve 42.0 g $NaHCO_3$, 10% NaOH, activated charcoal, $NaHCO_3$ weighted 15 g of ammonium molybdate, 10 N HCl bottle, and stannous chloride solution. The procedure followed to determine phosphorous was started by weighting 2.5 g of soil sample in a 100 ml conical flask, 50 ml of Olsen's reagent was added, 1 teaspoon of phosphorous-free charcoal was added, and the flask was shacked for 30 minutes. Clean and dry beakers were filtered using the Whatman 40 dry filter paper.

(e) Determination of potassium:

The potassium concentration was determined using standardized Kjaldahal determination and analysis procedures. Ammonium acetate solution, neutral 60 mL glacial acetic acid (99.5%), 75 mL concentrated ammonia solution, 60 mL glacial acetic acid (99.5%), 60 mL concentrated ammonia solution used to make one liter of reagents, dilute acetic acid or ammonia solution, potassium chloride solution, and distilled water was also used. In the procedure soil sample of 5 g in 25 mL neutral ammonium acetate was weighed, added, and agitated for 25 minutes in a 25 mL conical flask. The filtrate was promptly filtered through a dry filter paper, with the first few milliliters being rejected.

(f) Determination of the cation exchange capacity:

The reagents used to determine the cation exchange capacity were 1 (N) NH_4OAc, 75 mL pure ammonia, 60 mL glacial acetic acid, standard H_2SO_4; 0.1 (N), standard NaOH; 0.1 (N), standard oxalic acid 0.1 (N), methyl red indicator, NaOH, silver nitrate solution around 0.1 (M), and dissolved 8.5 g of $AgNO_3$ in 500 ml water. As a procedure, in a 250 mL beaker, we weighed 10 g of the air-dry soil sample, then we added 50 mL of neutral normal ammonium acetate solution and transferred without loss. The operation was repeated until the flask reached the desired level of the filling. By leaching the soil or colloid with neutral ammonium acetate, the cation exchange capacity was determined. The surplus salt was then washed away using 95% ethanol. Steam distillation with magnesium oxide in an alkaline media was used to measure the ammonium ion (NH_4^+) [36].

(g) Determination of moisture content:

To the determination of moisture content the apparatus used was a core sampler, vernier slide caliper, can boxes, oven balance, desiccator, and knife spatula. The core sampler was pushed vertically into a level surface deep enough to fill the sampler can in the sampler, with the help of a spade. The moist soil has been placed apart in a can box. The bulk density of the undisturbed soil sample was determined using a core sampler [37].

$$m = \frac{W_1 - W_2}{W_2} \times 100, \quad (2)$$

where m = moisture content (%), w_1 = initial wt. of the sample (in gms), w_2 = final wt. of the sample (in gms), V = volumetric water content (water content in terms of volumetric), mx bulk density of the soil. Bulk density is the mass of oven-dry soil divided by the total volume of soil samples taken from the field. V = volumetric water, mx = bulk density, and equivalent depth of water per depth of soil profile (Dz) = V × Dz, where Dz is the depth of soil profile (30 cm).

(h) Determination of soil texture:

The proportions of sand, silt, and clay in the soil controlled its texture. A standard hydrometer with the Bouyoucos scale, electrical stirrer, dispersing/stirring cup, graduated cylinder (1000 ml) with a rubber stopper, thermometer, stopwatch, hot plate, beaker, and watch glass were among the equipment and apparatus utilized. The regents included 5% sodium hexameta phosphate, 50 g Calgon, and 6% H_2O_2. As a procedure, a 50 g fine texture soil or a 100 g coarse texture soil (>75–80% sand) was passed through a 2 mm screen based on oven-dry condition into a beaker, 50 ml of 6% H_2O_2 was added, and the beaker was covered with a watch glass and placed on a water bath until the oxidation of organic matter was accomplished. An electric stirrer was used to agitate the suspension for 10 minutes before transferring it to a liter graduated cylinder and adding distilled water to get it up to the 1-liter mark. A stopper was used to close the cylinder's mouth and shake it violently upside down and back for about 1 minute. The cylinder was set on a table, and the time was immediately recorded. After 4 minutes, when particles >0.02 mm had settled, the hydrometer was dipped into the suspension and the first reading was collected. The hydrometer was carefully removed and rinsed with distilled water, and the temperature of the suspension was recorded [38]. Finally, the result of physicochemical soil quality was analyzed and then compared with Arshi et al. standard [35]. Mean and standard deviation were calculated for each pair of soil quality parameters by using an Excel spreadsheet. The standard formulas in which mean $(\mu) = \Sigma X \div N$, x = value of observation and N = number of observation was used in the calculation for statistical parameters.

2.8. Respondents' Response Analysis. The information was gathered from 200 household heads; the rest were incomplete and returned. Furthermore, village elders were requested to narrate stories about human activities and their effects on the wetlands, and important data was collected and inferences were derived from the stories told. Triangulation was used to ensure that the results acquired by the questionnaire were consistent and varied. The data collected through the questionnaire was analyzed using the statistical package for the social sciences (SPSS) version 20. Data were coded, imported into SPSS, cleaned for mistakes, and missing data were examined.

The respondents' perceptions of the effects of wetland ecosystem degradation and the impacts of human activities in the Kadar-Basaso wetland environment were then described using descriptive analysis. To assess numerous background parameters, percentage and frequency were used. Aside from correlation analysis, a model representing the relationship between the dependent and independent variables was developed. The dependent variable was the impact of human activities on the Kadar-Basaso wetland ecosystem, whereas the independent factors were the community's attitude about the implications of wetland ecosystems, which were projected to influence the dependent variable. The qualitative data gathered through open-ended questions, interviews, and focus group discussions, on the other hand, was analyzed using content analysis, which involved deeply describing and contextualizing the situation to explain the real community's attitude toward the consequences of wetland ecosystem degradation and human activities impact on the Kadar-Basaso wetland ecosystem.

3. Results and Discussion

3.1. Demographic Characteristics of Respondents

3.1.1. Sex and Age of Respondents. Demographic parameters of the sample respondents (sex, age, education, marital status, and household size) were very essential variables that provided thorough background information for assessing wetland ecosystem degradation status and local community perspectives. As it is indicated in Figure 2(a), the majority of 150 (75%) respondents were male, while 50 (25%) respondents were female. The above percentage implies that there are more men than women. The age distribution of the houses (Figure 2(b)) shows that 10% of the household respondents were between the ages of 18 and 25. Twenty percent of the participants were between the ages of 26 and 36. The remaining 50 (25 percent) and 120 (60 percent) respondents were in the age groups of 36–46 years and above 46 years, respectively. This suggests that the communities under consideration are populated by older people, who are frequently less amenable to conservation initiatives than younger people. Age, length of residency, and schooling year are observed to be significantly impacting attitudes towards wetland conservation [39]. This is in line with Wester and Eklund [40], who claim that each generation has experienced a different "slice of history" and hence has varied perspectives on the importance or validity of various environmental challenges.

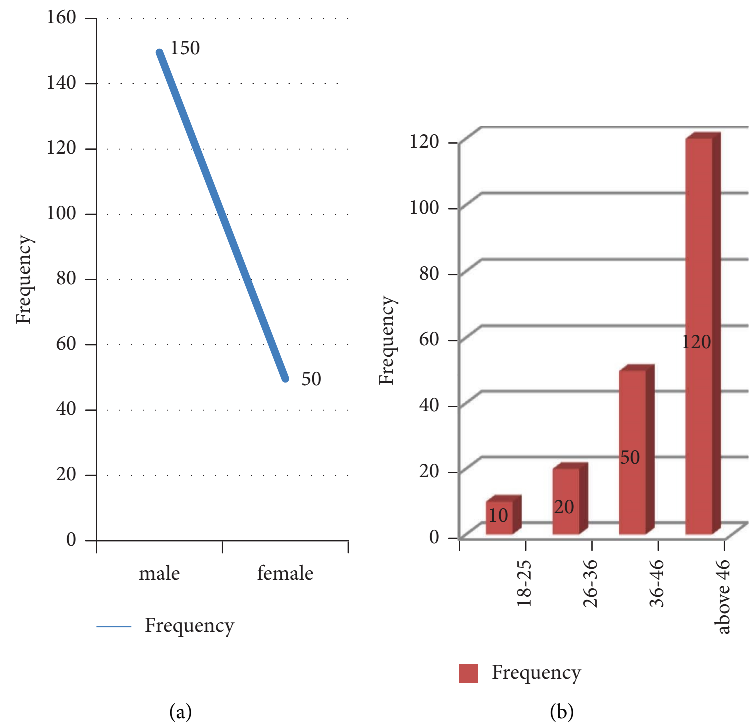


Figure 2: The diagrams showing (a) sex and (b) age of respondents.

3.1.2. Education Level, Marital Status, and Family Size of Respondents. As shown in Figure 3(a), 100 (50%) of the household heads had completed grades 1–4, while 70 (35%) of the household heads had no formal education; 10 (5%) of the household heads had completed secondary education, and 20 (10%) of the household heads had completed grade 5–8. The findings suggest that the study area's educational level is low since even some residents lack formal education; thus, education has a direct impact on the sustainable use of wetland resources and the repercussions of wetland degradation on the area's livelihood. The findings of the study show that people who think their local environment such as land productivity, water level, and biodiversity are declining are more concerned about the family size and contraceptive use [41]. This is in line with Kateregga's findings that education has an impact on how people use natural resources [42]. Increased understanding and knowledge of environmental issues often result in the view that those environmental concerns are legitimate and thus influence a person to act favorably toward conservation [43]. Results in Figure 3(b) show that 175 (86%) of the surveyed households were married, 15 (8%) were single, and 10 (5%) were widows. The results imply that most of the surveyed households had a husband and a wife plus children who were able to engage in various production activities along the wetland area which may promote wetland degradation. Figure 3(c) shows that 130 (65%) of the surveyed homes had a size of 4–7 people, 55 (28%) of households had a size of 1–3 people, 10 (5%) of households had a size of 8–11 people, and 1 (1%) of households had a size of more than 8–11 people. The average household size is 4.8, which is in line with the national average. The findings are consistent with those of Rockström et al. who found that a big household size suggests resource utilization since a large household size implies high consumption units within the home, which can lead to higher resource extraction, resulting in resource degradation [44].

3.2. Comparison of Physical Analysis of Soil Quality with Standard Set. Topography and slope greatly influence the microclimatic properties in the soil, and hence also the physical properties [45]. Doran and Parkin identified a set of physical indicators for evaluating soil quality [46]. The wetland side to sacred natural site where vegetation exist relatively suspected of compaction as number of livestock observed for grazing and using vegetation shadow during midday from the sun. Although the organic matter is low in sampled soils, according to study of Githae et al. this could be linked to presence of organic matter at this area [47]. In study area it found that the physicochemical variables, temperature, turbidity, and moisture content were within acceptable ranges of wetland soil standards in each plot. As a result, the mean and standard divisions of the following physical parameters were determined, as shown in Table 2.

3.2.1. Comparison of Chemical Analyze of Soil Quality with Standard Set. Doran and Parkin have also chosen chemical indicators for soil quality assessment that include soil organic matter, pH, electric conductivity (EC), available nitrogen, available phosphorous, and available potassium are some of the markers [46]. As a result, the following chemical parameters were determined in this investigation, and their

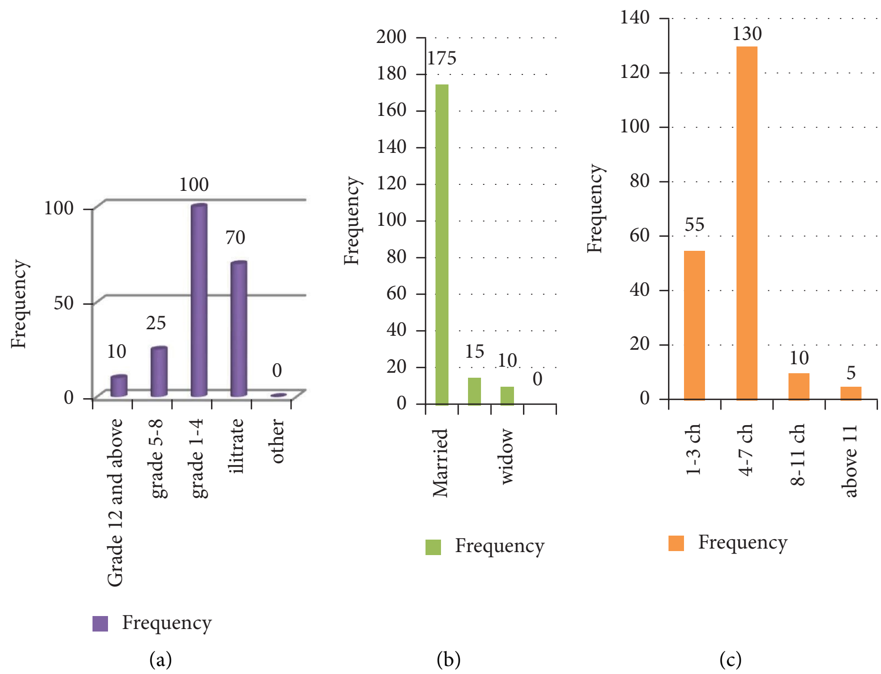


FIGURE 3: The diagrams showing the (a) education level, (b) marital status, and (c) household family size.

TABLE 2: Average laboratory results of temperature, turbidity, and temperature of the topsoil (0.20 cm) of the wetland plots.

Parameter	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Temperature (°c)	14.73	14.43	14.93	14.13	14.6	14.7
Turbidity	7.5	8.4	7.4	8.3	7.8	8.6
Moisture content	5	5	5	5	5	5

mean and standard deviation are shown in Table 3. The pH level of the soil is the most important attribute since it influences all other soil properties [48] As a result, pH is taken into account while testing any type of soil.

(1) Variation of Soil pH Level and Electric Conductivity. The pH is termed to be acidic soil if the pH is less than 6.5, normal soil if the pH is 6.5 to 7.5, and alkaline soil if the pH is greater than 7.5 [35]. As a result, the pH of the sample soil is 6, indicating that the soils in the current study region have low pH values for wetland soils. These numbers indicate that the soil is slightly acidic. Acidic pH levels could indicate the presence of acidic waste effluents from nearby town and agricultural inputs like fertilizer. This finding is in line with research finding conclusion that showed the valley system exhibits a slightly acidic to a moderate acidity and lower soil pH could be due to addition of inorganic fertilizers (e.g., urea), loss of organic matter through erosion, and the leaching of basic cations as a result of seasonal flooding of the wetland [49, 50]. Leaching of essential nutrients like calcium and magnesium may occur as surplus rainfall passes through the soil (Figure 4(a)). Acidic elements like hydrogen and aluminum will thus replace these nutrients. The acidity of the soils will rise as a result of these circumstances [51].

Estimation of EC gives us an idea about the soil concentration of soluble salts at a specific temperature. Electrical conductivity is another essential feature of soil that can be utilized to assess its quality. It is a metric for the number of ions in a solution and has been used to infer the relative concentration, extent, and movement of animal wastes in soils. With an increase in ion concentration, the electrical conductivity of a soil solution increases. Electrical conductivity is a rapid, easy, and low-cost way to assess the health of soils. It is a metric for the number of ions in a solution [52]. The electrical conductivity values in this investigation were salt-free, ranging from 0.7 mmhos to 1 mmhos in all sampling plots. The low EC values could be due to high rainfall in this area which washes out soluble cations from the soils. More or less the research conducted by Bruckner et al. stated that the lower soil pH indicates larger number of hydrogen ions in the soil can affect the level of electrical conductivity [53] and is conceptually the same with our finding. So, the presence of low EC values showed that the impact of anthropogenic activities in and around Kadar-Basaso wetland is minimum (Figure 4(b)).

(2) Variation of Kadar–Basaso Wetland Soil Phosphorous and Potassium. For establishing a balance between the other plant nutrients and guaranteeing optimal crop growth, an appropriate phosphorous (P) concentration is required [54]. Phosphorous is one of the major soil elements essential for the process of photosynthesis, and also, involved in the formation of all oils, sugar, starches, etc. It helps in the transformation of sunlight into energy; proper plant maturation; increased vigor, promotes the disease resistance, encourages flowering and growth of root systems. The available forms of phosphorous are as phosphate ions (H_2PO_4 and HPO_4). Available phosphorus ranged in soil samples of study area is in between 14.7 and 15 kg/ha

Table 3: Average laboratory mean of total nitrogen, organic matter, available potassium, available phosphorous, pH, and the cation exchange capacity of the sample wetland.

Parameter	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
pH	6.12	6.13	6.21	6.21	6.22	6.22
Organic matter (%)	1.61	3	7	10	12	14
Electrical conductivity (ds/m)	0.8 mmhos	0.9 mmhos	0.7 mmhos	0.8 mmhos	1 mmhos	1 mmhos
Available nitrogen (kg/ha)	0.06	0.43	0.50	0.60	0.62	0.63
Available phosphorous (mg/kg)	14.78 kg/ha	14.86 kg/ha	14.90 kg/ha	15.01 kg/ha	14.85 kg/ha	15 kg/ha
Available potassium (mg/kg)	277 kg/ha	287 kg/ha	296 kg/ha	300 kg/ha	288 kg/ha	2.95 kg/ha
Cation exchange capacity	14.07	14.07	14.07	14.07	14.07	14.07

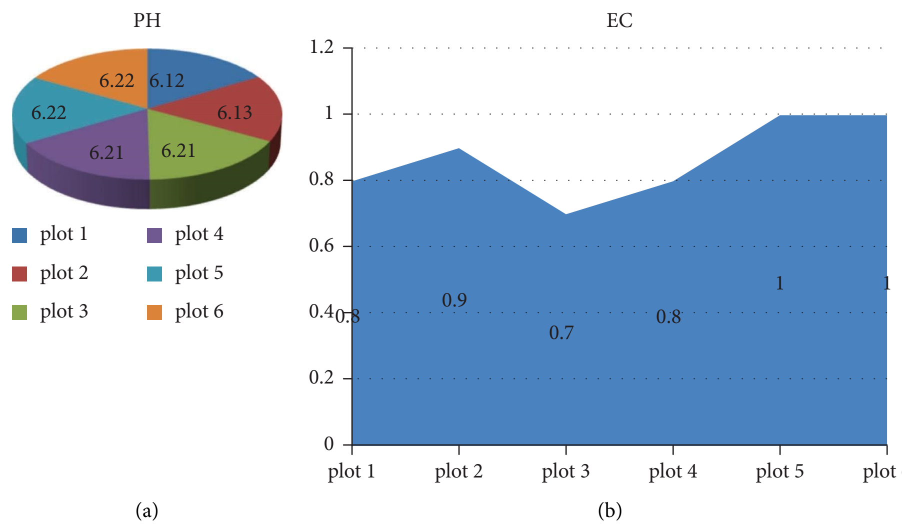
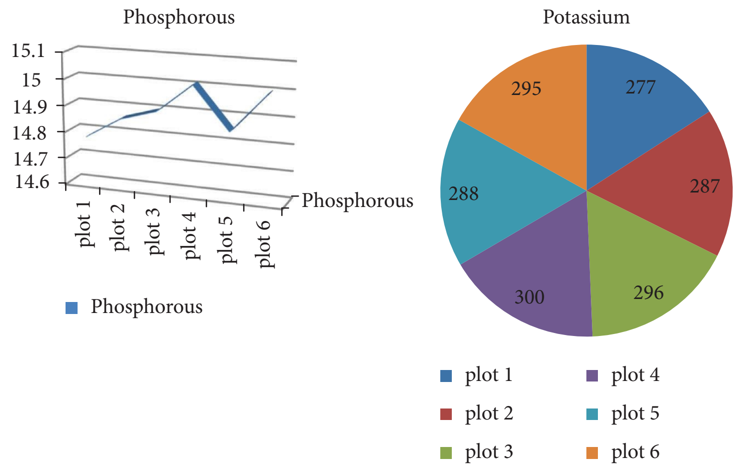


Figure 4: The diagrams showing the variations of (a) pH and (b) EC.

(Figure 5(a)). Therefore, the contents of phosphorus were found to be very low, and variation of phosphorus between plots was very little. The standard is 51–65 kg/ha for appropriate concentration of phosphorus in wetland soil [55]. Although human activity impacts were observed in the wetland catchment, the low concentration of phosphorus indicates negligible impact of anthropogenic activities like domestic sewage, uncontrolled grazing, and converting wetland into agricultural areas around Kadar-Basaso wetland.

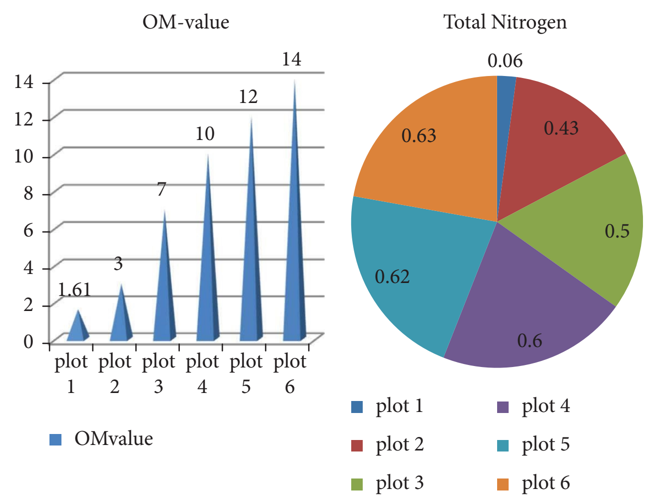
Potassium is one of the essential elements for plant development and plays a key function in a variety of physiological processes. It is engaged in a variety of plant metabolism events, including the generation of cellular structural components, photosynthetic regulation, and the manufacture of plant sugars, for a variety of plant metabolic demands [56]. Potassium levels in the research region samples range from 241 kg/hectare to 300 kg/hectare (Table 2). Our results are similar and in ranges with the studies of Woodruff et al. with potassium values 159 to 578 kg/ha from the paddy field soil of Kuttanadu wetland agro-ecosystem [57]. Additionally, the finding value was in the ranges observed by Petkar (undated) with values of potassium between 123.66 and 460.92 kg/ha soils [58]. The standard for the acceptable potassium concentration in wetland soil is 301 to 360 kg/hectare and the upper limit of our find fall in this category. Potassium levels vary very little in the study area (Figure 5(b)). So, the concentration of average potassium in the study area is showed that in the study area to some extent there is an impact of anthropogenic activities like domestic sewage and converting the wetlands into agricultural areas in and around Kadar-Basaso wetland.

(3) Variation of Kadar-Basaso Wetland Soil Organic Matter and Total Nitrogen. Organic matter in the soil provides the foundation for soil fertility. It helps plants grow by releasing nutrients, improving the soil's structure, biological and physical health, and acting as a buffer against dangerous elements [59]. Organic matter ranged from 0.0161 to 0.14 percent in the research. As stated in the standard, marsh soil with 80–100 percent organic matter is suitable [35]. As can be seen in Figure 6(a), the value of organic stuff is relatively low. As a result of the low organic matter concentration in the research region, anthropogenic activities such as residential sewage, unregulated construction, conversion of wetland into agricultural areas, and accumulation of heavy metals and hydrocarbons in and around the Kadar-Basaso wetland had a minimal influence. The finding concept could be in line with waterlogging conditions as it is always experienced in valley systems; it reduces N, availability due to low mineralization rates and the risk of denitrification under alternating wet and dry conditions [55].



(a) (b)

Figure 5: The diagrams showing the variations of (a) phosphorous and (b) potassium.



(a) (b)

Figure 6: The diagrams showing the variations of (a) organic matter and (b) total nitrogen.

The cation exchange capacity (CEC) values of soils collected from wetland plots are found to be extremely high in some cases (Figure 6(b)). The soils studied had a texture similar to clay, according to laboratory examination. These finer soil particles are negatively charged. As a result, they can attract, hold, and release positively charged nutrition particles (cations). Sand particles have a low charge and do not reach. As a result, high-clay soils can contain more cations than low-clay soils [60].

Soil fertility is determined by the average total nitrogen concentration. It helps plants grow by releasing nutrients, improving the soil's structure, and biological and physical health, and acting as a buffer against dangerous elements [59]. The average total nitrogen content for the study was from 6 kg/ha to 63 kg/ha. The standard is 151–300 kg/ha for a better concentration of nitrogen content in wetland soil [48, 61]. The low nitrogen concentration could be due to heavy rains, overwatering from flood towards the wetland, and acidic chemistry. The deficiency of nitrogen could result in slow growth and rehabilitation of wetland vegetation rehabilitation which is similar with research finding of Land et al, 2016 that showed tree growth and nitrogen content increase when wetlands are drained which indirectly means overwatering affects nitrogen.

3.3. Descriptive Analysis Result. It is discovered that although not the majority in numbers still significant populations in the Kadar-Basaso wetland were involved in tree cutting for agricultural purposes, overgrazing, and other activities as a result of their inadequate knowledge of the effects of their activity on the wetland ecosystem. In addition, they were involved in activities that have an impact on wetlands, causing them to fall short of their minimum carrying capacity. As a result, public understanding of wetland ecosystem management was essential to manage the effects that have already occurred.

Table 4: Respondents' view on communities' attitude towards consequences of wetland ecosystems degradation.

No.	Item	Mean	Std. deviation
1	Wetland ecosystem degradation affected access to income	2.76	0.53026
2	Wetland ecosystem degradation affected access to livestock feed	1.78	0.46891
3	Wetland ecosystem degradation affected access to inland water	1.79	0.71305
4	Wetland degradation affected biodiversity	1.94	0.50763
5	Wetland ecosystem degradation affected medicinal plants	2.73	0.53716

Table 5: Respondents' view on the impacts of human activities on the Kadar-Basaso wetland ecosystem.

No.	Item	Mean	Std. deviation
1	Humans cut trees for agricultural practice	3.71	0.824
2	Humans cut trees for construction practice	3.58	0.963
3	Farming 60 meters toward the wetland	3.71	0.828
4	Pesticide use	1.79	0.713
5	Collection of firewood	1.86	0.455
6	Charcoal production	1.74	0.493
7	Overgathering	3.72	0.850
8	Human clear vegetation along with the Kadar-Basaso wetland ecosystem	3.76	0.868

3.4. Communities' Attitude towards Consequences of Wetland Ecosystems Degradation. In determining how communities felt about the impacts of wetland ecosystem deterioration respondents were asked whether the communities' perceptions about wetland ecosystem degradation impacted access to money, animal feed, inland water, biodiversity, and medicinal plants in item 1 of Table 4. They disagreed with impressions with ($M = 2.76$), ($M = 1.78$), ($M = 1.79$), and ($M = 1.94$), but were undecided with ($M = 2.75$). Local communities believe that the degradation of the wetland has resulted in a decrease in many services and goods that the wetland has previously provided them, posing a threat to their livelihood options. Although not the majority, the respondent believes wetland destruction as denies society of a variety of benefits, including wildlife habitat, inland quality water, and cattle access (Table 4).

According to data gathered through interviews with key informants about communities' attitudes toward the consequences of wetland ecosystem degradation as a hazard to wetland ecosystems the most important determinant of conservation effort was younger community's members' attitude toward the consequences of wetland ecosystem degradation as a hazard to wetland ecosystems. This is due to the fact that most of farmers around the wetland were in the middle age and given the farmland as job less/farmland less community members. The allocation of such critical areas like wetland, near river bank and hill side for farmland less community members is challenging activity in this area and in the zone. For farmers who saw wetland ecosystem deterioration as an issue with negative consequences for wetland ecosystem productivity and who expect positive benefits from conservation were more likely to embrace available conservation solutions. Farmers, on the other hand, who did not recognize wetland ecosystem degradation as a problem were unlikely to expect any benefits from addressing it, and therefore, unlikely to adopt any conservation technologies.

According to the respondents due to a lack of farming land and income to perform extra business activities to expand habitat on their property, the households tended to hold strong attitudes about increasing production from wetlands area, especially for grazing purposes. In addition households had not been trained in using current technologies to optimize their understanding of the biodiversity of their wetland. Furthermore, the respondents outshined that the local government did not gave them the option to share responsibility for wetland biodiversity protection with the wetland management organization. They remove trees to extend farming space, construction materials, and livestock feed because their income was low. Wetland degradation had a significant impact on the dwindling of livelihood options available to local households and exacerbates the plight of the rural poor because residents face wildlife habitat, inland quality water, livestock feed, and water shortages, particularly during the dry season [62]. This finding is similar with research conducted by Sinthumule that showed as the majority of local community had positive attitudes towards wetlands and wetlands conservation. In addition, the report showed as motivation for wetlands conservation was ethical and even they were willing to donate money for wetlands conservation [63]. It is concluded that the positive attitude of communities toward wetland conservation offers some hope for sustainable utilization of wetlands [63].

3.5. The Impacts of Human Activities on the Kadar-Basaso Wetland Ecosystem. In determining the effects of human activities on the Kadar-Basaso wetland environment, Table 5 shows whether humans cut trees for agriculture practices for construction, farming 60 meters away, grazing, and clearing vegetation in Kadar-Basaso wetland ecosystem or not, and respondents agreed on opinions but disagreed on whether farmers used pesticides, collected firewood, or produced charcoal around Kadar-Basaso wetland ecosystem. These villages graze their cattle regularly with no means of proper usage or management. According to respondents, overgrazing was a farmer-related problem, and harmful factor that threatens biodiversity in the Kadar-Basaso wetland. In their opinion overgrazing destroyed the natural qualities of wetlands, because it was open access and every individual moves their cattle there as needed and freely use. As a result of persistent overgrazing the vital wetland floras like wetland grasses, trees, and shrubs that were required to characterize the wetland were fully consumed and killed by livestock. This finding was similar with the findings of Bahati, (2012) that listed the same human activities affecting wetlands in our study [64].

4. Conclusion and Recommendation

4.1. Conclusion. In the study area, it was found that the physicochemical variables, temperature, turbidity, and moisture content were within acceptable ranges of wetland soil standards in each plot. The wetland side to sacred natural site where vegetation exist relatively suspected of compaction as number of livestock observed for grazing and using vegetation shadow during midday from the sun. Although the organic matter is low in sampled soils, this could be linked to the presence of organic matters at this area. The physicochemical analysis of the soil reveals that the pH is somewhat acidic, indicating the presence of acidic waste effluents from nearby town and agricultural inputs like fertilizer the value of organic stuff is relatively low. The low nitrogen concentration could be due to heavy rains, overwatering from flood towards the wetland and acidic chemistry. The lower soil pH indicates larger number of hydrogen ions in the soil and can affect the level of electrical conductivity. The EC was salt-free, low, and this could be attributable to the area's heavy rainfall, which washes soluble cations out of the soils. Phosphorous and potassium levels are below the necessary limit for plant growth and could hinder wetland-based vegetation rehabilitation.

According to the study, the majority local people do believe that the wetland's deterioration has resulted in a decrease in the numerous services and goods that the wetland has previously provided to them and posing a threat to their livelihood alternatives. This needs awareness creation for all wetland beneficiaries on wetland services and goods at all level. Due to a lack of sufficient farming land and income to improve habitat on their property, the households tended to hold strong attitudes about increasing production from wetlands, particularly for grazing purposes. This trend and activity of competition for utilization expected to wetland degradation unless agricultural technologies that could help in increasing productivity from parcel of farmland introduced and proper wetland management plan devised and implemented. In line with agricultural technologies and comprehensive wetland management adoption and implementation and other income generation business activities like tourism should be established in study area. Overgrazing and clearance of forest cover around the wetland catchments has harmed wetland biodiversity.

4.2. Recommendation. Based on the findings, the government and wetland management authorities should develop strategies to reduce degradation in the area, such as diversifying livelihood options and replacing them with low- or no-impact alternatives. The government should build and provide better infrastructure for both livestock keepers and farmers because livestock grazing and farming in the wetlands have been major challenges in the area, resulting in substantial degradation. To prevent degradation, farmers in the area surrounding the wetland should be taught correct farming methods. The government and wetland management authorities should actively enforce the 60-meter buffer zone rule and the formulation of by laws prohibiting the human activity. The community should be made aware of the causes and consequences of wetland degradation, as well as their indicators so that they can conserve these resources for future generations' benefit; education campaigns should be established to raise a positive perception of the economic consequences of wetland degradation in the area. The income generating activities, agricultural technologies and wetland management plan should be adopted and implemented. Allocating areas like wetland, nearby river bank and hillside for farmland to farm less community should be avoided. The sacred natural conservation strategy should adopted and implemented as the area is considered and respected area for elder community members.

Data Availability

The data supporting this research work are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there are no conflicts of interest for funding and other contribution to the manuscript.

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