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WETLAND DEGRADATION AND CONSERVATION OF NATURAL RESOURCES IN *HAOR* AREAS: A STUDY AT TAHIRPUR AND DHARMAPASHA UPAZILAS OF SHUNAMGANJ DISTRICT

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Abstract

The study investigates the issues concerning wetland degradation and analyzes the conservation and management initiatives of natural resources in the study area. Using both quantitative and qualitative methods, primary data were collected from two selected upazilas (Tahirpur and Dharmapasha) of the Sunamganj district. For the survey, 150 households were selected in 9 villages. Four focus group discussions and 8 key informant interviews were also carried out. Data from the landsat satellite images have been analyzed using the NDWI and the supervised image classification approach. The study results demonstrate that the deep water area in Dharmapasha and Tahirpur upazila have declined by more than 17 $km^{2,}$ and 26 km^2, respectively, between 1989 and 2019. In addition, due to overexploitation and mismanagement, the wetland resources have been greatly reduced, leading to degradation. However, the conservation of natural resources in the study area faces many challenges due to lack of proper management practices.

Keywords: Wetland degradation, Natural resources, *Haor*, Water body, Conservation challenges, Sunamganj.

Introduction

Wetlands in Bangladesh include rivers, streams, freshwater lakes, marshes, *haors, baors, beels,* fishponds, artificial lakes, flooded cultivated lands, and estuarine systems with wide mangrove swamps (Rahman *et al.* 1996; Chakraborty 2009). In every sector, wetland provides a wide range of benefits, which is important for a country's economic development (Ramsar Convention Bureau 1971). As a result, globally, a wide range of human interventions are reported to be responsible for the change of wetland functions and degradation (O'Connell 2003; Erwin 2009). However, the wetlands of Bangladesh have a great role in supporting the economic, ecological, and commercial sectors. They are highly rich in biodiversity. Poor communities live adjacent to the wetlands to secure livelihoods (Rahman *et al.* 2001). Akhter *et al.* (2018) reported that the wetlands of Bangladesh are degraded rapidly due to the increasing pressure of rapid population growth. The degradation of the floodplain is also closely related to the rapid decline in freshwater biodiversity, habitat alteration, flood control, habitat invasion, and pollutions

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are the reasons for wetland degradation (Tookner and Stanford 2002). The climate change phenomenon has also recently been reported as a threat to the livelihood of the haor community (Monwar *et al.* 2014).

Geographically Bangladesh is one of the most vulnerable countries in the world due to climate change. It is a major threat to the survival of the species and wetland ecosystem, and it may also affect the hydrology of individual ecosystems of wetlands (Hulme 2005; Erwin 2009). On the other hand, lack of institutional coordination and awareness, intensive agriculture, siltation, and pollution are the major causes of wetland degradation. As a result, many species of flora and fauna are threatened, and the ecosystem is deteriorating in the wetland region (Byomkesh *et al.* 2008). Therefore, the Bangladesh government has enacted a significant number of laws and adopted policies to protect the natural environment from extinction, as well as to conserve natural resources. In 1990, the country seriously recognized the importance of resource management, and consequently, wetland management and conservation become a significant priority. These initiatives were helpful for the sustainable use of wetland resources (Chakraborty 2009; Islam 2010; IUCN 2015). Williams (2002) reported that community participation in the conservation and management of wetland resources is essential and required for the conservation wetland resources. In addition, implementating any management plan or strategy on wetlands requires the active participation of the local people (Dugan 1990).

However, in the study of wetland areas, the poor local communities entirely depend on natural resources (e.g., fisheries, fuel wood collection, dry season agriculture, grazing, etc.) of the wetlands in the study areas. Until, Tanguar Haor was declared a Ramsar site in 2000, the wetlands of the study areas used to be leased out to the influential local elites, and the leaseholders used to exploit as much as they could. Such overexploitation of the natural resources (fisheries, fuel woods, etc.) in the study wetlands leads to degradation. As soon as Tanguar Haor was declared as the country's second Ramsar site, the management of wetlands of the study areas went under Sunamganj district administration, excluding local people from resource use. This situation triggers conflicts between the user groups and the administration. The recent development is that the *beels* (that deeper section of the wetlands that retains water throughout the year) have been distributed by the administration among the cooperatives formed by local people. Poor local communities often fail to manage enough funds to form a cooperative for taking a lease of the *beels* from the administration. Local rich people (often influential political leaders) are reported to take advantage of giving loans to the poor user groups and exploit wetland resources as extent as possible. The paper focuses on how the wetlands are

degraded over the period and unveils the challenges faced by current management practices and initiatives undertaken by the stakeholders of the wetlands.

*Objectives of the study***:** The objectives of the present study are to identify the areal changes of the wetlands from 1989 to 2019 to evaluate the challenges faced in current management practices and explore initiatives being undertaken for the conservation of wetlands in the study areas.

Study area: Tahirpur and Dharmapasha are the two-selected upazila of Sunamgonj district in the Sylhet division (Fig. 1). The study area is located at 25.0715^0N, 91.3992^0E. The Indian state of Meghalaya bonds Tahirpur to the north, Dharmapasha and Jamalgonj upazilas on the south, Bishwambarpur on the east, and Dharmapasha upazila on the west. Dharmapasha is located on the bank of the Kongsha River, which is very close to the *haor* areas of Sunamgonj district. Nine villages were selected to accomplish this research. Marala, Matian, Tahirpur, Jamlabad, Bhabanipur, and Anandanagar are selected from Tahirpur upazila, and two villages such as Rangsipara and *Haor* para, are selected from Dharmapasha.

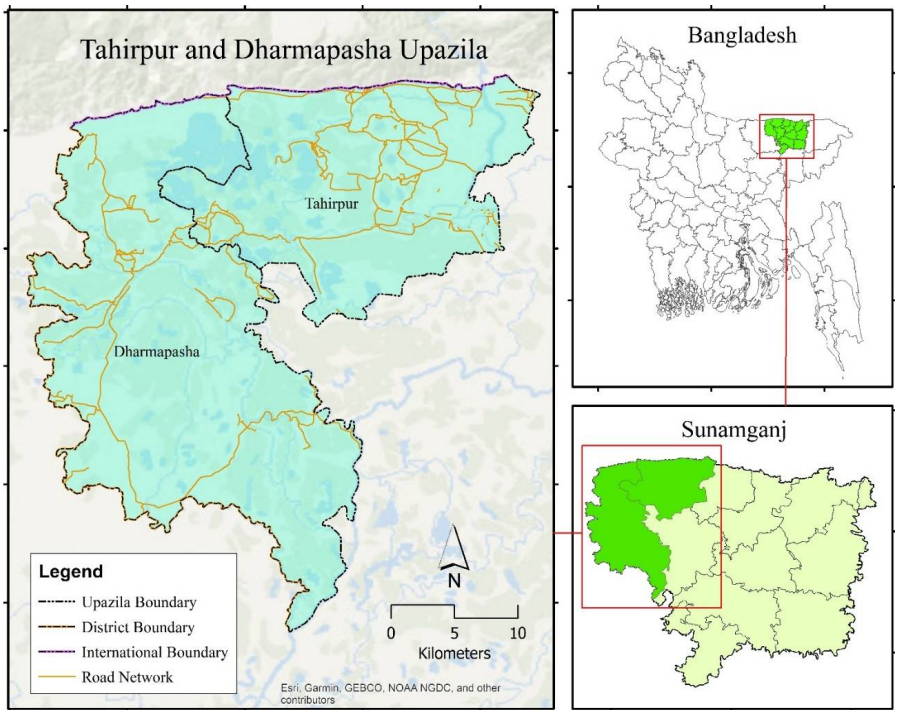

Fig. 1. Location of the study area. (Source: BBS, 2015).

These nine villages are adjacent to *haor*, and the people of this area are extremely dependent on natural resources.

Materials and Methods

Data collection: The individual household survey employed close-ended and open-ended questions. One hundred fifty households were selected in nine villages for the questionnaire survey. Four Focus Group Discussions (FGDs) were conducted with the villagers, such as farmers, fishermen, day laborers, and local people of the study area. The study was conducted with 08 Key Informant Interviews (KIIs) to explore the current issues, present initiatives for managing *haor* resources, and possible steps, necessary for *haor* conservation. KIIs covering government officials, journalists, leaseholders, and other organizations for collecting in-depth information were also carried out. Secondary materials were collected from relevant institutions like International Union for Conservation of Nature (IUCN). Alongside, journals, books, and other printed documents were consulted.

Techniques of data analysis and Map making: Statistical Package for the Social Science (SPSS) has been used to analyze and interpret the collected questionnaire data. Normalized Difference Water Index (NDWI = GREEN-NIR/GREEN+NIR) and supervised classification of Landsat satellite images are performed to illustrate the deep water and shallow water of the study area. The deep and shallow water extent information was necessary to identify the rate of changes in water bodies. Hence, deep and shallow water extent was analyzed to assess the changes of waterbody over the period in the study area. Here, the deep blue and light blue colors were also used to represent the deep and shallow waterbodies, respectively.

Methodology of extracting the waterbodies: Landsat satellite images were collected from the USGS Global Visualization Viewer (GloVis) (https://glovis.usgs.gov/app) to extract information on the research area at different times in an attempt to reach the study's objectives.

Image enhancement, radiometric correction, layer stacking, and subset have been used to pre-process the selected Landsat satellite images using ERDAS Imagine software. ERDAS Imagine 2014 has been used to complete the NDWI (Table 1). ArcGIS 10.8 has been used to classify the NDWI images using the supervised image classification method.

The area of the water body has been calculated, and maps have been created to illustrate the decadal variations of the shallow and deep water bodies for both Tahirpur and Dharmapasha upazilas.

Table 1. References of satellite imagery used in the study.

Satellite ID	Sensor ID	Path/Row	Acquisition date	Spatial resolution (m)
Landsat 4	TM (Thematic Mapper)	137/043	13-02-1989	30
Landsat 5	TM (Thematic Mapper)	137/043	17-02-1999	30
Landsat 5	TM (Thematic Mapper)	137/043	28-02-2009	30
Landsat 8	OLI (Operational Land Imager)	137/043	07-01-2019	30

Results and Discussion

*Changes of water body in Dharmapasha upazila***:** Normalized Difference Water Index and supervised classification of Landsat satellite images show the downward trend of deep water (Fig. 2a & 2b) from 1989 to 2019. On the other hand, the shallow water of the study area has an upward trend from 1989 to 2009. However, from 2009 to 2019, shallow water had a downward trend due to various reasons. Table 2 and the satellite images (Fig. 2) show the decadal scenario of waterbodies and how their reduction and expansion process passed from 1989 to 2019. In 1989, the total area of deep waterbodies of Dharmapasha was 33.28 km^2, and the shallow waterbodies were 34.36 km^2.

The satellite image of 1989 shows the maximum deep waterbody in the north- eastern part of the area. Besides some other deep-water bodies are scattered towards the eastern and south- eastern parts and shallow waterbodies are scattered all over the upazila of Dharmapsha, especially towards the middle, western, eastern, and south-eastern parts. In 1999, the deep waterbody covering area decreased from 33.28 sq km to 26.67 sq km, and the shallow waterbodies covering area has increased from 34.36 sq. km to 50.56 sq km. In the satellite image of 1999, it is demonstrated that here the north-eastern part is holds most of the deep water bodies, some other parts of deep water bodies are scattered towards the eastern and south-eastern part, and the shallow waterbody has had a further development all over the area.

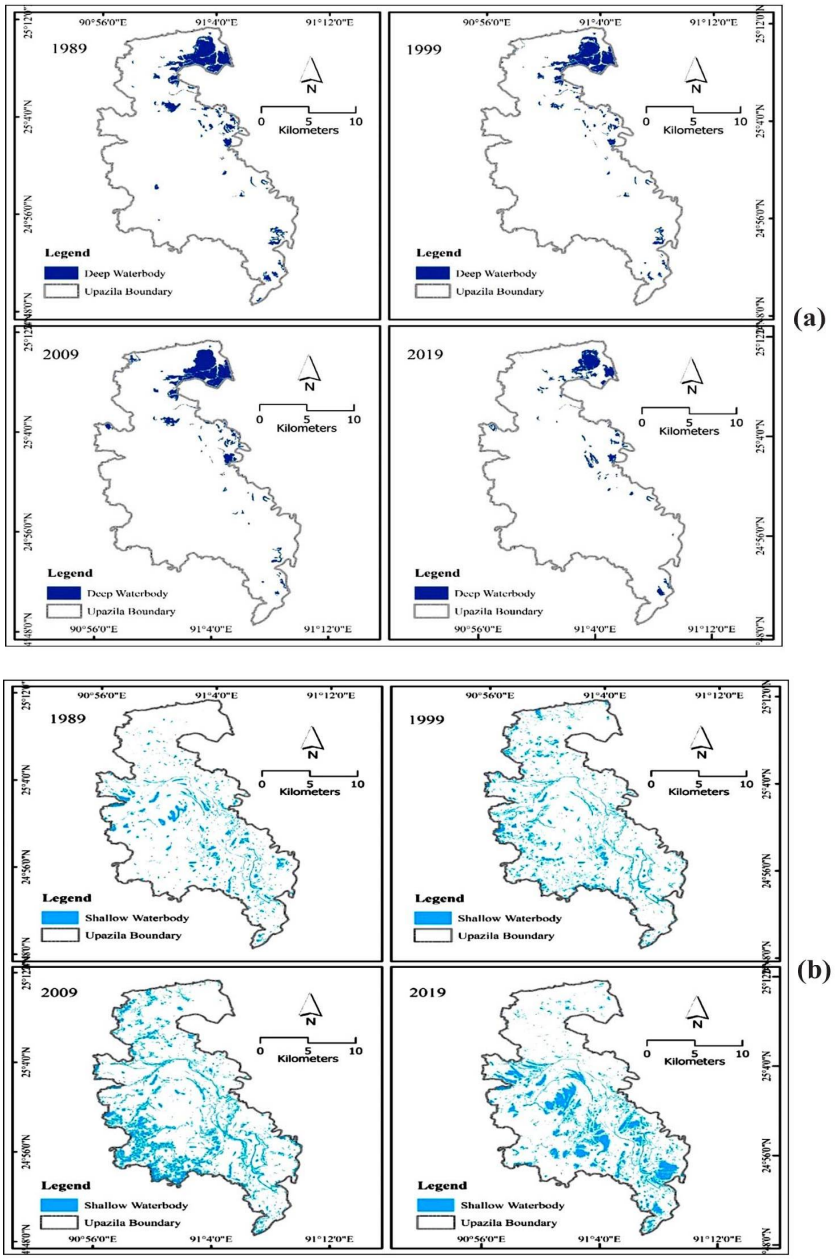

Fig. 2. Spatio-Temporal variation in Deep (a) and shallow (b) water bodies in Dharmapasha Upazila.

Table 2. The areal extent of the shallow and deep-water bodies from 1989 to 2019.

	Dharmapasha		Tahirpur	
Year	Shallow water (km^2)	Deep water (km^2)	Shallow water (km^2)	Deep water (km^2)
1989	34.36	33.28	8.70	63.86
1999	50.56	26.67	22.79	45.46
2009	74.65	30.02	37.81	35.97
2019	72.44	16.11	12.84	37.71

Source: Prepared from Landsat image analysis.

Generally, in the western and south-western parts, there is also a huge amount of shallow waterbodies towards the eastern, central, and western parts. Afterward, in the year of 2009, both the deep and shallow water bodies increased to 30.02 and 74.65 km^2, respectively. Here the satellite image is inflating that further development of deep waterbodies has occurred in some parts of north-eastern and eastern parts and the shallow waterbody in the south-western parts of the study area. Then in 2019, a huge cut-off occurred in the deep waterbody from 30.02 to 16.11, and the shallow water bodies decreased to 72.44 km^2. The satellite image also reflects fewer water bodies in the north-eastern and eastern parts. Besides the shallow water bodies of the northern and south-western parts are missing remarkably, and other area remains almost unchanged. Figure 3 demonstrates that the deep water bodies increased in 2009 and decreased gradually. The shallow waterbodies are steadily following an upward trend in Dharmapasha Upazila.

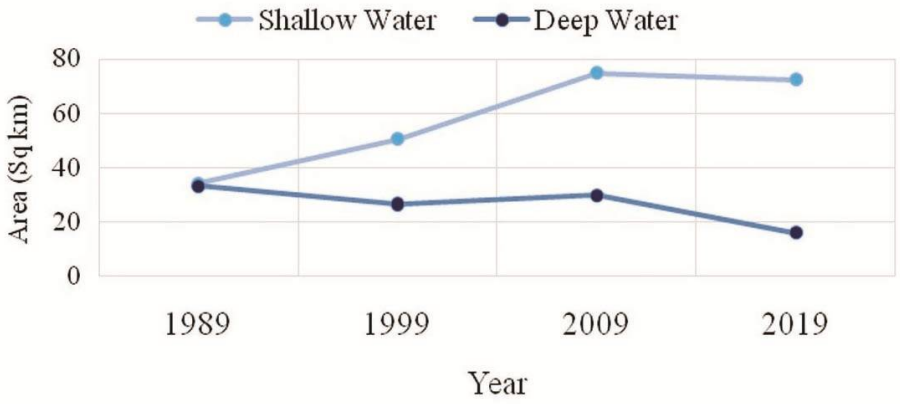

Fig. 3. Temporal variations in the area extent of deep and shallow waterbodies in Dharmapasha upazila between 1989 and 2019.

Changes of waterbodies in Tahirpur Upazila: Deep water bodies are mostly situated in Tahirpur Upazila. Table 2 and Figs 4 (a and b) demonstrate that in 1989, the deep-water bodies covered 63.86 km^2 and shallow water 8.70 km^2. The satellite image of 1989 of Tahirpur Upazila shows that most of the deep waterbody is in the western, southern, and in the central part of the area, and some shallow waterbodies can be seen sporadically all over the area.

After one decade, in 1999, the deep waterbody dramatically decreased from 63.86 to 45.46 km^2, and shallow water bodies increased from 8.70 to 22.79 km^2. The satellite image of 1999 reveals that most of the deep-water bodies are towards the western and southern parts. Shallow water bodies have developed sporadically throughout the area, especially towards the eastern and northern parts. In the year 2009, it is noticeable that there was an intense cut-off in the area of deep water, from 45.46 to 35.97 km^2, and a little augmentation has occurred in the shallow water area from 22.79 to 37.81 km^2. The satellite image of 2009 shows the scenario that the maximum deep-water area is located in the western and southern parts of the area. There are also some other parts towards the central and northern part, and the shallow water satellite image shows that a dramatic shift has occurred during this decade towards the eastern and south-eastern parts and there is scattered shallow water all over the area. Here a little satisfactory indication is that during the decade of 2019, further development has taken place from 35.97 to 37.71 km^2. Figure 5 shows that the extent of the deep water body in Tahirpur Upazila decreased from 1989 to 2009, and since 2009 remained stable until 2019. The shallow water bodies have increased from 1989 to 2009, and since 2009 experienced a declining trend until 2019.

*Conservation and management system***:** It has been observed from the study that local people are still deprived of resource use. Approximately 90% of respondents (Fig. 6) opined that influential local rich people, often political leaders fully maintained the study area. The study demonstrated that over 85% of the respondents opined that the wetland fishery resources of the study areas are still being controlled by local influence. Local people alleged that they do not have access to the *haor*, and are treated in the same manner as during leasing system.

Most respondents (78.67 per cent) believe that the government solely works in the study area to construct submerged embankments cum roads to protect wetland resources (Fig. 7). Though desired by local people, permanent embankments are not constructed by the

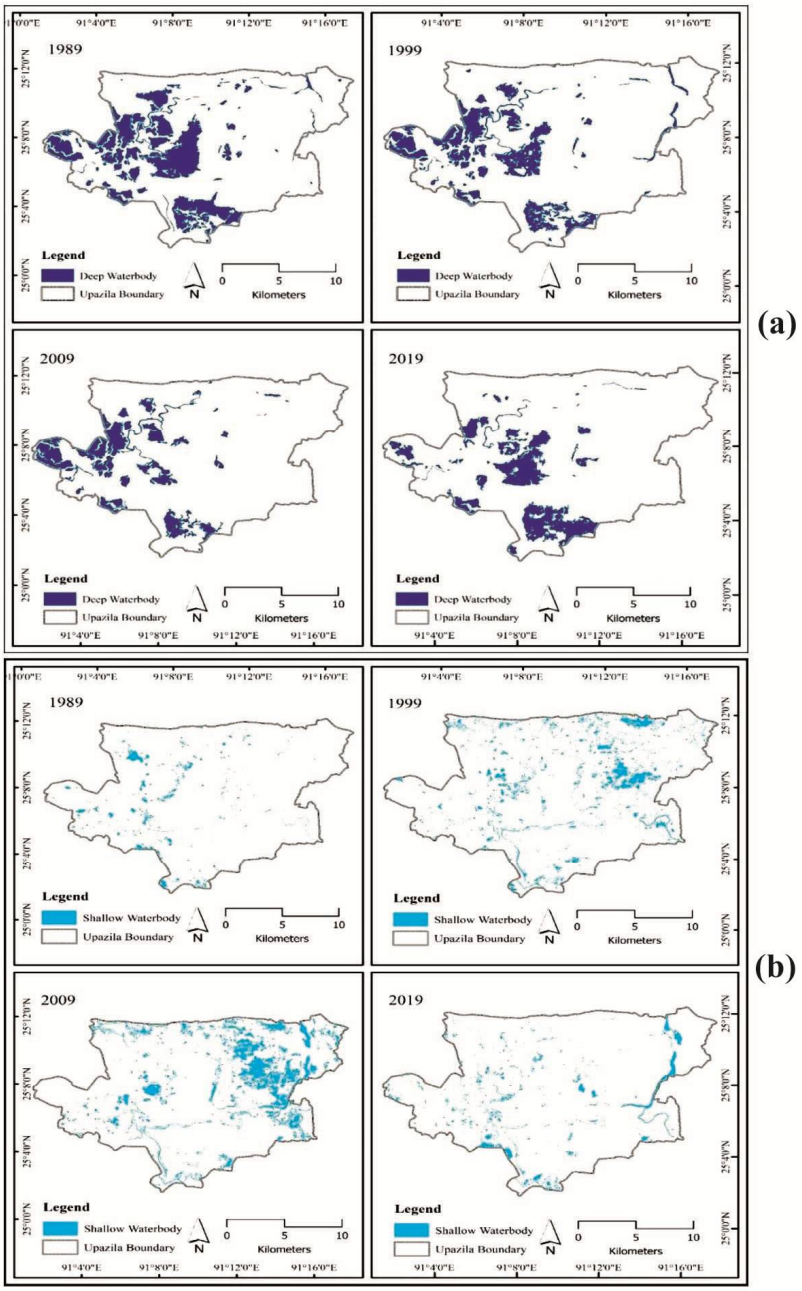

Fig. 4. Spatio-Temporal variations in deep (a) and shallow (b) waterbodies in Tahirpur upazila.

Water Development Board (BWDB). Maintaining the embankments to protect crops especially standing paddy, is a prime concern to the LGED and BWDB. NGOs interventions are seldom observed in the study wetlands.

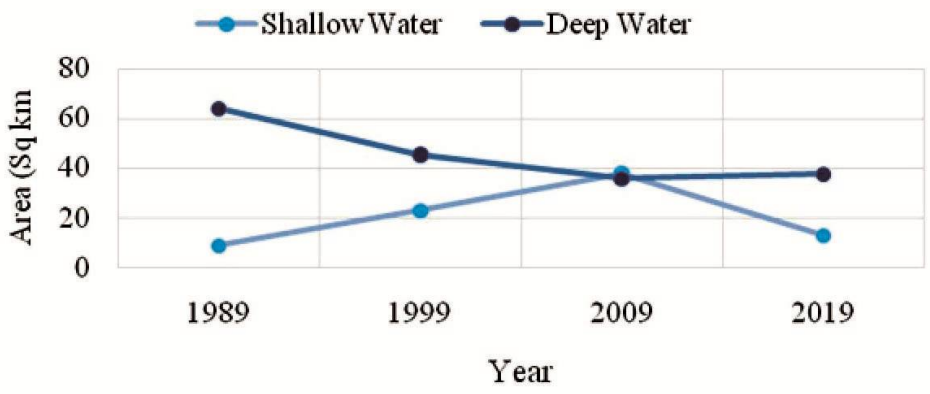

Fig. 5. Temporal variations in the areal extent of deep and shallow waterbodies in Tahirpur upazila.

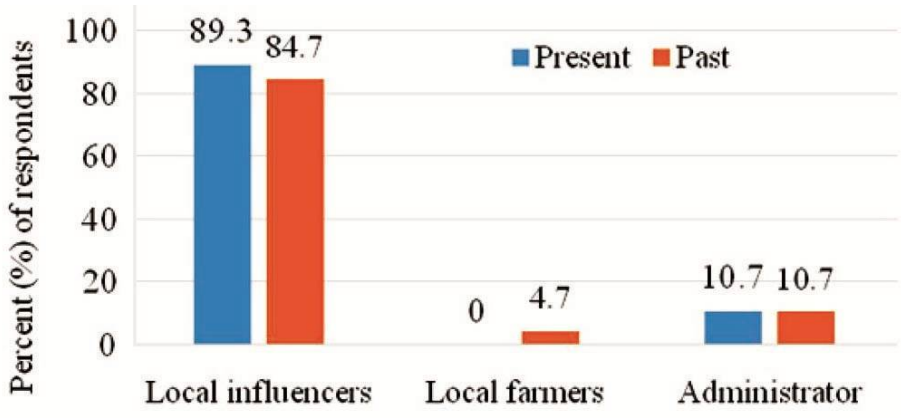

Fig. 6. Variations in stakeholders roles affected the number of respondents in *haor* management.

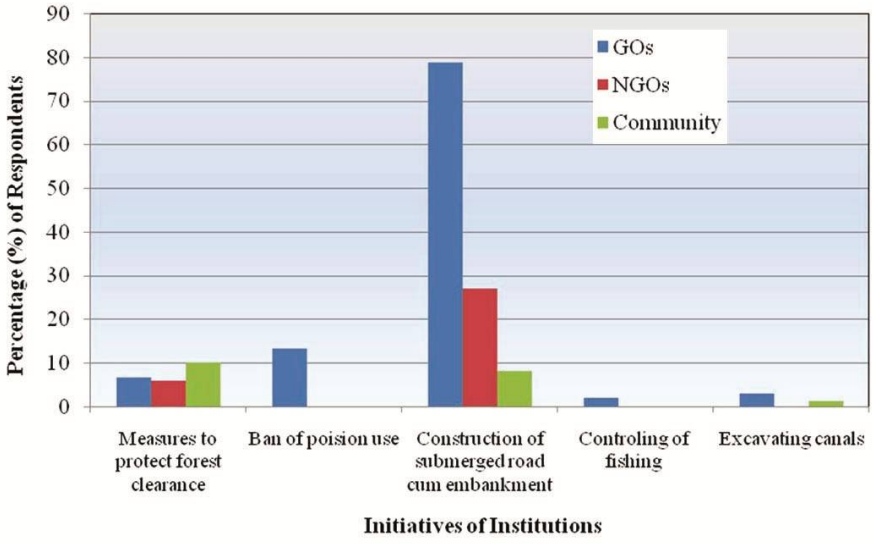

Fig. 7. Relative positions of the initiatives taken to protect *haor* resources.

Conclusion

Wetlands of Tahirpur and Dhamapasha Upazilas are the sources of enormous natural resources and provide various of ecological services, including offering excellent habitat for migratory birds and local aquatic floral and faunal resources, retaining water to protect against flash floods, etc. Mainly due to increasing unplanned interventions (rapid population growth expansion to settlements and agricultural practices, illegal poaching, etc.) and overexploitation of natural resources, the wetlands of Tahirpur and Dharmapasha Upazilas of Sunamganj have been gradually degraded. The fishery resources and fuel wood supply from the wetlands have seriously declined. In terms of wetland areal extent, the study observed that from the period 1989 to 2019, deep water (beels) at Tahirpur declined from 63.86 km^2 to 37.71 km^2, while some have declined from 33.28 km^2 to 16.11 km^2 at Dharmapasha Upazila. In contrast, shallow water bodies have dramatically increased in both the upazilas. The loss of deep water bodies has led to the loss of immense aquatic resources. The deeper sections of the wetlands in the study areas have been fragmented and converted into shallow water bodies. On the other hand, natural resources, including indigenous waterfowl, fisheries, and migratory birds are highly threatened even at Tanguar Haor, which is recognized as a Ramsar site at Tahirpur Upazila. The current practices of beel management through cooperatives formed by the

beel user groups appeared to be more unsustainable. The effective implementation of the existing government plans and policies (e.g., Haor Master Plan) ensures the wise use principle is required to conserve the wetlands of the study areas. In addition, local people's awareness of the importance of the conservation of migratory bird stock, and indigenous aquatic resources needs to be enhanced, and poverty eradication schemes covering all the poor need to be strengthened. Effective training on fisheries, raring of ducks, cattle, etc., has to be imparted to the local beel user groups and the hard-core poor of the study areas.

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