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WATERLOGGING THREATEN BIODIVERSITY ALONG THE SOUTH-WEST COASTAL REGION OF BANGLADESH

Syed M. Tareq[1], M. Tauhid Ur Rahman[1], Syed Zia Uddin[2] and A.F.M Jamal Uddin[3]

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Abstract

Water logging started appearing as silent killer to the lives and livelihood of the south west coastal region of Bangladesh .Data were collected through FGD (Focus Group Discussion), KII (key Informant Interview) and questionnaire survey from three water logged villages of three unions of Tala upazila of south-western region. The study reaches to the conclusion that duration of water logging and peoples' response to that situation are two important factors that determine the impact of water logging in the study area. A substantial number of birds, livestock, fisheries, as well as plants and vegetation are disappearing from the flora and fauna of Tala upazila. The study also finds that water logging affects peoples' wellbeing by narrowing down the livelihood options of the people. Water logging squeezes the scope for maintaining household economy by reducing the number of livestock, fisheries, and restraining the growth of vegetation, fruit trees and timber trees. Increased salinities are also appearing as silent threat associated with the detrimental biodiversity.

Key Words: Ecosystem**,** Biodiversity, Water logging, Wellbeing, TRM, Beels.

Introduction

Water is termed as life. Once there is water, there will be existence of life. But when this water is trapped or logged, cannot drained out , make the lives miserable. Lives and livelihoods of the people in the south-western region of Bangladesh are greatly influenced by water. Water resources offer enormous potentiality in this region by providing income and employment opportunity for most of the people. The rivers of south-western region in Bangladesh are characterized by active deposition of sediment causing significant reduction in their drainage capacity. Besides, construction of coastal polders that de-linked the flood plains from the rivers, and diminished upstream flow during the dry season deteriorated the eco-system. Consequently, the area has been experiencing severe drainage congestion and water logging since the early eighties. Since 17th century, landlords or Zamindars constructed wooden sluice gates around the area to protect the arable land from flood. During rainy season, farmers exchanged saline water of their fields with river water when it becomes sweet. This traditional knowledge and practices of water management called Tidal River Management (TRM), which was effective enough to make a balance between sedimentation and subsidence in that area. But these local structures were weak and required continuous maintenance (IFI WATCH, 2006). After abolition of the Zamindary system, the maintenance of these structures became disrupted. As a result, the land water management problems became serious and crop failure occurred frequently. In 1959, to solve this problem, a gigantic program of construction and maintenance of permanent polders was undertaken by the then government. In Khulna and part of the Jessore districts, 39 polders (1,014,100 acres) were constructed (Aftabuzzaman,1990). Sedimentation in the tidal rivers of the South-western region of Bangladesh is the main reason behind water logging problem. These troublesome sediments have blocked the rivers and caused upstream drainage congestion and flooding (Shampa 2012). Millions of people especially poor & landless farmers, sharecroppers, agricultural wage labors, petty traders and others lost their livelihood security due to water logging. Water logging also have detrimental impacts on biodiversity and environment in the south-western region. Water logging induced salinity has already killed off almost all types of vegetation in that region. Agricultural production has drastically reduced and even homesteads vegetation and cattle rearing become impossible. Most of the rivers have dried up. Tala upazila. is the badly victim of natural water logging since massive rainfall of 2011 (Awal 2014).Among the unions , rain water remain trapped in Jalalpur as well as Islamkathi union . But in Khaliskhali union, low lands are inundated by pumping in saline water, which may be termed as anthropogenic water logged.

*Corresponding Author's Email: syedtareq71@gmail.com
1 Dept of Civil Engg., Military Institute of Science and Technology, Dhaka 1216
2 Climate Change Laboratory, Military Institute of Science and Technology, Dhaka 1216
3 Dept of Horticulture, Sher-e-Bangla Agricultural University, Dhaka 1207

There are number of studies on impact of water logging. Most of them focus on crop productivity and cropping pattern .Water logging hampers the agricultural sector and water logging induced salinity significantly impact farmers in the Arkansas River Basin of Colorado (Houk et al., 2004). Similar findings were made by (Barrett- Lennard, 2003), who argued that interaction between water logging and salinity has major implication for salt land management. Likewise, water logging in the South-west region in Pakistan has been adversely affecting the cropping pattern in irrigated areas. Cottons are now completely being replaced by paddy, Similarly, sugarcane, and other crops have disappeared , wheat and paddy have reduced almost fifty percent in water logged area (Singh 2013).In Bangladesh a study was carried out on rainfall induced water logging in Dhaka city, where water logging creates adverse social, economic and environmental impacts (Towhid,2004).Another study was conducted on impact of water logging on biodiversity in Kalaroa and Dumuria upazila of Bangladesh (Masud *et. al.* 2013). Thus there are very few specific to capture the impact of water logging on biodiversity in the south-western region of Bangladesh. Present study tries to discover the impacts of water logging on biodiversity in the south-western region of Bangladesh. It identified that water logging affects human settlement, habitation of birds, animals and fishes as well as growth of trees and plants in that region.

Materials and Methods

Study Area Selection

The study purposively selects Tala upazila (Fig.1) of south- west region of Bangladesh has the long history of water logging. The study selects three unions Khalishkhali,Islamkathi and Jalalpur union of Talaupazilla in Sathkhira district. Among these areas, Jalalpur and Islamkathi union remain water logged naturally almost throughout the year. Usually rain water remain trapped in Vabhanipur area of Islamkathi as well as Kanaidia area of Jabalpur. On the contrary Khalishkhali union can be termed as anthropogenic water logged. Saline water is pumped in this area for shrimp cultivation. For in depth study, the most affected villages Dalua, Vabanipur and Kanaidia villages were selected, which represents Khaliskhali, Islamkhati and Jalalpur union respectively.

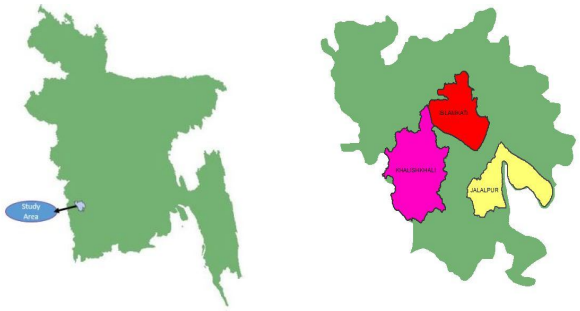


Fig.1. Location of study area in Bangladesh and unions of Tala upazila

Data Collection

Primary data were collected during the period of April 2015 toApril 2016. Twenty semi-structured interviews were conducted for capturing the impact of water logging on plant growth, biodiversity and physical environment. The interviewees were mainly farmers and businessmen, who live in the study area for long time and thus would be able to capture the impact of water logging on biodiversity. In addition to this, five key informant interviews were conducted to get deep insight about changes in physical environment and changes in biodiversity and peoples' adaptation to those changes in the study area. In order to gather data on these diversified issues, number of FGDs in the unions has been done. After collection of all primary and secondary data, they were processed and analyzed to obtain the findings of the study.

Result and Discussion

Water Logging Hazards

Tala upazilla is the most affected water logged areas since massive rainfall of 2011 (Awal, 2014). Nature and severity of water logging problem differs in different unions or villages. It is important to note that Kanaidia and Vabanipur villages are situated on the bank of river Kabodak, which have been waterlogged during rainy season in every year since 2011(Tareq, 2015).Mostly rain water remained trapped in these villages for about eight (8) months. On the contrary, Khaliskhali union on the bank of river Shalikha is artificially inundated for shrimp cultivation. As brakish water was easily available in the nearby river, which was pumped into the agricultural land for more profit by shrimp cultivation.

Water logging creates livelihood displacement for the local poor through reducing access to the common property resources. This situation also squeezes their income earning opportunity from agricultural and non-agricultural activities, their access to the safe drinking water and sanitation system. Water logging

destroys educational and religious institutions, housing conditions and reduces scope for other utility services. It also affects plant growth, availability of birds and livestock, fruit and timber trees and availability of fishes in this region. Present study is an attempt to make a detail investigation on this issue.

Impacts on Biodiversity

Water logging significantly affects localbiodiversity in the study area. Water logging reduces the availability of birds and fishes, restricts the opportunity to rear livestock. Field survey shows that the scenario of whole physical environment has changed due to water logging.

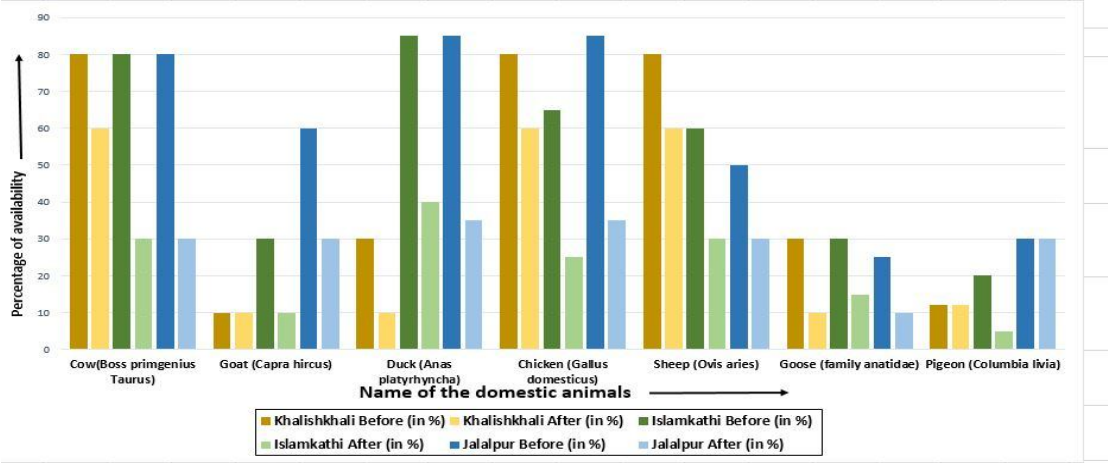


Fig.2. Impact of water logging on domestic animals and birds

Field survey shows that water logging restrains the opportunity of rearing domestic animal as well as bird by the households. The graph (Fig. 2&3) above compares the availability of animal and birds in three unions before and after water logging. FGD data shows that the number of cows, goats, ducks, chicken and goose have reduced significantly in three unions altogether. It is important to note that number and availability of cows have reduced more in Islamkathi and Jalalpur rather than that of Khalishkhali union. In case of goat, significant change has occurred in Jalalpur as well as Islamkathi unions, but the availability remains same in Khalishkhali union. Duck has reduced significantly in Jalalpur unions due to scarcity of fodder. There were no changes in number of cats and dogs in Khalishkhali union but reduced in Jalalpur and Islamkhati union.

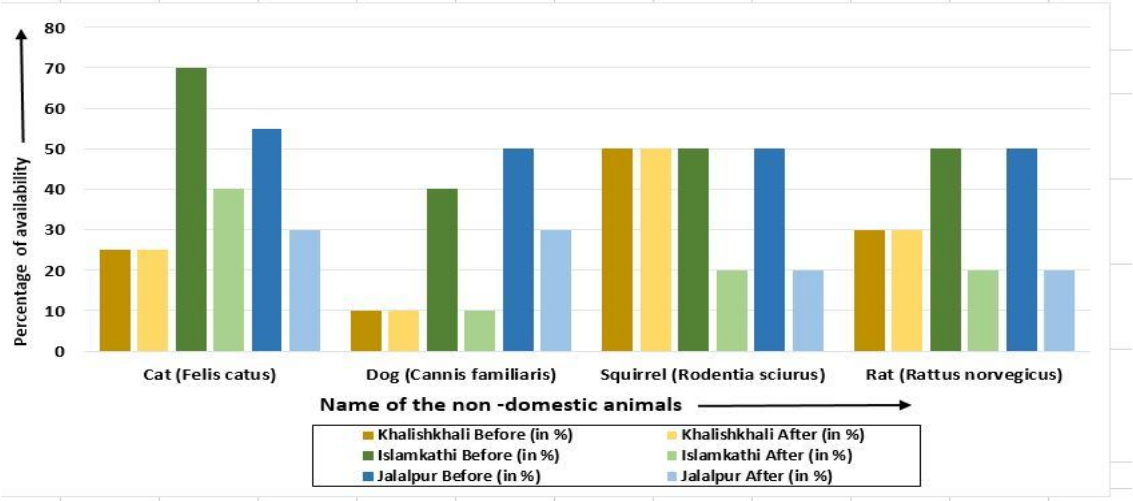


Fig. 3. Impact of water logging on other (non- domestic)animals *(The graph above captures mean responses on availability of livestockof FGD participants in percentage form before and after water logging. The study categorizes four distinct types of responses on the basis of availability, which reports that (60-90) % means very commonly seen, (30-59) % means commonly seen, (15-29) % means rarely seen and (5-14) % means very rarely seen.)*

In case of livestock, Dalua village has been experiencing comparatively little loss in rearing cows and sheep than other two villages even after water logging. The reason is that controlled nature of water logging in this locality does not affect the availability of fodder significantly and they have alternate source of fodder for cows other than grass. Likewise, reduction of chicken in these areas implies that water logging affects family food consumption level, a part of which were earlier being used as fodder for chicken and duck. Similar connotation may be applied for explaining the reduction of the number of cats and dogs in Jalalpur union.

Field survey shows a mixed impact of water logging on fish species (Table 1). The impact varies depending on the existence of fish availability in the study areas. In Dalua union, there is no change in native fish species, like koi, magur, taki, singhi, shoil,tengra etc.,but a significant reduction has occurred in the availability of puti, khoshe, ruhi, katla, silver carp, grass carp and mrigel. Unlike Dalua village, Kanaidia and Vabanipur villages have been experiencing a significant increase of local fish varieties, for example koi, magur, taki, singhi, shoil etc, but vetki ,khorshula etc had decreased. No change has captured in case of ruhi, katla, silver carp, grass carp and mrigel. Cultivation of telapia increased in all the villages.

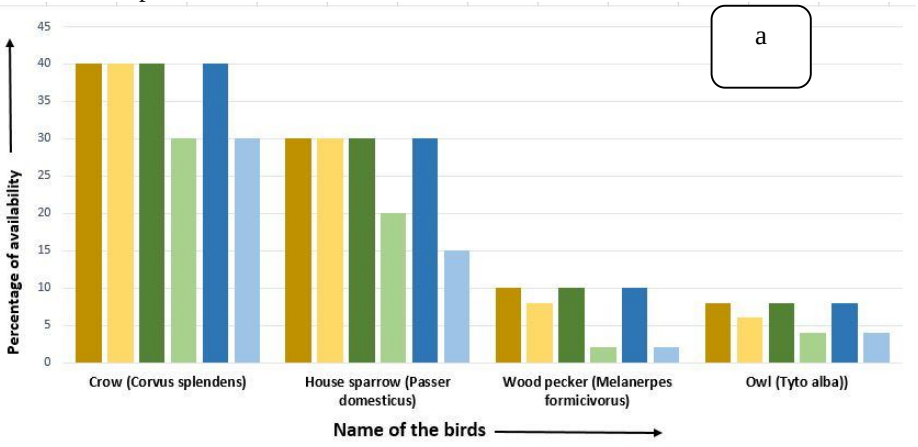
In earlier days, Jalalpur union was rich in vetkhi, khorshola, parshe and other saline fishes, but now a day's these were not available. Rather sweet water fish like taki, koi, tengra, etc., were appearing. Cultivation of telapia was in increasing in high rate in Islamkathi due to availability of sweet water. On the contrary huge amount of shrimp cultivation was going on in agricultural land of Khaliskhali union by drawing saline water from the Shalikha river.

Table 1. Impact of water logging on fish species

Name	Fishes_Khalishkhali		Fishes_Islamkathi		Fishes_Jalalpur	
	Before (in%)	After (in%)	Before (in%)	After (in%)	Before (in%)	After (in%)
Koi (*Anabas testudineus*)	20	20	10	30	10	30
Taki (*Channa punctata*)	20	20	15	30	15	30
Magur(*Clarias batrachus*)	20	20	15	30	15	30
Singhi(*Heteropneustes fossilis*)	20	20	10	30	15	30
Shoil (*Channa striata*)	10	10	10	20	10	30
Tengra(*Batasio batasio*)	15	15	40	60	50	70
Punti (*Puntius puntio*).	60	30	30	40	30	50
Gazar(*Channa marulius*)	10	10	10	15	10	15
Pangas(*Pangasius pangasius*)	20	20	20	40	20	40
Khorshula(*Rhinomugil corsula*)	20	40	20	10	20	10
Ruhi (*Labeo rohita*)	20	10	10	10	10	10
Katla (*Catla catla*)	20	10	10	10	10	10
Silver carp (*Hypophthalmichthys molitrix*)	20	10	10	10	10	10
Grass carp (*Ctenopharyngodon idella*)	15	10	10	15	10	15
Bele(*Glossogobius giuris*)	60	60	20	20	30	20
Baim(*Mastacembelus armatus*)	20	20	40	50	40	50
Telapia (*Oreochromis mossambicus*)	20	60	20	80	20	70
Vetki (*Lates calcarifer*)	50	50	40	10	40	10
Kholshe(*Colisa fasciata*)	30	10	40	30	30	10
Mrigel(*Cirrhinus cirrhosus*)	15	10	10	10	10	10
Nilontika (*Oreochromis niloticus niloticus*)	30	30	30	60	30	60
Shrimp (*Penaeus monodon*)	50	90	50	30	50	30
Parshe (*Liza parsia*)	50	50	40	10	40	10

The table (Table 1) above captures mean responses on availability of fishes of FGD participants in percentage form before and after water logging. The study categorizes four distinct types of responses on the basis of availability, which reports that (60-90) % means very commonly seen, (30-59) % means commonly seen, (15-29) % means rarely seen and (5-14) % means very rarely seen.

The graph (Fig. 4) below captures the impact of water logging on availability of birds in the study area. Field survey shows that crow, house sparrow have reduced in all of the villages after water logging except Dalua village. A good number of Heron, Kingfisher etc had increased in Jalalpur as well as Islamkathi union , but reduced in Khalishkhali union .A significant reduction of dove,magpie robin etc had occurred from Jalalpur and Islamkathi.



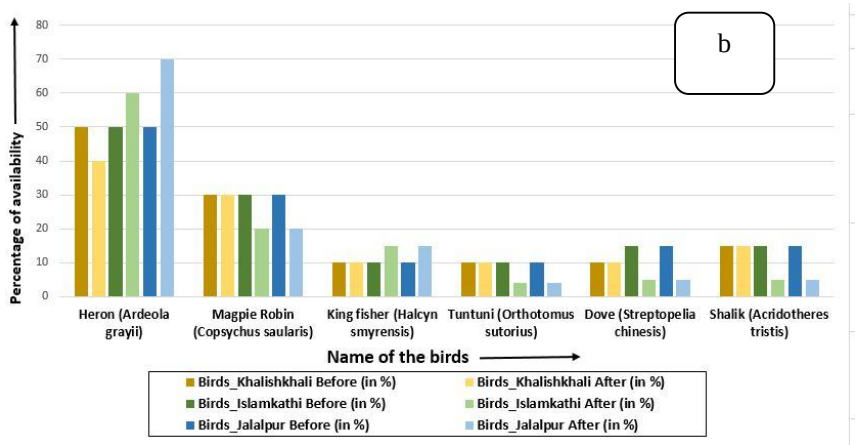


Fig. 4(a&b). Impacts of water logging on bird species *(The graph above captures mean responses on availability of livestock of FGD participants in percentage form before and after water logging. The study categorizes four distinct types of responses on the basis of availability, which reports that (60-90) % means very commonly seen, (30-59) % means commonly seen, (15-29) % means rarely seen and (5-14) % means very rarely seen.)*

The birds which depend on trees for their habitation are greatly reduced after water logging. For example, owl, wood pecker, magpie robin, and shalik belong to this category. Then another significant reduction has occurred in case of crow (except Khalishkhali), which is dependent on human wastages like spoiled food, decomposed material etc. Water logging affects human wellbeing by reducing consumption level and degrading living standard of the people, which restrains the scope for discarded material and spoiled food for the households.

Water logging occurs when roots cannot respire due to excess water in the soil profile whenever the soil is so wet that there is insufficient oxygen in the pore space for plant roots to be able to adequately respire. Other gases detrimental to root growth, such as carbon dioxide and ethylene, also accumulate in the root zone and affect the plants. Waterlogged soils release increased amounts of nitrous oxide (N_2O), a particularly damaging greenhouse gas. Lack of oxygen in the root zone of plants causes their root tissues to decompose. Usually this occurs from the tips of roots, and this causes roots to appear as if they have been pruned. The consequence is that the plant's growth and development is stalled. If the anaerobic circumstances continue for a considerable time the plant eventually dies. Most often, waterlogged conditions do not last long enough for the plant to die. Once a waterlogging event has passed, plants recommence respiring. As long as soil conditions are moist, the older roots close to the surface allow the plant to survive. However, further waterlogging-induced root pruning and/or dry conditions may weaken the plant to the extent that it will be very poorly productive and may eventually die (Fig.5a). Many farmers do not realize that a site is waterlogged until water appears on the soil surface. However, by this stage, plant roots may already be damaged and yield potential severely affected.

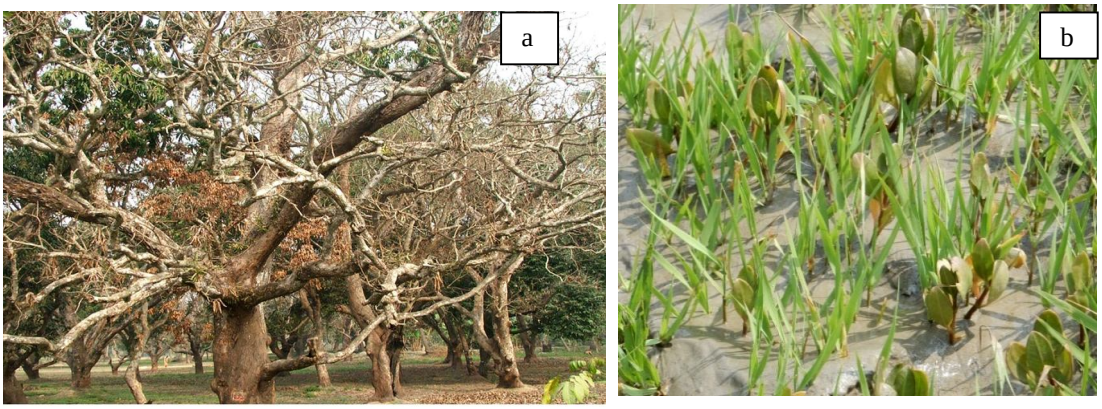


Fig. 5. (a) Death of historical mango garden at Gopulpur, Islamkathi, (b) Growing of Gaooa (Mangrove tree) on the bank of Kabodak at Jalalpur

The graph (Fig.6) below shows the impact of water logging on availability of fruit trees. Field survey shows that Jalalpur union was rich in fruit plants before water logging, which is the most affected area since 2011. Water logging crumbles all sorts of fruit plants in Jalalpuras well as Islamkathi union. Blackberry, banana, jackfruit, papaya, coconut, boroi, palm, guava and betel nut trees were destroyed completely. No change has captured in case of sofeda, coconut and date fruits. In Khalishkhali union, fruit trees were affected comparatively less inside the villages, but agricultural land had lost her seasonal crops.

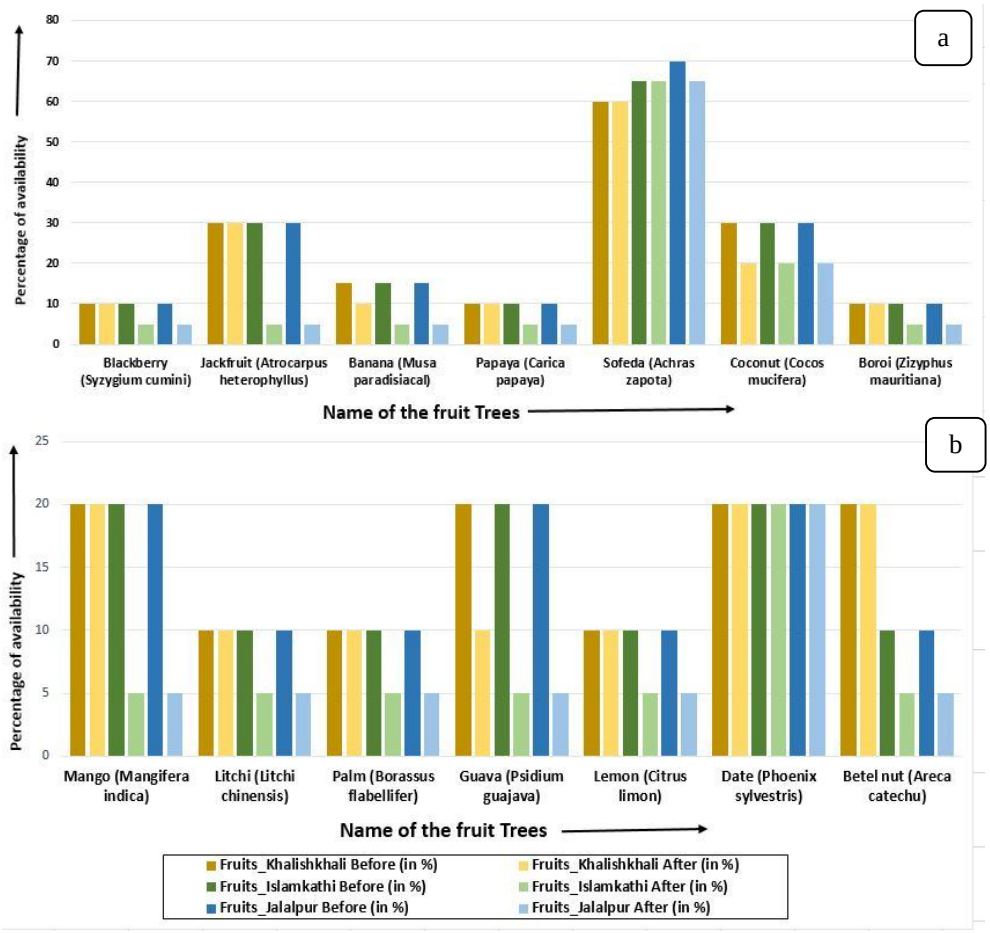
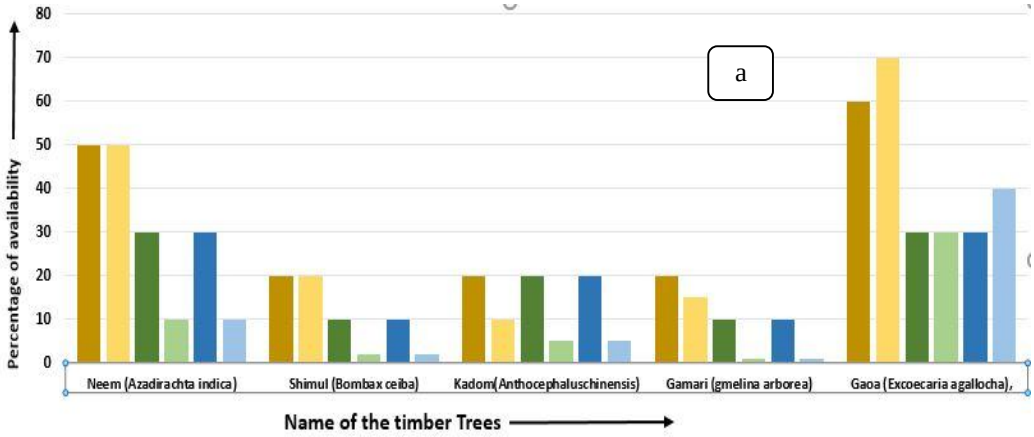


Fig. 6 (a&b). Impactof water logging on fruit plants *(The graph above captures mean responses on availability of fruit trees of FGD participants in percentage form before and after water logging. The study categorizes four distinct types of responses on the basis of availability, which reports that (60-90) % means very commonly seen, (30-59) % means commonly seen, (15-29) % means rarely seen and (5-14) % means very rarely seen.)*

The graph (Fig.7) below captured the impact of water logging on timber trees in three villages in the south-western part of Bangladesh. Permanent nature of water logging in Jalalpur as well as Islamkathi union reduced the availability of timber trees, such as neem, shimul, kadom, gamari, shegun, mehgani etc.In addition, Jalalpur union had been experiencing increased number of salinity tolerate species, like Gaoa and Golpata (Fig.6b), as little brakish water could come upto that spot. Neem, Mehegani and Baine has remained unchanged in Khalishkhali union.



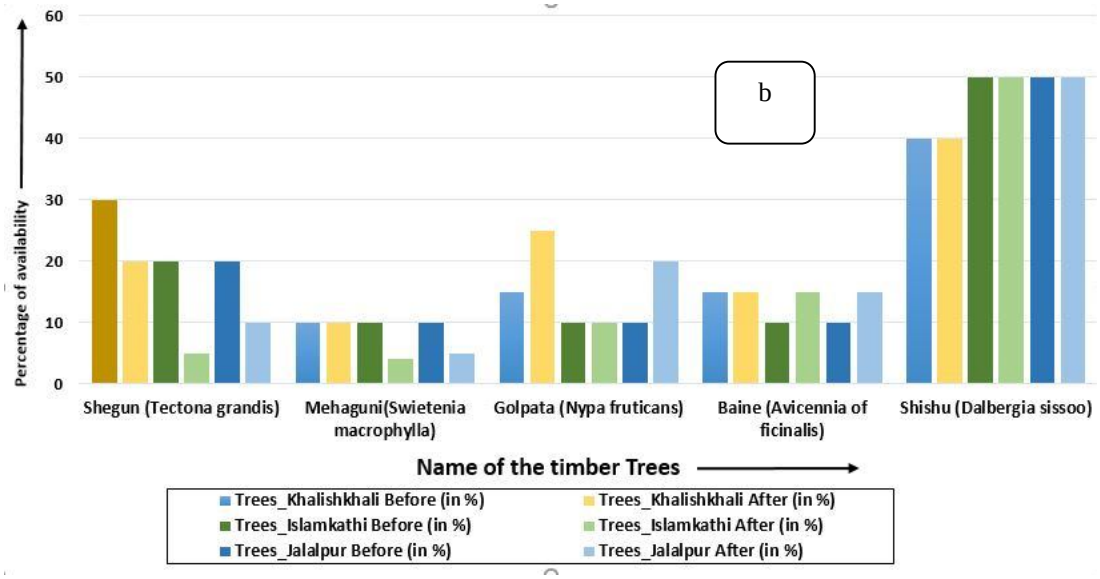


Fig.7(a&b). Impact of water logging on timber trees. *(The graph above captures mean responses on availability of timber trees of FGD participants in percentage form before and after water logging. The study categorizes four distinct types of responses on the basis of availability, which reports that (60-90) % means very commonly seen, (30-59) % means commonly seen, (15-29) % means rarely seen and (5-14) % means very rarely seen.)*

Socio-economic Implication of Biodiversity Loss

All the unions were richer in biodiversity before water logging. Therefore, resultant biodiversity losses are greater when the area goes under water. In connection to this, socio-economic vulnerability of this area turned more acute than other comparable union. But observation in the field survey showed that socio-economic condition of the people in Khalishkhali union is better than other two unions.KII data discloses the fact that people of this union had been able to adapt the changed environmental setting and incorporate those changes into their livelihood dynamics. In relation to this, it was found that water logging increases the availability of native fish species in Kanaidia as well as Vabanipur villages, but it did not had any major impact on large scale commercial fish cultivation. Again people adopt different nonfarm activities to reduce dependence on agricultural sector. Occupational diversification in this village ranges from day laboring, petty trading to large scale commercial fish cultivation, cropping, both government and non-government service holding etc. People also tend to migrate both temporarily and permanently to other adjacent places as a part of adaptation.

As rain water remains trapped in Vabanipur as well as Kanaidia village, fresh water fishes were available instead of brakish water fishes. Locals of these villages had the habit of taking sea fishes, but now a day they are getting fresh water fishes. On the contrary, low land of Khaliskhali union inundated by brakish water for shrimp cultivation, which also allows sea fish like vetki, khorsula ,purshea to grow . Due to saline water, frog, the friend of nature was disappearing. Activities of earthworm were decreasing. As a result, soil nutrient was deteriorating. In addition ,salinity intrusion was going on in the ground water .Most of the mango, jackfruit, litchi, gamary etc were disappearing from the nature due to water logging. But bubla, shishu(raintree), sofeda, dates were found to survive somehow.

Conclusion

It reveals that nature and severity of water logging problem affect the study areas in different ways. Duration of water logging and peoples' response to that problem are two important factors which determines the effect of water logging problem in the study area. Permanent nature of water logging in Kanaida as well as Vabanipur village induces the people to adapt the consequences of water logging into their livelihood dynamics even amid severe biodiversity losses. On the contrary, controlled nature of water logging in Khalishkhali union does not compel the people to compensate the water logging induced welfare losses. But it is evident from the field survey that water logging has profound impacts on biodiversity loss and resulting reduced wellbeing in terms of squeezed household economy and reduced access to open access fisheries. Analyzing the causes and impacts of water logging problem on biodiversity in the study area, few recommendations can be suggested to reach a long term solution towards this problem. These recommendations are extracted from the opinion of the respondents in the study area. People in Kanaidia village opine that dredging or excavating Kobadak River would be the most important solution to allow regular tides of the river at first stage. Then it is also very important to prohibit active deposition of sediments inside the river beds. Tidal River Management (TRM) has proven as effective tools in mitigating severe water logged areas. In case of Vabanipur village, people recommend excavation of existing linked canal to drain out logged water from the habitation. Local

people in this area also suggest continuing TRM in the upstream rivers to increase drainage capacity of the Kabodakriver. But people in all of the study areas opine that whatever the measures adopted for solving water logging problem should incorporate local people perception and their indigenous knowledge. Good packageof compensation for affected people in TRM beels may help all stakeholder in execution of TRM operation.

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