

Effects of Agricultural Practices on Biodiversity in Bangladesh

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Abstract Biodiversity in Bangladesh is deteriorating gradually due to many anthropogenic activities. Agricultural practices along with modern farming techniques causing depletion of biodiversity. The study was conducted to determine the impacts of agricultural practices on biodiversity in the study area. Cultivable land increase only 1% but total cultivable land came under irrigation. Cropping in wetland area got popular and increase 95% in term of land area. As water level goes down, digging pond in wetland area became a trend recently. Simultaneously, the use of submersible water pumps gaining popularity. Agricultural practices shift dramatically from inorganic fertilizer to organic fertilizer and chemical fertilizer. The numbers of pesticides use reached three folds. On the other hand, floral and faunal species is losing its diversity in the study area. Total, 29% fruit plants, 38% timber plant and 42% medicinal plant species extinct. In case of fauna, 33% wild animal, 26% birds and 46% fish species extinct form the study area. People perception mentioned cultivation land used pattern, use of chemical fertilizer, pesticide etc. irrigation, cultivating hybrid, HYV and exotic plant, use of modern agriculture technology, habitat destruction, infrastructural development, urbanization etc. as the causes of loss of biodiversity. But, in this study finds most of the biodiversity caused by anthropogenic activities. Farmers of the study area have no training of any kinds of fertilizer using but they admit that conserving biodiversity is important. Anthropogenic agricultural effects on biodiversity are a field needs further research, particularly about the conditions where native and diverse species may sustain and flourish.

Keywords: agricultural, biodiversity, land degradation, conservation, organic-inorganic-chemical fertilizer

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1. Introduction

Agricultural activities are the most important economic activities of Bangladesh. In rural areas around 75% of people are involved in agricultural activities directly or indirectly. Irrigation, use of chemical fertilizer and pesticides are some crucial part of agricultural activities.

Agriculture imposes external costs upon society through pesticides, nutrient runoff, excessive water usage and other assorted inputs [1]. Chemical fertilizers and pesticides have been widely and extensively used in Bangladesh agriculture. Continuous use of inorganic fertilizers alone to soils had a deleterious effect on soil productivity and a steady declining trend in crop productivity associated mainly with loss of inherent soil fertility [2].

In Bangladesh agricultural technology has made a significant contribution to the increased food grain production [3].

Agricultural production has improved dramatically in the last two decades due to the advancement in modern technologies [4]. But the indiscriminate use of agricultural technology in certain areas like groundwater, pesticides, shrimp farming, etc. also caused tremendous environmental hazards.

Natural vegetation has been declining day by day being replaced by cultivated crops and the intensity of cropping in the cultivated land has been increased to the maximum possible extent [5]. These human activities have created numerous complexities, both in nature and in human society. For example, deforestation has increased the crises of fuelwood and timber shortage and has hastened soil erosion and degradation of the environment [6].

Irrigation water is one of the vital and costly inputs in agriculture. The present irrigated area of Bangladesh is about 29% of the total cultivated area (43% receive surface water irrigation and 57% utilize groundwater) [7]. Use of chemical fertilizer on their agriculture land and

loss of their ecological system effects the water source which causes pollution to both the surface and groundwater, which also highly impacts human water use and also makes water a scare resource [8].

Alarmingly about 50 percent of the fertilizers applied to soil remain unused and causes enormous chemical reactions resulting in deterioration in the water conservation capacity of soil [9,10].

Therefore, it is clear that large-scale use of fertilizers, pesticides and irrigation water by the farmers for a long period as well as non-judicious use have been damaging the natural resources such as land, fishes, beneficial insects, soil microbe, etc. Agriculture and environment has a close relationship and interacts with each other in such a way that the health of agriculture depends on the proper functioning of environmental process and the health of the environment depends upon a respectful agriculture.

Lack of environmental education and awareness programs training and motivation activities; rural people used cow dung, homestead waste, crops and vegetables wastes as fuel instead of managing the crop field which lead to vulnerable soil erosion, nutrient depletion, or other natural hazards like air and water pollution.

So, it is necessary to increase environmental awareness of the farmers about sustainable system. Sustainable system is a management strategy which helps the producer to choose hybrids and varieties, a soil fertility package, a pest management approach, a tillage systems and a crop rotation to reduce costs at purchased inputs, minimize the impact at the system on the immediate and the off-farm

environment and provide a sustained level of production and project from farming.

2. Methods

2.1. Study Area

Six villages were selected from Puthia sub-district under Rajshahi district. The selection was made on the basis of two criteria. One, upland not regularly affected by annual flooding or comparatively dry land area with three villages are i) Baraipara ii) Ramjibanpur and iii) Kathalbaria and low land (marshy) or “beel” area with three villages are i) Shilmaria, ii) Udanpur and iii) Pompara.

2.2. Data Collection

The study based on both primary and secondary data. Primary data consists of household survey based on a questionnaire, observation, focused group discussion, case study, photographs etc. As for secondary data, researcher collected them from various sources. Such as Department of Agricultural Extension (DAE), Department of Livestock and Fisheries (DLF), Department of Forestry (DF), Bangladesh Bureau of Statistics (BBS), Department of Meteorology (DoM), newspaper, peer-reviewed academic journals etc.

After necessary coding, compile and tabulation of collected data we analysis them with MS Excel and SPSS for further presentation.

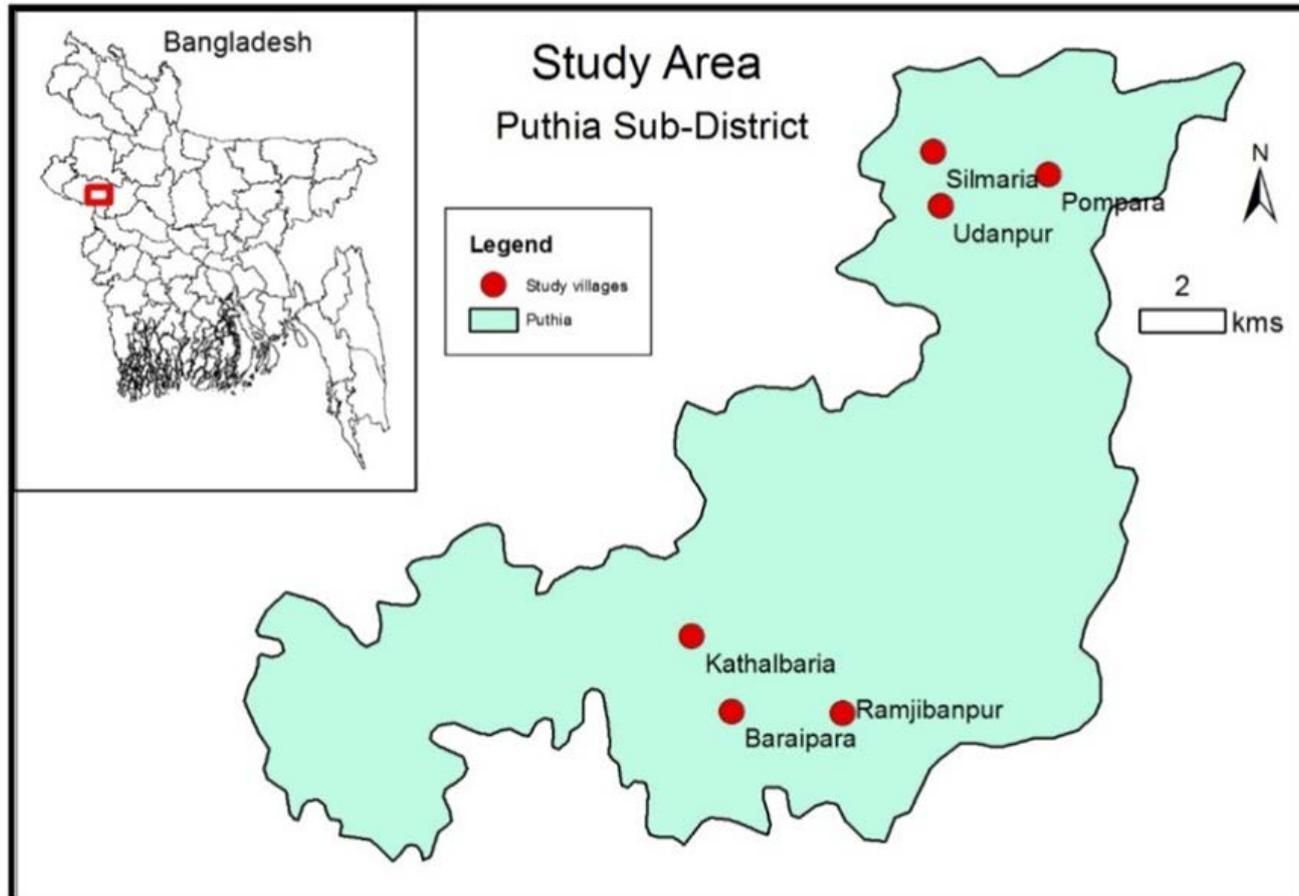


Figure 1. Map of the Puthia Sub-District, Rajshahi

3. Results and Discussions

Firstly, in pre-1970, all irrigation was done from surface water, primarily from lakes and from ponds. Around the 1980s, a number of shallow tube wells and in 1990s deep tube wells were introduced. The number of tube wells increased rapidly; currently, most of the irrigation water comes from the underground water. Recently, Submergible pumps are being used for irrigation in cultivated land and also for drinking purpose.

Table 1. Total Cultivated and Irrigation Land (Acre) of Puthia Upazila 1990-2014

1990		2014	
Cultivated	Irrigation	Cultivated	Irrigation
36157	4514	36481	36481

Source: Official record of DAE, Puthia.

Table 1 shows how cultivated lands all come under the irrigation system within just 25 years. At present, there is no land left unirrigated.

Table 2. Cultivated and Irrigated Land (Acre) of Different Villages in the Study Area from 1990-2014

Villages	1990		2014	
	Cultivated	Irrigation	Cultivated	Irrigation
Baraipara	469	45	471	471
Ramjibanpur	132	7	134	134
Kathalbaria	456	24	458	458
Silmaria	46	10	40	40
Udanpur	83	25	86	86
Pampara	108	22	113	113

Source: Official record of DAE, Puthia.

Table 2 shows that six study villages cultivable and irrigated land area in 1990-2014. Researcher found that in 1990 irrigated area were only, Baraipara (9.5%), Ramjibanpur (5%), Kathalbaria (5%), Silmaria (21.7%), Udanpur (30%) and Pampara (20%). But in the 2014 year, 100% of cultivated land is under irrigation.

The result of this study is supported by Haque *et al.* (2012) and said that labor and irrigation costs together normally account for two- thirds of the total cost of production [11]. Mandal (2006) also supported this finding [12].

Table 3. Level of Ground Water Table (Static Level) During 1990- 2014

1990		2014	
Wet Season (ft.)	Dry Season (ft.)	Wet Season (ft.)	Dry Season (ft.)
14-17	26-28	16-20	30-32

Source: Official record of DPHE, Puthia.

Due to excess irrigation and over dependency on ground water level of groundwater is decreasing rapidly. During 1990 to 2014 groundwater level dropped 2-3 feet in a wet season and around 13 feet in a dry session. So, shallow tube wells are not functional in that study area. Deep tubes are used for irrigation which pushing the groundwater level even further down.

Table 4. Species Richness of Different Plant Groups in the Study Area of Puthia Upazila in Rajshahi District

Villages	No. of species						Total
	Weeds	Vegetables	Spices	Fruit	Timber plants	Medicinal Plants	
Baraipara	74	25	5	19	17	22	162
Ramjibanpur	82	24	4	20	15	15	160
Kathalbaria	68	20	4	21	17	18	148
Silmaria	70	23	5	20	14	21	153
Udanpur	75	26	4	19	16	23	163
Pampara	78	24	6	22	17	23	170
Average	74	24	5	20	16	20	159
All	84	27	8	22	18	25	184

Source: Field visit FGDs and Interview.

A total of 25 species were identified from six selected villages (Table 4). These were mainly trees, shrubs and herbs such as Durba (*Cynodon dactylon*), Duttura (*Datura metel*), Akanda (*Calotropis procera*), Kochu (*Colocasia esculenta*), Bel (*Aegle spp.*),Varenda (*Ricinus communis*), Hatishur (*Heliotropium indicum*), Katanate (*Amaranthus spinosus*), Dhonia, (*Coriandrum sativum*), Thankuni (*Holorhena antidysenterica*), Begun (*Solanum melogena*), Lebu (*Citrus spp.*), Mukta Jhuri (*Acalypha indica*), Dadmordon (*Cassia alata*) and Kolkasunda (*Cassia sophera*) were common in six villages. In addition, Shimul (*Bombax ceiba*), Mehedi (*Lawsonia inermis*) and Tulshi (*Ocimum santum*) were common in three villages Baraipara, Udanpur and Kathalbaria. Babla (*Acacia nylotica*) were common in Ramjibanpur and Pampara. Apang (*Achyranthes aspera*) and Jostimodhu (*Glycerrhiza glabra*) were recorded in four villages Silmaria, Ramjibanpur, Pampara and Udanpur. Arjun (*Terminalia arjuna*) and Sorpogondha (*Rauwolfia serpentine*) were recorded in Kathalbaria only.

A total of 14 wild animal's species were mentioned by the respondents which observed in the study area during the last one year in 2014 (Table 5).

Table 5. Species Richness of Different Animal Groups in the Study Area of Puthia Upazila in Rajshahi District

Villages	No. of Species						Total
	Livestock	Poultry	Pet Animals	Wild Animals	Birds	Fishes	
Baraipara	2	3	2	12	21	24	64
Ramjibanpur	2	3	2	13	18	22	60
Kathalbaria	2	3	2	11	21	25	64
Silmaria	2	3	2	14	17	26	64
Udanpur	2	3	2	10	22	28	67
Pampara	2	3	2	12	24	25	68
Average	2	3	2	12	21	25	65
All	2	3	2	14	25	29	75

Source: Field visit, FGDs, and Interview.

These species were as: Sheal (*Vulpus* spp.), Begi (*Herpestes* spp.), Guisap (*Varanus* spp.), Badhur (*Pteropus giganteus*), Chamcika (*Pipistrellus coromandallanus*), Katberali (*Funumbulus pennanti*), Edur (*Mus musculus*), Edur (*Rattus rattus*), Edur (*Bandicoota* spp.), Goma (Ghokra) (*Naza* spp.), Bora (*Vipera ruselli*), Daraj (*Ptyas muscosus*), Kaklas (*Calotis versicolor*), Onjony (*Mabua carianta*). More or less similar species were recorded in the six study villages.

The number of species declined in every aspect in animal variety with the last 25 years from 1990 to 2014. Especially for livestock's, poultry and pet animals declined to a very low number.

Table 6 indicates that the loss of biodiversity is occurring day by day in many ways. The causes of

biodiversity lose in the study area of six villages as Baraipara, Ramjibanpur, Kathalbaria, Silmaria, Udanpur and Pampara in Puthia Upazila due to some parameters. These are cultivation (land use pattern), use of chemical fertilizer, use of pesticide, irrigation, hybrid and exotic plant, use of modern agriculture technology, habitat destruction, road construction and urbanization and some other reasons. To fulfill the research objective, the people's perception for the causes of biodiversity loss are about 48-51% for cultivation (land use pattern), 15-17% for use of pesticide, 8-10% for use of chemical fertilizer, 4-6% for use of modern agriculture technology, 4-5% for Hybrid, HYV and exotic plant, 3-10% for road construction and urbanization, 3-5% for irrigation, 2-4% for habitat destruction and 1-3% for other reasons.

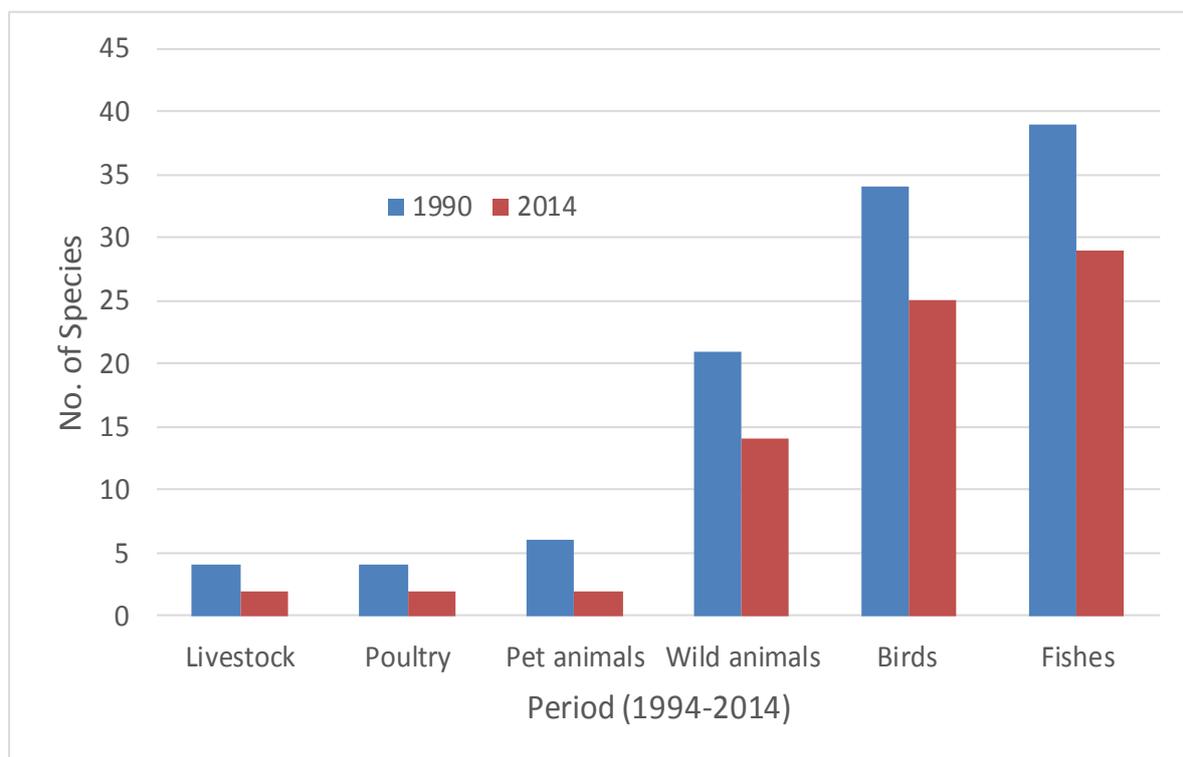


Figure 2. Changes in Animal Biodiversity (Species Richness) in the Study Area (1990-2014)

Table 6. Causes of Biodiversity Depletion in the study areas

Villages	Cultivation/Land Used Pattern (%)	Use of Chemical Fertilizer (%)	Use of Pesticide etc. (%)	Irrigation (%)	Hybrid, HYV and Exotic Plant (%)	Use of Modern Agriculture Technology (%)	Habitat Destruction (%)	Road Construction and Urbanization (%)	Others (%)	Total (%)
Baraipara	50.78	9.73	15.02	3.78	4.89	5.86	3.64	4.29	2.01	100
Ramjibanpur	49.68	9.06	17.08	3.98	4.90	5.77	3.48	3.39	2.66	100
Kathalbaria	48.52	8.98	16.35	4.31	4.12	6.01	2.99	3.56	5.16	100
Silmaria	51.04	8.83	15.84	4.55	4.47	5.46	3.28	4.12	2.41	100
Udanpur	49.89	9.97	16.19	5.17	4.23	4.16	3.31	9.68	2.4	100
Pampara	50.36	9.14	16.05	4.66	4.76	5.02	3.83	4.56	1.62	100
Avarage	50.00	9.2	16.00	4.4	4.5	5.2	3.4	4.7	2.6	100

Source: FGDs and interview. (% of respondent's mention).

4. Conclusion

In Bangladesh, farmers use land throughout the year for the continuous production of food grain. Pesticides and chemical fertilizers for farming are common practice and unsustainable due to its negative impact on biodiversity. Preserving soil quality is mandatory to make agriculture more 'Sustainable'. Loss of biodiversity caused by agriculture to farm environment due to intensive land use, the introduction of high yielding varieties, mono-cropping practices, inadequate and unbalanced use of chemical fertilizers and pesticides. These practices are destroying the natural habitat for wild flora and fauna. For the above reasons, land degradation, losses of soil fertility and microorganisms, air and water pollution, health hazards of people and so on problem occurred in a farm environment.

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