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# People's Perceptions of Environmental Pollution in Mokosh Beel, Bangladesh

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## Abstract

*This study examines people's perceptions of environmental pollution in Mokosh Beel. Mokosh is a perennial beel in Gazipur District, located approximately fifty-five kilometers north of Dhaka, Bangladesh. I conducted case studies in two villages to investigate the perceptions of residents concerning impacts of environmental pollution on drinking water, agricultural lands, crop production, and human health. Local residents believe the cause of Mokesh Beel's pollution is industrial in nature, rather than due to agricultural pesticides. Though happy with ongoing projects that have empowered women and helped communities, residents wish for additional interventions to address pollution. They question why the "polluters pay principle" is not used and think local employment in industries should increase. They want to be involved in activities that protect them from environmental pollution. Although the mandate to control industrial pollution is with the Department of Environment (DoE), I argue that this department alone cannot solve the pollution problem. Rather, combating pollution requires community participation. In this paper I investigate environmental changes in Mokosh Beel and explore co-management as a viable option for sustainable management. I conclude with policy recommendations to improve Mokosh Beel's environment and the livelihoods of its residents.*

## Introduction

Bangladesh's wetlands contain an invaluable wealth of biodiversity and natural resources. More than two-thirds of the country can be classified as wetlands according to the definition enunciated in the Ramsar Convention<sup>2</sup>. Wetlands in Bangladesh encompass a wide variety of dynamic ecosystems including mangrove forests, natural lakes, man-made reservoirs (such as Kaptai Lake), freshwater marshes, oxbow lakes (*baors*), *beels*, freshwater depressions (of which there are around 1,000), fish ponds and tanks, estuaries, and extensive floodplains that are seasonally inundated (Akonda 1989). Wetlands in Bangladesh contain rich biodiversity that is significant at local, national, and regional levels making them ecologically, economically, commercially, and socially important.

Mokosh Beel is situated in Gazipur District and lies in the Turag River Basin surrounded by sal (*Shorea robusta*) forests, numerous canals (*khals*), and Juran Beel. The area is an integral part of local livelihoods and culture. The wetlands of Mokosh Beel play important roles in ground water recharge and discharge, storage of flood water, shoreline stabilization, reduction of erosion, sediment trapping, nutrient

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<sup>2</sup>. Signed in Ramsar, Iran in 1971, the convention is an intergovernmental treaty that provides a framework for the conservation and management of wetlands and their resources.

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retention and removal, supporting food chains, fisheries production, providing wildlife habitat, offering recreation, preserving natural heritage values, biomass production, water transport, biodiversity preservation, and micro-climate stabilization (IWRB 1992, Dugan 1990). However, the wetlands around the beel are endangered. For the last two decades enormous and uncontrolled industrial development has endangered the area. Pressures from population growth, increasing exploitation of resources, industrial development, agricultural expansion and intensification, siltation, deforestation, and flood control structures are all contributing to the decline of Mokosh Beel. Local residents of the beel strongly believe that the main reason behind the pollution problem is increasing industrial development.

The Turag Basin, including Mokosh Beel, is the largest wetland in Dhaka Division. The beel has the potential to be a source of drinking water for the local population, a source of fresh vegetables, and a spot for city residents to enjoy. However, pollution problems are difficult to address in Mokosh Beel because of the economic and political power of industrialists. Community monitoring of the beel, which is sponsored by government and development organizations, could be a first step towards curtailing pollution.

## **Background**

Mokosh Beel is a perennial beel with a catchment area of around forty six square kilometers. The area is home to large peri-urban tracts and urban agricultural communities that are economically connected to the city as sources of vegetables and fish. As a result of Bangladesh's rapid economic growth since the 1980's, an industrial area has developed in Gazipur District. In 1982, the Government of Bangladesh declared Gazipur District a protected area, including Bhawal National Park. The district boasts 5,022 hectares of sal forest. Presently, nineteen areas in Gazipur District are designated as protected areas.

A government order signed in 2006 formally recognizes co-management structures at five protected forest areas in Bangladesh. In order to secure a natural resource-base that improves the socio-economic well-being of rural communities, while at the same time protecting the valuable natural resources and beauty of Bangladesh's wetlands and forests, a United States Agency for International Development (USAID) funded Integrated Protected Area Co-management (IPAC) project (2008-2013) is currently being implemented through the Ministry of Environment and Forests (MoEF) and the Ministry of Fisheries and Livestock (MoFL). The governmental agencies implementing the program are the Forest Department (FD), the Department of Fisheries (DoF), and the Department of Environment (DoE).

Between 1981 and 1985 industrial growth in the study area expanded at an annual rate of between one and five percent, while between 1996 and 2000 it occurred at an annual rate approaching twenty percent. However, in the last several years (2007-2009) growth has ballooned to a rate verging on seventy percent per year (BCAS 2009). This rapid and unplanned boom in industrialization is placing

tremendous pressure on the natural resources of Mokosh Beel and threatens the livelihoods of people who live there.

Dominant industries in the Mokosh Beel area include textile production (dyeing, printing, and washing), large-scale commercial poultry farming, and pharmaceutical manufacturing. The number of industries is increasing rapidly with little consideration for their impact on the environment or local people's livelihoods, especially those who are heavily dependent on natural resources. According to the Environment Conservation Act of 1995 and the Environment Conservation Rules of 1997 every development activity must receive an Environmental Clearance Certificate from the DoE prior to site selection and construction. Industrial development in Mokosh Beel, however, is not well managed. Most industries do not have an effluent treatment plan, and many that do have a plan have not implemented it because of cost. An Institute of Water Modeling report shows that the biological oxygen demand in the Gazipur watershed exceeds one hundred percent due to industrial effluent. The daily effluent load is 37,844 kilograms, and researchers have shown high levels of surface water pollution from untreated industrial discharge.

In addition to the area's road network and proximity to Dhaka, it is assumed that the reason for rapid industrialization in the Mokosh Beel area is its ample water resources. Therefore, it is also assumed that industry owners are likely to indiscriminately discharge their toxic wastes into the surface water. While industry has brought with it employment opportunities, increased incomes, and foreign exchange, the discharge of untreated waste into rivers and onto the land is threatening drinking water, fisheries, and agriculture.

The Bongshi and Turag rivers are the principle waterways in the study area and significant sources of surface water. Mokosh Beel is bounded to the north and east by the Turag River, so that as the beel and its adjacent wetlands have become polluted, it has spread to the Turag River. The basic character of the river and its surrounding wetlands has changed, including the color and odor of the water (BCAS 2009).

## Objectives

My objectives in this paper are:

1. To understand how people in Mokosh Beel perceive the impacts of industrial development on their environment and livelihoods; and
2. To make informed policy recommendations for improving the environment and the livelihoods of residents in Mokosh Beel.

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## Methods

### *Study area*

This study was carried out in Mokosh Beel focusing on two villages, Korol Surichala and Medi Asulai, within the Turag-Bangshi wetland area of the Kaliakoir *Upazila* of Gazipur District, Dhaka. With an area of 341 square kilometers, Kaliakoir is the second smallest *upazila* (sub-district) of Gazipur District in respect to area, as well as population. The *upazila* consists of 9 unions, 181 *mauzas*<sup>3</sup>, and 283 villages. The study area is bounded by the Turag River to the north and east, Ratanpur Khal to the south, and the Gazipur-Square-Chandra-Kaliakor Highway to the south and west.

The study area consists of terraces one to ten meters above the adjacent floodplains. Geologically, the exceptional uniformity of the clay sediments of the area, both laterally and vertically, suggests that they were laid down under tidal or marine conditions, which must have continued without tectonic or other disturbance over a long period (RAJUK 2004). The study area is characterized by two types of land form, known locally as *baid* and *chala*. Chala are hillocks or areas of land that are comparatively higher than their surroundings. Most chalas were once covered by native forests of *sal* and *gojari* trees (also *S. robusta*, but refers to immature trees) but have since been replaced by jackfruit (*Artocarpus heterophylla*) orchards for the financial benefits of the latter. Chala areas are often used for settlements and plantations because of their higher elevation. Baid, in contrast, are low lying areas located between chalas that flood seasonally. Each year some baid are inundated with water from rainfall and flooded rivers. During most of the year, low baid that remain filled with water are used for fishing. High baid, on the other hand, are used for cultivation. During high tide, water flows through channels between rivers and beels.

<sup>3</sup> .A type of administrative district denoting a land area within which there may be one or more settlements.

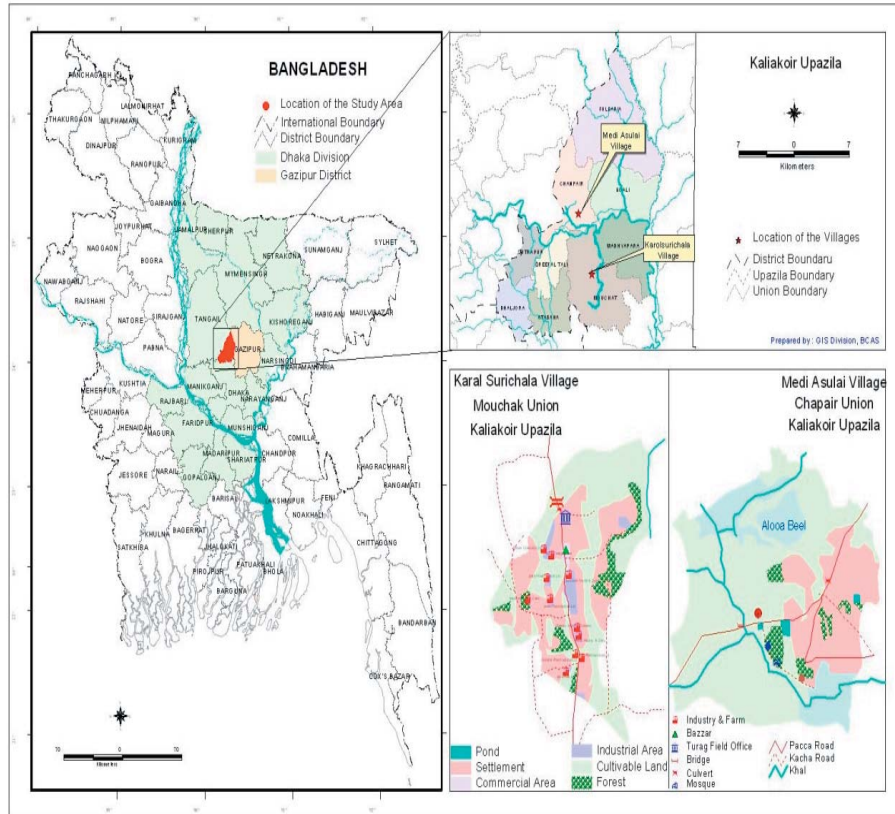


Figure 1: Map of study area

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## Data collection and analysis

I began with a literature review of relevant reports, articles, and books. Of special importance were reports from the DoF, the Management of Aquatic Ecosystem through Community Husbandry (MACH) project, the Forest Department's Nishorgo Support Project, and the Turag Demonstration Project of the Bangladesh Center for Advance Studies (BCAS). The documents and case studies I reviewed referred not only to the study area, but also to other regions and countries dealing with similar issues.

To get an overview of local people's perceptions of environmental pollution, I conducted a field investigation in two villages in Mokosh Beel from July 2009 to January 2010. Based on available information from project area maps, and discussions with knowledgeable people, I divided my project area into two strata: villages with high pollution levels and those with comparatively low pollution levels. I then classified the villages in the project area into one of these two strata depending on their levels of exposure to pollution. Next, I chose one village from the highly polluted stratum and one village from the lower polluted stratum. Before selecting villages I collected information on the communities through conversations with MACH project field-office staff members in Taltali, officials of the IPAC, and individuals from the projects' Resource Management Office (RMO).

For case studies, I chose the villages of Korol Shurichala and Medi Ashulai. Korol Shurichala has a comparatively low level of pollution and is situated in the union of Mouchak. The number of households in this village is approximately 330 and the population is approximately 1,750 people. The other village, Medi Ashulai, is situated in Chapiro Union and is highly polluted. The number of households in Medi Ashulai is approximately 250 and the population is approximately 1,250 people.

I followed standard participatory rural appraisal (PRA) methods to analyze data collected from local people concerning their perceptions. Six individuals of varying ages became my key informants. In addition, I conducted a total of four focus group discussions (two for each village), as well as informal discussions and individual interviews, including with different professionals. Prior to conducting PRAs, I consulted with village leaders, some of whom I included among my key informants because of their knowledge and their perceptions of long-term environmental changes in the area, as well as their perceptions of the impacts of these changes on the locality. I used a semi-structured questionnaire with a checklist format to facilitate discussions with key informants and in focus groups.

I also completed a household survey, for which I designed a questionnaire to interview twenty households, ten from each village. My sampling plan included a reasonably representative sample of households to ensure reliability and validity of results obtained. To learn more about livelihoods and environmental vulnerability, I also sought out individuals of various ages and occupations (fishers, boatmen, farmers, industrialists, laborers, students, and housewives). I then analyzed gathered information to get a sense of respondents' perceptions of the impacts of

information to get a sense of respondents' perceptions of the impacts of environmental pollution on drinking water, agricultural lands, crop production, and health.

## Results

### *Perceptions of Pollution Impacts on Drinking Water*

My research shows that today the vast majority of people in the study area depend on tube wells for their drinking water (Figure 2). Tube wells are the predominant source of drinking water in areas with both high and low pollution levels. Figure 2 also shows that as recently as a decade ago a large number of people in the study areas used water from rivers and beels for drinking, cooking, bathing and other domestic purposes. Today, due to the poor quality of surface water, almost everyone is completely dependent on water from tube wells for drinking.

### *Agriculture*

Villagers in focus group discussions in the polluted village reported that previously they could cultivate three crops per year. At present, however, they produce only one crop and the yield has been reduced by more than fifty percent due to the intrusion of polluted water into croplands (Figure 3).

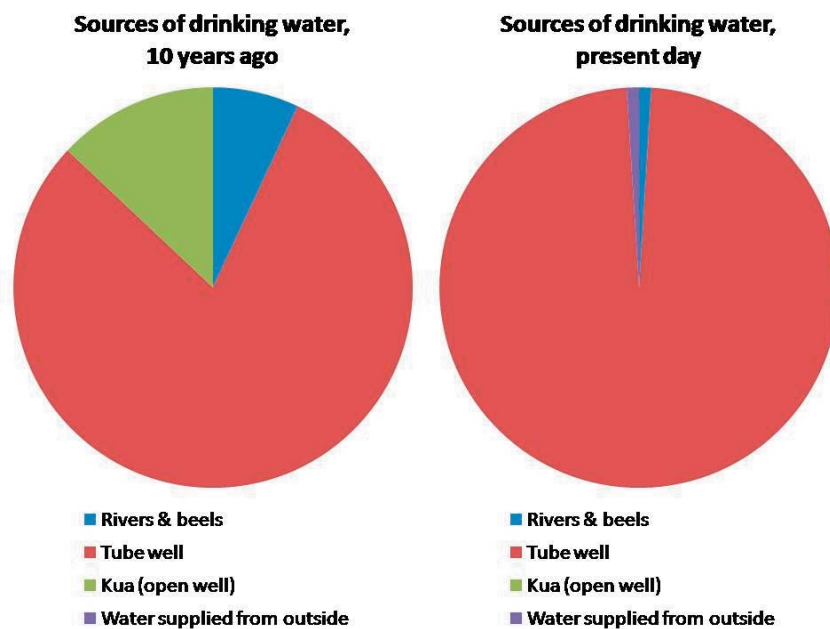
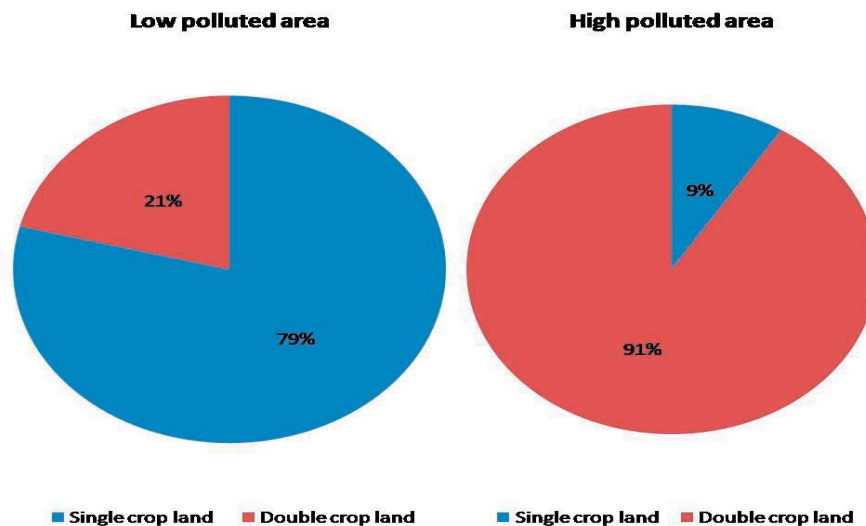


Figure 2: Sources of drinking water in study area, 10 years ago and present day



**Figure 3: Intrusion of polluted water into croplands in low and high polluted areas**

During focus group discussions farmers reported that toxic industrial effluents overflow from canals, rivers, and *beels* into their paddy fields. During the growing season rice seedlings turn yellow before they flower and the portions of the stalks immersed in water rot due to the high toxicity of the effluents. Respondents claim they have faced crop losses annually and that they will be forced to totally abandon agriculture in the paddies if the problem persists much longer. Respondents also find it extremely difficult to work in the paddies due to the extreme stench from the blackish polluted water. During the cold season farmers traditionally plant wheat in their paddies, but because of water pollution problems villagers in the more polluted village report an eighty percent decrease in wheat yields over the last 12 months (Table 1).

**Table 1: Average percentage of crop loss from 2008-2009**

Crop	Average estimated percentage of loss	
	High pollution area	Low pollution area
Rice n= 10	61.3	24.5
Wheat n= 20	80	-
Pulse	-	-
Jute	-	20.0
Potato	-	-
Maize	-	-
Mustard	-	50.0
Onion	-	-
Vegetable	47.8	-
Fruits	33.3	-
Others	82	-



### ***Fisheries***

In terms of fisheries, focus group discussion participants and key informants reported that in rivers and other bodies of water affected by pollution the species diversity and numbers of fish have dramatically dropped and that the safety of consuming local fish is questionable. Also migratory and aquatic birds no longer frequent Mokesh Beel. Some fishermen have switched to other professions even though it means accepting lower wages due to their lack of skills and knowledge required for new jobs. Participants felt a strong need to learn about alternative income generating activities in order to improve their livelihoods.

### ***Health***

According to information drawn from focus group discussions, during the monsoon season the smoke from nearby brick kiln factories sometimes reaches the homes of respondents; as a result, many people face problems with colds, headaches, and asthma. Respondents informed me that from the high density of brick kiln factories near Kaliakoir it seems that the government cannot manage the devastating air pollution problem. Responses from my household survey suggest that cases of a variety of diseases, including diabetes and skin diseases have increased in the study area over the past year (Table 2).

**Table 2: Respondents' answers to survey questions about increases in diseases in the past year**

<b>Name of diseases</b>	<b>Increase in cases</b>	<b>Same</b>	<b>Decrease in cases</b>
Fever	97%	2%	0%
Hypertension	20%	80%	0%
Diabetes	80%	20%	0%
Skin diseases	85%	15%	0%

### ***Non-Governmental, governmental, and co-management organizations***

Participants in the household survey and focus group discussions frequently mentioned that the activities of NGOs, as well as MACH, the Nishorgo Project, resource management organizations (RMOs), and the Federation of Resource User Groups (FRUG) did not address pollution control issues. They also mentioned other organizations, including the BCAS, Caritas, and the Center for Natural Resource Studies (CNRS). Respondents have joined meetings and rallies organized by the RMO formed under the MACH project. They have also submitted petitions to local government bodies and to public representatives asking for mitigation of the pollution problem. Participants are happy with micro-credit loans from FRUG, which have empowered women and helped communities. However, they wish that interventions would address pollution. People question why the "polluters pay principle" is not used and also think that more local residents should be employed in local industries.

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About twenty one NGOs work in and around Mokesh Beel assisting local people to maintain and build their livelihoods. Several of these NGOs and banks provide micro-credit to local people to invest in various income generating activities. Focus group discussion participants and key informants in this project, however, report that none of these organizations have made any serious attempts to solve the pollution problem. The national newspapers have reported on pollution issues in Mokesh Beel several times suggesting that RMOs formed under the MACH project have organized meetings and rallies, and raised awareness of the water pollution issue. However, the community is still suffering severely from the devastating environmental situation.

Local people have voiced strong demands that the appropriate government agencies take action and enforce laws to stop industries from continuing to pollute. Local people want the river and other water bodies to be clean as in pre-industrial days.

### ***Perceptions of Impacts on the Environment and Livelihoods***

This study also reveals that young and old people have different opinions regarding the volume of pollutants and the impact these pollutants have on the area. During an interview a young person from the highly polluted village of Korol Surichala expressed to me that the residents need jobs and income in order to live happily and that if polluting businesses are confronted then jobs will become scarce. Older residents of the same village also have strong feelings about their deteriorating environmental situation. They claim that pollution is happening as a result of unplanned and unmanaged industries. When they were young they played on their own land in a calm and clean environment. Older residents complain that lands were sold to industrial interests by outsiders and that population growth in the study area is a result of an increased need for industrial labor. According to these older residents, newcomers do not have any feelings about their environment and do not bother trying to stop pollution.

People who live around Mokesh Beel are willing to be involved in activities that protect them from environmental pollution. According to participants of focus group discussions, they would like to be able to control the situation and would like to see relevant laws and regulations enforced to prevent polluters from destroying the beel, which is central to their livelihoods. People I spoke with are willing to work with all concerned stakeholders, including government agents, industrialists, and other community members to solve their problems and restore the quality of their lives, livelihoods, and environment. They want result oriented actions against industrial pollution, prohibitions enforced against destructive fishing methods, afforestation of barren lands, reduced local poverty and unemployment, and a co-management system established for biodiversity conservation.

## **Discussion**

Mokesh Beel and its surroundings constitute a low lying area located about four kilometers from a highly industrialized parcel of land. Industrial wastes flow naturally to the beel by various canals and khals. These untreated wastes create a highly toxic level of pollution in the environment. Respondents and others in the

community perceive that their health problems are increasing as a direct result of industrial pollutants flowing into local wetlands. Migratory and aquatic birds no longer frequent Mokesh Beel and villagers are unable to use the water to irrigate crops, or to bathe and fish in the beel and khals as they once did. Conflicts have arisen among different water users; fishermen want to fish, but industrial owners use the beel as a dumping ground for their wastes.

This study reveals that respondents living around Mokesh Beel perceive that industrial pollution has adversely affected their lives and livelihoods. Due to the continuous disposal of untreated industrial wastes, water in the rivers, canals, and lakes of the beel are no longer usable for livelihood purposes including irrigation, fishing, livestock rearing, and so on. By looking at the color of the surface water and smelling its odor it is clear that the situation has deteriorated to the point that it is no longer necessary to conduct laboratory testing to prove the worsening quality of the water.

In the past, rivers and other bodies of water were a source of recreation for local inhabitants, such as swimming, fishing, and boating. Agriculture in general, and paddy cultivation in particular, have been seriously affected by water pollution in these villages. Vegetable and fruit crops have also been seriously affected by the pollution which is increasingly contributing to food insecurity in the area. For the fishing community the deteriorating water conditions have reduced production drastically, decimating their livelihoods. In addition, pollution poses serious health hazards to the human population living in the area. According to respondents, skin diseases, diarrhea, typhoid fever, and other diseases are spreading rapidly in the area.

The inhabitants of Mokosh Beel complain that although the economic and health impacts of pollution are significant, they are not being compensated by polluters. Respondents stated that they had approached local government bodies to solve their problem, but without success. Some participants in Kaliakoir mentioned that the chairman of the upazila once suggested that they refuse to offer a "No Objection Certificate", which is required in order to receive clearance for new development from the DoE. However, this strategy was unsuccessful, something that beel inhabitants perceive as being due to the financial and political strength of industrialists and their ability to influence decision makers. Moreover, respondents are not aware of governmental rules and regulations, which could be used to combat industrial pollution. They state that the enforcement activities of the DoE are not transparent. One respondent wondered aloud to me, if government officials visited companies that pollute, then how could they continue to pollute?

## Recommendations

In this paper I have documented the perceptions of local residents in Mokosh Beel. However, further study is needed to identify and quantify environmental degradation in the area. Some parts of Mokosh Beel are heavily polluted by untreated industrial effluents that have changed the color and quality of water. Though it's clear that this has had negative impacts on aquatic organisms, there has been little investigation

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into the effects of water contaminants on the health of the people who come in contact with the water, directly or indirectly, or on paddy production.

Proper land zoning and land-use planning are two major elements which can assist the sustainable development of land resources. Towards this end, the government of Bangladesh formulated a National Land-use Policy in 2001 to maximize the use of land resources in a sustainable manner. Rapid population growth, urbanization, industrial growth, and natural disasters have led to rapid changes in land-use patterns across the country. This growth over the last few decades has triggered unplanned use of land resources, along with environmental changes that negatively affect the quality of natural resources.

The devastating situation in Mokosh Beel and its surrounding area make it clear that research concerning the impacts of environmental changes on crop production, the quality of natural resources, and soil fertility among other things, is vital. Depending on the results of such research, conflicts over land use could be more amicably settled. A GIS based land zoning system is necessary for sustainable industrial development and to implement a proper Environmental Management System for the study area.

## Conclusion

The Government of Bangladesh declared Gazipur, including Bhawal National Park, a protected area in 1982. In recognition of the value of their natural resources, nineteen areas are to this day listed as protected areas for the purposes of preservation and conservation. In 2006 a government order was signed formally recognizing co-management structures at five protected forest areas around Bangladesh. In order to secure natural resource-based livelihoods while improving the socio-economic well-being of rural communities and protecting valuable natural resources, as well as the natural beauty of Bangladesh's wetlands and forests, a USAID funded IPAC project (2008-2013) is being implemented through the MoEF and the MoFL. The technical implementing agencies of the Government are the FD, the DoF and the DoE.

Extant data tells us that, up until now, numerous interventions have been undertaken to improve the environment and the quality of the life of residents in Mokosh Beel. However, there has been no coordination among these interventions in a way that would make them effective in curtailing industrial pollution and creating a healthy and sustainable beel. Industrialists are highly influential, both financially and politically, and so local people alone are not strong enough to revive the beel and protect common lands from the encroachment of industries. I argue that it is vital to implement participatory approaches that link local people with the government and its enforcing agencies in a co-management arrangement.

No rules or legislation concerning water exist in Bangladesh. According to the Environment Conservation Rules there are Environmental Quality Standards for water, and there exists a Coastal Zone Policy (created in 2005), which focuses on management issues related to coastal areas of the country. Though the Ministry of

Water Resources' Water Resource Planning Organization appears to be the managing authority of the study area, there is no legal authority for protecting the beels and khals of Gazipur, which are designated as protected areas of the Forest Department. Since the implementation of the MACH project by the Department of Fisheries and the Nishorgo project by the Forest Department, awareness of environmental pollution has increased, but local people are lagging behind in terms of actual solutions to problems of industrial pollution.

Having said this, the legal framework for protecting Mokosh Beel and other wetland areas is already in place in Bangladesh. The Environment Conservation Act, the Environment Conservation Rules, and the Environment Court Act have clearly defined the Environment Management System of different categories of industries. In addition, the DoE has developed Environmental Impact Assessment guidelines for the textile sector. No more new laws or regulations are necessary. What is needed is to strengthen the DoE's enforcement activities.

The DoE has a mandate to control industrial pollution. However, due to insufficient manpower, presently it is not possible for the DoE alone to control environmental pollution. Textile industries, which are discharging effluents by using bypass lines, are central players in perpetuating industrial pollution. Bypass lines used by textile companies make it very difficult to track sources of pollution through regular monitoring by the DoE. This situation calls for local participation in co-management activities to protect the environment and resources of Mokosh Beel. I argue that there is no alternative to co-management for protecting the study area.

The DoE is the sole governmental organization in Bangladesh tasked with environmental conservation. The prioritized mandate of the DoE is to control industrial pollution. Following the Environment Conservation Act and the Environment Conservation Rules, the DoE seeks to enforce prohibitions against polluters with limited manpower and only seven offices (the central office and six divisional offices). The current government recently acknowledged the importance of making the country pollution free, and the High Court ordered that effluent treatment plans be established for polluting industries by the end of February 2010. After this deadline industries that fail to establish such plans can be sued in court. The government has approved twenty one new district offices for the DoE and there will be a Gazipur district office very soon. According to the volume of pollution reported by respondents and from various reports, it is clear that the DoE cannot solve the pollution problem alone. Local people are willing to participate in co-management activities along with the government, NGOs, and other organizations to solve the problem. I argue that those living in Mokosh Beel need to be supported in their fight against environmental pollution.

Government revenues are not sufficient enough to make the DoE an effective enforcement agency over night. However, it is possible to work together with the IPAC project in a specific area to begin solving environmental problems in that area. A new morning will start with the Gazipur District office of the DoE, which will give the government a strong hand with which to work with local people of Mokeshe Beel

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and the IPAC project to revive the beel. There is hope in the near future.

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## References

- Akonda, A. W. 1989. Wetlands of Bangladesh. In Khan M.S.; Haq E.; Huq S.; Rahman A.A.
- Rashid S.M.A, and Ahmed H. 1994. Wetlands of Bangladesh. Bangladesh Centre for Advanced Studies in associated with Nature Conservation Movement. Dhanmondi, Dhaka, Bangladesh.
- BCAS (Bangladesh Center for Advanced Studies). 2009. Industrial Survey "Water Quality Management of the Turag River". BCAS, Demonstration Project on water quality Management in Upper Catchment of Turag River, 2009: Dhaka, Bangladesh.
- Dugan, PJ (ed.) 1990. 'Wetland Conservation: a Review of Current Issues and Required Action', IUCN, Gland, Switzerland. 96 pp.
- IWRB (International Waterfowl Research Bureau). 1992. Action Programme for the Conservation of Wetlands in South and West Asia. Northeast Regional Water Resources Development Project (FAP 6), 1992. Draft Thematic Study. Regional Water Resources Development Status, Flood Plan Coordination Organization, Government of Bangladesh, Dhaka.
- RAJUK 2004. Dhaka Metropolitan Development Plan. RAJUK: Dhaka, Bangladesh  
URL: [Accessed February 3rd, 2010]  
<http://www.rajukdhaka.gov.bd/planning/index.htm>.