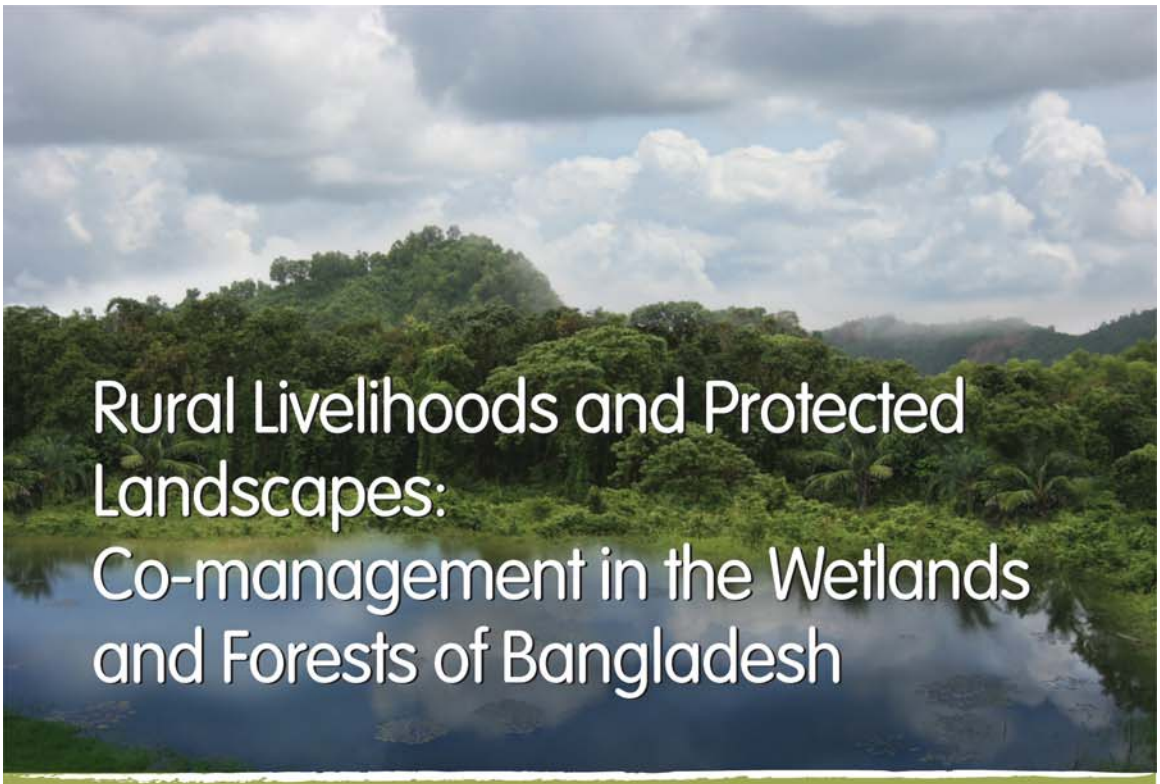

Rural Livelihoods and Protected Landscapes: Co-management in the Wetlands and Forests of Bangladesh

USAID
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Rural Livelihoods and Protected Landscapes: Co-management in the Wetlands and Forests of Bangladesh

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INTEGRATED PROTECTED AREA CO-MANAGEMENT IN BANGLADESH

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Introduction: Tailoring Collaborative Conservation in Bangladesh

Eric John Cunningham[1], Marla Chassels[2], Jefferson Fox[3], Md Golam Mustafa[4]

Common-Pool Resources And Collective Action

Despite a wealth of intellectual and practical engagement, natural resource conservation is an issue that remains unsettled for communities, governments, and non-governmental organizations (NGOs) the world over. While there are success stories from which to gain insights and inspiration (Acheson 2003, Lejano and Ingram 2007, McKean 1992), conflict and contention continue to mark many conservation projects (Pimbert and Pretty 1995). Causes of conflicts are numerous and varied, but are nearly always rooted in inappropriate fits among assemblages of user groups, institutions, and resources. The logic follows, therefore, that finding appropriate matches between management entities and stakeholders will ensure proper conservation. However, an increasing amount of research and practice have made it clear that generating successful conservation arrangements across differing socio-natural environments is exceedingly difficult. It is becoming evident that in order for natural resource management to be effective it must be tailor fit.

Ostrom (2008) cites a lack of fit between the characteristics of particular natural resources and management institutions to explain why resource conservation is so often laden with conflict and failure. Natural resources and the environments in which they are located vary both in quantity and quality, meaning that attempts to uniformly apply institutional arrangements of conservation and management tend to be unsuccessful. In other words, there is no such thing as a single "magic bullet" when it comes to using and caring for natural resources. The challenge of common-pool resources, in Ostrom's opinion, lies in designing institutions at multiple levels that are appropriate at various scales to the types of resource involved. She suggests a series of requirements for achieving this, including: relevant and accurate information gathering; conflict resolution mechanisms; enforcement of rules; suitable infrastructure; and the ability to adapt to changes. While these proposed requirements offer a foundation from which to think about institutional arrangements of resource conservation, they offer few insights into the broader socio-cultural contexts in which both institutions and resources are enmeshed.

Agrawal (2001, 2003) too has addressed at length the need to examine why institutional arrangements are so often unsuccessful in the task of managing and conserving resources. He contends that through localized studies researchers have identified an overabundance of factors that may contribute to effective governance

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and conservation. This, he argues, draws us away from effective analysis of the issue.

Along with a shift towards comparative studies, Agrawal prescribes research that is more attentive to historical processes of subject formation and positionality in relation to resource management and conservation, rather than research focused exclusively on the mechanics of governance. Resources, resource users, and institutions of conservation exist in webs of power and meaning woven through the historical movements and ideas of social actors. No matter the level of fit between natural resources and institutions they are bound to fail lest we recognize the broader social meanings they embody and produce. At the same time, we should also bear in mind that subjective formations always take place in and in reference to the biophysical world of cause and effect relationships (Agrawal and Chhatre 2006).

As these and other scholars have noted, conflicts surrounding natural resource management and conservation have something to do with tensions among stakeholders who have some investment in resources; institutions and organizations; and resources themselves, as well as the environments they are located in. Increasingly, collaboration has been laid as the keystone for conservation projects in an attempt to deal with conflicts between stakeholders. Collaboration occurs (or does not occur) at a variety of scales and through a variety of mechanisms involving often vast assemblages of actors, organizations, and institutions. Therefore, at the same time that collaboration eases some tensions it creates new ones. Thus, we must recognize natural resource conservation as fundamentally social in nature.

Protected Areas

Protected areas have fomented post-WWII as a globalized institutional framework for conservation. The number of protected areas began to increase rapidly around 1970, peaking between 1985 and 1995. Currently there are an estimated 105,000 protected areas worldwide covering approximately eleven percent of the Earth's terrestrial land (West, Igoe, and Brockington 2006). In name, protected areas are intended to be areas ascribed a protection status through which the environment can be conserved. However, anthropologists such as West (2006) also remind us that protected areas are not only sites of environmental conservation, but also sites of social practice. They are constructed spaces nested within existing forms and patterns of social activity.

Given the social nature of protected areas it is not surprising that they are often the source of conflict. Individuals and communities located in or near protected areas often depend on local resources for their livelihoods (Bahuguna 2000). Thus, though conflicts vary greatly in quality, they usually occur when the needs of individuals and communities living in or near protected areas do not correlate with the needs of conservation as defined by management entities (Badola 1998, Brosius, Tsing, and Zerner 2005). An increasingly prevalent answer to protected area related conflicts is governmental decentralization and the creation of community-based conservation (CBC) programs with the goal of involving local community members as active stakeholders in conservation.

In addition to local residents and governmental entities and agents, international governmental and/or non-governmental agencies also frequently participate in CBC programs. CBC arrangements are therefore complex and involve a wide variety of stakeholders and institutions operating at various scales, often with differing goals and techniques. Accordingly, collaboration in CBC programs is highly political, with power distributed unevenly among entities and agents. This does not mean that successful CBC arrangements are unattainable, but that attention to unequal relations of power is fundamental. Agrawal and Gupta (2005), for example, provide evidence from Nepal to illustrate how "collaboration" has the potential to recreate existing relations of power, allowing some in the local community to monopolize access to resources (both natural and economic) through their social and physical proximity to conservation entities. Adhikari *et al* (2004), also in Nepal, show similar inequalities related to access to forest resources based on socio-economic variables.

In a similar vein, Balint (2006) makes a convincing argument that failures in CBC often stem from a lack of recognition of community development needs. He states that in the case of protected areas the focus of government, non-government, and other actors is on environmental needs and variables, rather than those related to local communities. He prescribes a re-focusing of conservation efforts on variables that have been identified as being important in international development studies-human rights, community capacities, ability to govern, and sources of revenue. In conservation schemes it is essential, in other words, to ensure the healthy development of human communities in order to develop healthy resources. Based on a global survey of changes in the governance of protected areas Dearden *et al* (2005) report that the majority of respondents felt that protected area governance had improved over the decade since 1992. Meanwhile, Naughton-Treves *et al* (2005) argue that globally while protected area status has worked to conserve biodiversity in protected areas themselves, deforestation has increased in adjacent areas, which suggests that the livelihood concerns of local residents are not being appropriately addressed.

Protected areas and the resources located within are thought of and conceptualized in different ways, which influences how they are cared for. In the United States, for instance, different ideas of conservation and management, debated since the time of John Muir and Gifford Pinchot (Meyer 1997), have resulted in different types of protected areas and conservation regimes. For example, while national parks and national forests in the U.S. are both seen as entities for managing resources, the former are intended to conserve natural beauty and the later are intended to regulate wise use of resources. Recognition of "success" or "failure" in terms of resource management, therefore, depends largely on what the expected outcomes are in relation to specific resources, as well as on whose expectations take precedence.

Conceptions of Unlike Environments and Natural Resources

In Bangladesh institutional arrangements for conserving and managing natural resources differ in form depending on the way those resources and the environments in which they are located are conceptualized. In turn, governing arrangements for conservation have evolved distinctly in each of these environment types. Though it is beyond the scope of this introduction to explore in detail, it is reasonable to assume that ideas about the nature of resources are linked to broader global discourses and apparatuses of conservation (i.e. international governmental and non-governmental organizations). Papers in this volume focus on two environment types and their associated natural resources: wetlands and forests. Defining the ways that forest and wetland are differentially conceptualized as resources in Bangladesh adds an important perspective for understanding issues related to local human communities in those areas.

Wetlands

Wetland environments and the resources therein resist definition as static entities; they are fluid in a literal sense and as such persistently flout boundaries placed on them. The dynamic nature of wetlands is particularly evident in Bangladesh where flows of water from seasonal rains constantly redefine the size and hydrology of large wetland areas comprised of *haors, beels,* and other depressions that are linked through networks of streams and canals. The "illegibility" of wetland areas is also due to the qualities of their resources, namely fish. Fish are mobile and for the most part unseen until harvested. Therefore, even with refined scientific methods and sophisticated technologies, estimating movements and sizes of fish stocks is a risky proposition (Acheson 2006). In addition to fish, other wetland resources in Bangladesh, such as plant and tree leaves and stems, are difficult to quantify and keep account of in terms of the ecosystem as a whole.

The indefinable and unknowable characteristics of wetlands and wetland resources influence the ways in which they are managed. In Bangladesh wetlands tend to be perceived of as being open, which means that the harvesting of resources should be regulated. Therefore, rather than focusing on the conservation of wetland environments as a whole, both traditional and contemporary institutions have often developed around the regulation of access to and use of resources. For example, in this volume both Sarker and Haque examine economic systems of moneylending that have evolved in relation to, and in large part control, the exploitation of fish resources in wetland areas. This is not to say that the traditional economic system is the only institution of governance of wetlands, but it has co-evolved with these environments to the extent that it has developed regulative functions that exist alongside, or at times in place of, governmental institutions. Put differently, wetland areas in Bangladesh tend to be thought of as environments that contain resources which ought to be regulated. This is in contrast to forest areas that are themselves often conceived of as resources to be bounded, locked up, and conserved.

Forests

It is arguable that of all the natural resources the earth bestows, forest resources are the most visible to us as human actors. Forests are comprised of trees that stand in groups up and apart from other elements in an environment, according them a visual quality of boundedness. Given this characteristic, forests have throughout history been made "legible" and claimed by elites through cartographic techniques of state-making (Scott 1998, Vandergeest and Peluso 1995); more recently, local peoples employing similar techniques have also mapped forests (Fox 2002, Peluso 1995). Through processes of mapping, forests around the world have come to be conceptualized by governmental officials and organizations as resources in and of themselves. In turn, changes in the quality of forest resources are defined by changes in quantity-forest loss and gain-with less attention paid to more inconspicuous resources that lay beneath forest canopies. However, it are these less visible resources-various non-timber forest products (NTFPs)-that local people living in or near forests regularly rely on to support their livelihoods. For these people the forest itself is not perceived as a bounded resource, but rather as a bounty of resources that are located throughout a forested area.

One way to think about conflicts over forests in Bangladesh between Forest Department officials and local communities is as conceptual misunderstandings. Operating under conceptions of forests as standing resources the logical approach to conservation and management for the FD has been to simply "lock up" forests. This approach, however, has proven problematic because implicit within it are over-simplifications of complex and diverse forest resources; ignorance of the porous qualities of forest boundaries; and denials of the role that forests and their resources play in the lives of local people. As a result, the activities of local actors within reserved forests come to be labeled by government officials as "intrusions" or "encroachments" (Muhammed *et al.* 2008, Mukul *et al.* 2008). On the other hand, forest-dependent people perceive limits on access to forests and the resources found there as being equivalent to limits on their ability to make a living. Due to this lack of conceptual fit, common solutions to conflicts around forest protected areas can be generally categorized as either removing local people or getting them to cooperate. However, local people's dependence on forest resources coupled with poverty and a lack of alternative livelihood options continue to thwart efforts by NGOs and the Bangladeshi government to create sustainable co-management arrangements for forest protected areas.

Markets and Resources

The presence of markets also significantly influences the ways in which natural resources are used, managed, and/or conserved. By changing values associated with particular resources, markets can modify relations of power and threaten the operations of local governing institutions. As with styles of management, the impacts that markets and commoditization have on patterns of resource use have much to do with the characteristics of the resource itself.

Wetland fish resources in Bangladesh are readily accessible, easily transportable, and quickly regenerate. In a governmental sense, wetlands are generally considered open, with rights of usufruct leased to private citizens (Ahmed, Capistrano, and Hossain 1992, Thompson, Sultana, and Islam 2003). Therefore, markets for fish in Bangladesh have evolved in a relatively localized manner around separate wetland areas, with many local residents involved in fishing as an occupation. However, the local nature of markets has not prevented the development of inequalities between local fishers on the one hand and moneylenders, buyers, and wholesalers on the other. In this volume both Sarker and Haque note the extreme poverty of fisher households and their reliance on unequal systems of moneylending and marketing to meet livelihood needs. Poverty and inequality have implications for the health of wetland areas because these are conditions that create vulnerable situations for local residents, which often lead to exploitative activities that may compromise management goals.

In the case of forests, timber markets tend to move forest management into the domains of governments and/or powerful elites who have (or at least purport to have) access to capital, technologies, and personnel for dealing with the time scales and transportation costs associated with the cultivation of trees (Rangan 1997, Ribot, Agrawal, and Larson 2006). In Bangladesh as elsewhere, groups that depend on forests, and are more often than not poor and socially marginalized, are said to lack the capacity to engage in timber markets. Forest-dependent peoples tend to engage in subsistence activities, either modifying the forest to plant crops (*jhum*) or collecting NTFPs. Though some NTFPs and cultivated products may be sold, markets for these items tend to be small. Forest-dependent groups are often perceived as threats or nuisances to conservation and management goals because of their subsistence activities in forests. Therefore, as noted in several papers in this volume, providing economic alternatives that forest-dependent groups are capable of participating in has become a key feature of forest conservation arrangements in Bangladesh.

Market values of resources have much to do with both resource characteristics and perceptions of resources. Markets influence power relationships and dictate in part the ways that different resources are governed and the roles that local community members play in governance. In Bangladesh the high value of forest resources (whether related to timber markets or conservation) has led to largely top-down management approaches where the goal is to wean local residents off of forest resources through the introduction of AIG activities. In contrast, the status of fish and other wetland products as resources, and of residents as resource users, has resulted in approaches to wetland management that are framed in terms of sustainable use of resources through regulations and improved markets.

Resource Management in Bangladesh

In Bangladesh protected areas account for only about 243 thousand hectares (2,420 square kilometers), or roughly 1.7 percent, of the country's total land area (Mukul *et al*. 2008). The country, however, is the world's seventh most populous, with approximately 160 million people, and one if its most densely populated with 1,142

people per square kilometer (United Nations Population Division 2008). These geographic and demographic realities have several implications for resource conservation and management in Bangladesh. First, bounded protected areas without human presence do not exist in any real sense. Instead, most protected areas have porous boundaries (physical, social, and legal), which humans move across in various manners. Second, the number of stakeholders in relation to sets of natural resources, whether protected or not, is likely to be high. Furthermore, stakeholders operate at a variety of social levels and spatial scales in relation to resources. Given these realities, consideration of human communities is an inseparable part of natural resource conservation and management in Bangladesh.

Wetlands management

Bangladesh is a nation of wetlands. Floodplains comprise the majority of the country, with most being inundated on a seasonal basis between June and October with the coming of monsoonal rains and heavy flows from Himalayan snowmelt. Wetlands are rich in aquatic resources, particularly fish, which accounts for eighty percent of the animal protein consumed in the country. Estimates for annual fish yields range from 750,000 to 1,500,000 tons, 97 percent of which is consumed domestically (Craig *et al*. 2004). In addition to these pressures on fish resources, wetland environments in Bangladesh are threatened by the competing needs of agriculture and industry; wetlands continue to be converted for these purposes through hydrological engineering projects (see Akter, this volume).

Present-day management and conservation of wetlands in Bangladesh has been shaped by a history of elite control and overexploitation of aquatic resources. Due to their wealth of fish resources, wetlands have for a long time been managed, for all intents and purposes, as private property through the leasing of fishing rights to the wealthy (Ahmed, Capistrano, and Hossain 1992). Thus this approach has proven costly not only in environmental terms, but also human terms. The capture of fishing rights by elites has created in Bangladesh a system by which middlemen and moneylenders benefit from the labor of poor fishers by securing access to both fish resources and fish markets (Deb 2008, Hossain *et al*. 2006, Sultana and Thompson 2007).

The consequences of past wetland (mis)management in Bangladesh for the socio-natural environment are difficult to fully ascertain. However, there is a general consensus of overall decline in fish stocks (Ahmed, Capistrano, and Hossain 1992, Craig *et al*. 2004, Murshed-e-Jahan, Salayo, and Kanagaratnam 2009, Thompson, Sultana, and Islam 2003). Drawing on FAO data from 2002, Hossain *et al* (2006) suggest that of 260 inland fish species found in Bangladesh 54 face varying categories of threat from critically endangered to vulnerable. Also, as a result of elite control over fish resources and markets many local fishers in Bangladesh continue to live at levels of extreme poverty (see Haque; Sarker; and Bishwajit, this volume).

In 1998 the Management of Aquatic Ecosystems through Community Husbandry (MACH) project was launched in Bangladesh as a response to these socio-natural environmental concerns. The project, which was designed and implemented by the

Bangladeshi government with the support of USAID, included activities focusing on community-based participatory approaches to wetland management. Through the MACH project CBC was accomplished by securing access rights to several key inland fisheries across Bangladesh and enlisting the help of local fishers and others to design and implement conservation schemes. The project continued until 2005 and during that time officials worked with partners to secure dry season water; establish sanctuaries; reduce fishing pressure by exploring AIG activities; promote policy-level coordination; link resource users; and improve local wetland habitats (USAID 2007). However, now that the MACH project has concluded, there are questions as to what will happen to the community controlled leases that were part of the project.

Forests management

Forests comprise about 2.53 million hectares of Bangladesh's land area, or approximately 17.5% of the country. The existence of large tracts of reserved forest, controlled by the ruling glass or the government, is a phenomenon that stretches back to ancient times (Millat-e-Mustafa 2002). Presently, the government of Bangladesh directly controls over half (about 1.53 million hectares) of the nation's total forested area (Muhammed *et al*. 2008). Both prior to and after Bangladesh became independent in 1971 forest policies were formulated that tended to be utilitarian in scope, with little thought to the livelihood needs of local communities. This began to change in 1994 when the government of Bangladesh, with assistance from the Asian Development Bank and the United Nations Development Program, presented the twenty year Forestry Master Plan which contained explicit provisions for participatory forestry (Millat-e-Mustafa 2002). In the ensuing years participatory forestry existed in Bangladesh in name, though not always in practice. As is true in other locations around the world (Few 2001, Jim and Xu 2002, Johnson and Forsyth 2002), Fox (2007) points out that, "Many past efforts to incorporate local people into the management of protected areas proceeded on the basis of simple and incorrect assumptions about the nature of the dependence of poor local people on natural resources systems."

Building off the MACH model, in 2004 the Bangladesh Forest Department created a new protected areas management program, known as "Nishorgo." Financial assistance for this program also comes from USAID via the Nishorgo Support Project. The goals of the Nishorgo program were to improve conservation and management of protected areas by building cooperative partnerships between the Forest Department and stakeholders at local, regional, and national levels (Nishorgo 2010). The focus of much of the activities of the Nishorgo program were development of alternative income generating activities among resource users who live in or near forest protected areas in order to reduce pressure on forest resources, namely non-timber forest products (NTFPs).

Integrated protected area co-management

Currently, management of protect areas in Bangladesh, both wetland and forest, is being carried out under the Integrated Protected Area Co-management (IPAC)

program. IPAC began in 2008 with support from a variety of international organizations, including USAID, East-West Center, WorldFish Center, and World Wildlife Fund-U.S. The program's goal is to scale-up natural resource co-management at both the policy and operational levels. Components of the program have been designed to meet the needs of co-management arrangements at national, regional, and local levels; these include policy development, institutional capacity building, and support for site-specific implementation. The IPAC program is a continuation of the CBC programs that were developed under MACH and Nishorgo and operates under the Government of Bangladesh's Nishorgo Network, which is a national network of protected areas.

Papers in this volume are based on research funded as part of the Nishorgo Network's IPAC program with the hope of overcoming the "simple and incorrect assumptions" that have hindered past attempts at CBC. Research funds were allotted to government officers from various departments, as well as to one graduate student, to support site-specific research pertaining to issues of CBC. It is expected that the research findings reported in this book will illuminate new directions for policy and implementation strategies for creating arrangements that meet the goals conservation while not hindering the livelihoods of local community members. Spending time to investigate the realities of local resource users in both wetland and forest environments will help in tailoring conservation programs to the site-specific variables of socio-natural environments.

Overview of Papers in this Volume

Collaborative management in wetland environments

Unlike forests, wetland areas in Bangladesh are not governmentally recognized as protected areas, meaning that the involvement of government agencies is comparatively limited. Rather, collaborative management arrangements in wetland areas tend to be more localized and involve resource users, NGOs, and market actors such as moneylenders, wholesalers, and industry owners. Due to this multiplicity of stakeholders, the challenge in developing collaborative management arrangements for wetland areas is dealing effectively with the economic and social inequalities that are implicit in relations between various actors.

In her paper focusing on co-management projects in Alua Beel, **Masud Ara Momi** argues the need for participation of resource users in all facets of management. While pointing out that co-management projects have been successful in bringing economic benefits to poor resource users in Alua Beel, she suggests that these are limited due to the low number of fishers who participate in decision-making. It is non-fishers in conjunction with government officials, points out Momi, who make decisions regarding the management of Alua Beel. Fishers, for the most part, participate only in implementation phases through technical activities. In other words, management of the beel is top-down, rather than collaborative. Momi suggests that the IPAC project currently being implemented should work to increase information sharing among stakeholders and to empower fishers to participate in decision-making regarding management.

Through an analysis of the existing fish-market chains in the Sherpur District of north-central Bangladesh, **Md. Aminul Haque** argues that poor fishers are often exploited by middlemen due to their isolation and a lack of adequate transportation and communication infrastructure. Furthermore, he points out that inequalities and exploitation are amplified through the process of high-value fish traveling through the market chain because of their popularity among consumers who are geographically farther away. Citing a nearly exclusive control of fish-market chains by the private sector, Haque suggests greater government intervention on the behalf of poor fishers.

Khalekuzzaman Sarker looks at the livelihood strategies of fishers and shrimp farmers in the mangrove forest wetlands of the Sundarbans. His findings suggest that fishing is the primary occupation for many households in the area, but that it appears to be insufficient to support these households. Poor health and sanitation, lack of adequate drinking water, exploitation by moneylenders, and vulnerability to natural disasters are among the problems that Sarker identifies among fisher households in the Sundarbans. He concludes that the livelihoods of fishers will only improve with a focus on practical issues and notes, as Haque does, systems of moneylending as a major hindrance to bettering the welfare of fisher households.

In his paper on the livelihood status of fishers in Baikka Beel, **Bishwajit Kumar Dev** focuses on differences between fishers who are participants in the MACH program and those who are not. He finds that according to indicators such as type of housing, level of education, occupational variability, and dependency of household members fishers who participate in the MACH program are much better off than those who do not. Bishwajit argues that the livelihood conditions of local resource users are linked to biodiversity conservation and natural resource management in Baikka Beel. He suggests, therefore, that the Bangladeshi government, NGOs, and local government officials should support institutional development related to community co-management of natural resources.

Afrin Akter shows how participatory programs can end up missing the mark in her paper examining people's perceptions of environmental pollution in Mokosh Beel. She suggests that though local community members are happy with ongoing projects that have, among other things, helped empower women, they wish for additional interventions to address pollution. Afrin shows how the delegation of various regulatory functions among government agencies (in this case the Department of Environment) can undermine the health of socio-natural environments through a process of de-localization and a moving away from participatory approaches. She concludes that co-management arrangements are a viable option for addressing pollution concerns in Mokosh Beel.

Collaborative management in forest environments

People who live in or near forests use forest resources for a variety of purposes. Plants are used for food and medicine; animals are hunted for consumption or sale; and wood materials are used for fire and building. However, incursions into forests

and the use of forest resources by local people are taboo activities within broader governmental frameworks in which forests are envisioned as resources to be protected. In Bangladesh this has created conflict between Forest Department officials, whose task it is to enact policies meant to protect forests, and local people who see the resources they obtain from the forest as vital to their livelihoods.

Fatima Tuz Zohora's paper in which she examines the livelihoods of wood and honey harvesters in the mangrove forests of the Sundarbuns is an exception to the model of forest governance that we have laid out in this introduction. Zohora notes that in the Sundarbans the government's strategy for conservation and management is focused on regulating the harvesting of NTFPs by local people. This strategic difference is perhaps due in part to the inability of the Forest Department to effectively monitor the wetland forest environments that dominate the Sundarbuns; or perhaps it is due to the presence of traditional markets that have evolved around the exploitation of NTFPs (wood and honey in particular).

Whatever the reasons for this strategic difference may be, Zohora examines the livelihoods of resource harvesters in the context of governmental regulations. She argues that because of regulatory frameworks that make harvesting a tenuous livelihood strategy harvesters are forced to rely on systems of moneylending that put them at an economic disadvantage. Regulations on and limited access to forest resources, Zohora concludes, puts harvesters in vulnerable positions and often drive them to break rules in order to meet their livelihood needs. She suggests that the government and NGOs should take the initiative to insure the safety and livelihood security of harvesters in order to prevent rule-breaking that could lead to unsustainable harvesting practices.

Md. Abdur Rahman suggests that a paradigm shift in thinking about the management of protected areas has compelled the Bangladeshi government to develop new approaches to protected area management that integrate the livelihoods of forest dependent people with conservation objectives. In his paper he examines efforts to provide livelihood options to the Tanchangya people who have traditionally practiced *jhum* agriculture and collected various products in the forests that comprise the present-day Teknaf Game Reserve.

Rahman first discusses conflicts that have arisen between Forest Department officials and Tanchangya people over the latter's continued illegal use of reserve forests, particularly their practice of *jhum*. He goes on to argue that because of their dependence on forest resources to provide daily necessities such as food and medicine the Tanchangya too are acutely aware of and concerned about forest degradation issues. However, he insists that the Tanchangya are forced to encroach onto reserved forestlands to maintain their livelihoods in the face of inadequate food security, a lack of formal land rights, high risks of infectious diseases, and a lack of social support. Moreover, Rahman points out that historically the Tanchangya people have contributed little to forest degradation because of their small numbers (less than 4,000 individuals).

Rahman concludes that though the Tanchangya are ideal candidates for conservation partnerships under the IPAC project, their livelihood needs must be addressed if co-management is to be successful. He suggests several steps needed in order to achieve the twin goals of conservation and livelihood improvement; among these are guarantees of rights of usufruct for Tanchangya people, official recognition as forest dwellers, and beneficiary member status within a Forest Department administered Participatory Benefit Sharing Agreement. Lastly, Rahman emphasizes the need for educational opportunities for Tanchangya peoples.

Md. Zahidur Rahman Miah examines the livelihood patterns of residents of villages located in or near Kaptai National Park. He notes that many residents continue to rely on swidden agriculture (*jhum*) for subsistence, something that Forest Department officials have in the past attempted to integrate into the creation of agar (*Aquilaria agallocha*) plantations. However, as plantation forestry has diminished as a management strategy in favor of conservation swidden activities are more and more perceived by Forest Department officials as having negative impacts. Therefore, as Zahidur points out, the focus of the Forest Department, in conjunction with the Integrated Protected Area and Co-management (IPAC) project, is now on generating Alternative Income Generation (AIG) activities that can relieve the pressure put on forest resources by local users. Zahidur argues that local community members are eager to engage in AIG activities such as fish cultivation, eco-tourism, creating fruit orchards, and mushroom cultivation.

In her paper exploring the short-comings of past social forestry projects **Rokeya Begum** notes that forest-dependant people in and near Madhupur National Park have become suspicious of such projects. In particular, she examines the failures of plantation forestry projects to provide community benefits sufficient enough to curtail forest use practices seen as being destructive. By pointing out how in the past participation in and the receiving of benefits from plantation forestry projects tended to follow localized lines of power, Rokeya reveals how well-intentioned projects can have unintended consequences due to insufficient understanding of local socio-political conditions. She concludes that greater understanding of the livelihood needs of residents in and near Madhupur National Park is needed to ensure success for future co-management endeavors.

Even with appropriate implementation, projects that offer alternative income generating (AIG) activities with the goal of easing forest-use by local may lack the scope to produce a positive impact on forest conditions. **Mahmudah Roksena Sultana** explores this dilemma through a comparison of forest user group (FUG) members and non-members among village residents near Satchari National Park. She found that compared to non-members a significantly smaller percent of FUG members were involved in forestry related activities (49% and 5% respectively) and that this correlated to overall higher incomes for FUG members. In addition, she suggests that involvement in FUG activities has helped raise awareness among members of forest-related issues and the need for conservation. However, Mahmudah points out that only 508 of 17,836 households in her study area belong to

FUGs and argues that this is not sufficient to meet conservation goals. She recommends efforts to expand involvement in FUG initiatives and increases in the financial benefits of AIG activities to ensure greater participation.

In her paper focusing on perceptions of climate change among tribal groups living in Kaptai National Park, Suriya Ferdous reminds us that recognizing vulnerabilities and adaptations to environmental change among local people is another key to designing well-tailored collaborative management arrangements. She notes that there exists among local tribal groups a large body of environmental knowledge that allows people to perceive changes and develop responses. Giving sufficient attention to the perceptions of local tribal groups, argues Suriya, will help policymakers and others in creating novel forms of governance that strengthen livelihoods while meeting the new challenges of climate change.

References

Acheson, J. M. 2003. *Capturing the commons : devising institutions to manage the Maine lobster industry.* Hanover, NH ; London: University Press of New England.

Acheson, J. M. 2006. Institutional Failure in Resource Management. *Annual Review of Anthropology* 35:117-134.

Adhikari, B., S. Di Falco, and J. C. Lovett. 2004. Household characteristics and forest dependency: evidence from common property forest management in Nepal. *Ecological Economics* 48:245.

Agrawal, A. 2001. Common property institutions and sustainable governance of resources. *World Development* 29:1649-1672.

Agrawal, A. 2003. SUSTAINABLE GOVERNANCE OF COMMON-POOL RESOURCES: Context, Methods, and Politics. *Annual Review of Anthropology* 32:243-262.

Agrawal, A., and A. Chhatre. 2006. Explaining success on the commons: Community forest governance in the Indian Himalaya. *World Development* 34:149-166.

Agrawal, A., and K. Gupta. 2005. Decentralization and Participation: The Governance of Common Pool Resources in Nepal's Terai. *World Development* 33:1101-1114.

Ahmed, M., D. Capistrano, and M. Hossain. 1992. Redirecting benefits to genuine fisheries: Bangladesh's new fisheries management policy. *Naga, the ICLARM Quarterly* 15:31-34.

Badola, R. 1998. *Local People Amidst the Changing Conservation Ethos: Relationships Between People and Protected Areas in India.* RECOFTC.

Bahuguna, V. K. 2000. Forests in the economy of the rural poor: An estimation of the dependency level. *Ambio* 29:126-129.

Balint, P. 2006. Improving Community-Based Conservation Near Protected Areas: The Importance of Development Variables. *Environmental Management* 38:137-148.

Brosius, J. P., A. L. Tsing, and C. Zerner. Editors. 2005. Communities and Conservation: Histories and Politics of *Community-Based Natural Resource Management.* Walnut Creek, CA: AltaMira Press.

Craig, J. F., A. S. Halls, J. J. F. Barr, and C. W. Bean. 2004. The Bangladesh floodplain fisheries. *Fisheries Research* 66:271-286.

Dearden, P., M. Bennett, and J. Johnston. 2005. Trends in Global Protected Area Governance,1992–2002. *Environmental Management* 36:89-100.

Deb, A. K. 2008. "'The Slaves of Water': Socio-cultural Construction of the Community-based Coastal Resource Management in the South-eastern Bangladesh," in *"Governing Shared Resources: Connecting Local Experience to Global Challenges," 12th Biennial Conference of the International Association for the Study of Commons.* Cheltenham, England.

Few, R. 2001. Containment and counter-containment: planner/community relations in conservation planning. *Geographical Journal* 167:111-124.

Fox, J. 2002. Siam Mapped and Mapping in Cambodia: Boundaries, Sovereignty,and Indigenous Conceptions of Space. *Society & Natural Resources* 15:65-78.

Fox, J. 2007. "Introduction: Linking Rural Livelihoods and Protected Areas in Bangladesh," *in Making Conservation Work: Linking Rural Livelihoods and Protected Area Management in Bangladesh.* Edited by J. Fox, B. R. Bushley, S. Dutt, and S. A. Quazi. Honolulu: East-West Center.

Hossain, M. M., M. A. Islam, S. Ridgway, and T. Matsuishi. 2006. Management of inland open water fisheries resources of Bangladesh: Issues and options. *Fisheries Research* 77:275-284.

Jim, C. Y., and S. S. W. Xu. 2002. Stifled stakeholders and subdued participation: Interpreting local responses toward Shimentai Nature Reserve in South China. *Environmental Management* 30:327-341.

Johnson, C., and T. Forsyth. 2002. In the eyes of the state: Negotiating a "rights-based approach" to forest conservation in Thailand. *World Development* 30:1591-1605.

Lejano, R. P., and H. Ingram. 2007. Place-Based Conservation: Lessons from the Turtle Islands. *Environment* 49:18-27.

McKean, M. A. 1992. Success on the Commons. *Journal of Theoretical Politics* 4:247-281.

Meyer, J. M. 1997. Gifford Pinchot, John Muir, and the Boundaries of Politics in American Thought. *Polity* 30:267-284.

Millat-e-Mustafa, M. 2002. A Review of Forest Policy Trends in Bangladesh: Bangladesh Forest Policy Trends. *Policy Trend Report*:114-121.

Muhammed, N., M. Koike, F. Haque, and M. D. Miah. 2008. Quantitative assessment of people-oriented forestry in Bangladesh: A case study in the Tangail forest division. *Journal of Environmental Management* 88:83-92.

Mukul, S. A., M. B. Uddin, M. S. Uddin, M. A. S. A. Khan, and B. Marzan. 2008. Protected Areas of Bangladesh: Current Status and Eficacy for Biodiversity Conservation. *Proceedings of the Pakistan Academy of Sciences* 45:59-68.

Murshed-e-Jahan, K., N. D. Salayo, and U. Kanagaratnam. 2009. Managing fisheries conflicts through communication planning: Experience from inland fisheries of Bangladesh. *Fisheries Research* 99:112-122.

Naughton-Treves, L., M. B. Holland, and K. Brandon. 2005. The role of protected areas in conserving biodiversity and sustaining local livelihoods. *Annual Review of Environment & Resources* 30:219-C-1.

Nishorgo. 2010. "Nishorgo," vol. 2010: Forest Department, Ministry of Environment & Forests, Government of Bangladesh.

Ostrom, E. 2008. The Challenge of Common-Pool Resources. *Environment* 50:8-21.

Peluso, N. L. 1995. Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. *Antipode* 27:383-406.

Pimbert, M. P., and J. N. Pretty. 1995. *Parks, People and Professionals: Putting 'Participation' into Protected Area Management. Discussion Paper No. 57*. I. I. f. E. a. D. UN Research Institute for Social Development, WWF.

Rangan, H. 1997. Property vs. Control: The State and Forest Management in the Indian Himalaya. *Development and Change* 28:71-94.

Ribot, J. C., A. Agrawal, and A. M. Larson. 2006. Recentralizing While Decentralizing: How National Governments Reappropriate Forest Resources. *World Development* 34:1864-1886.

Scott, J. C. 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed.* New Haven: Yale University Press.

Sultana, P., & Thompson, P. 2007. Community Based Fisheries Management and Fisher Livelihoods: Bangladesh Case Studies. *Human Ecology* 35:527-546.

Thompson, P. M., P. Sultana, and N. Islam. 2003. Lessons from community based management of floodplain fisheries in Bangladesh. *Journal of Environmental Management* 69:307-321.

United Nations Population Division. 2008. *World Population Prospects*: The 2008 Revision. United Nations.

USAID. 2007. "Management of Aquatic Ecosystems through Community Husbandry (MACH) in Bangladesh," vol. 2010. USAID.

Vandergeest, P., and N. L. Peluso. 1995. Territorialization and State Power in Thailand. *Theory and Society* 24:385-426.

West, P. 2006. An Anthropological Perspective on Some Unexpected Consequences of Protected Areas. *Conservation Biology* 20:609-616.

West, P., J. Igoe, and D. Brockington. 2006. Parks and Peoples: The Social Impact of Protected Areas. *Annual Review of Anthropology* 35:251-277.

Socio-economic Benefits of Co-management for Resource User Groups in Alua Beel

Masud Ara Momi[1]

Abstract

Fisheries co-management is a new tool for the sustainable management of inland fisheries. Through this approach, water bodies are operated and managed by local communities. This paper discusses the responsibilities, duties, and benefits of wetland users involved in the co-management of Alua Beel in Dhaka Division, Bangladesh. Data collection was carried out through focus group discussions and semi-structured interviews. Results indicate that most respondents were aware of fish production increases and alternative income generating activities, but that very few respondents knew about environmental protection. Results also reveal that many co-management action plans have been decided upon and created by local elite and then imposed upon fishers who only directly participate in their implementation. Thus, fishers are not involved in co-management decision-making activities. I identify approximately twenty different types of benefits (both direct and indirect) derived from co-management in Alua Beel that help to improve the livelihoods of poor fishers. Respondents in this study wish for Alua Beel to continue being co-managed with support (both technical and financial) from the government. I argue that sustainable management is dependent upon full participation of all members in all phases of management.

Introduction

Borrini-Feyerabend *et al* (2004) define co-management as "a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements, and responsibilities for a given territory, area or set of natural resources." As a paradigm that seeks to conserve natural resources while enhancing local livelihoods, there are many aspects that need to be considered when addressing co-management. In the past two decades community-based management has become a common strategy for improving the management of natural and common pool resources and empowering local communities by using local knowledge, recognizing local institutions, and establishing common property regimes (Berkes and Folke 1998, Ostrom 1990, Pomeroy and Berkes 1997, DoF 2006).

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In the fisheries context, co-management is defined as a management arrangement whereby government and user groups share responsibility for managing and utilizing fishery resources with the goal of achieving a balance between economic and social goals, and within a framework of preserving ecosystem and fishery resources (Nielsen 1996). Open water is an important common pool or common property resource where anyone potentially can harvest fish and other fisheries products. Accordingly, successful co-management of water bodies can provide food and livelihood security for fishermen as well as other resource users (Sultana and Thompson 2004). Community-based fisheries management is a new tool for the sustainable management of inland fisheries resources. Through this proposed approach, water bodies are operated and managed by local communities to ensure equal rights and sustainable use of resources. However, the success of this management approach depends on the motivation and active participation of community members (Thompson and Colavito 2007).

Bangladesh is blessed with huge inland open water resources that vary widely in character. The country is home to numerous rivers, canals, *haors* (big depressions or low-lying floodplain areas that are inundated during the monsoon season creating vast sheets of water), *beels* (deeper depressions where water remains throughout the year), lakes and also vast floodplains. In addition, Bangladesh is one of the richest countries in the world in terms of fisheries and is blessed with diverse fauna. However, natural fishery resources in the country have been gradually declining due to natural degradation (e.g. siltation, loss of natural breeding grounds) and man-made problems (e.g. catching of brood and undersized fish; unregulated use of insecticides and pesticides; and construction of bridges, embankments, dams, and culverts that disturb aquatic ecosystems). These activities have negatively affected the breeding, growth, and development of natural fish populations, which has resulted in depleted fish populations, dispersal and unemployment of fishers, and reduced animal protein supplies, especially for the poor. Moreover, intensive fishing, the conversion of wetlands into agricultural lands, and the use of agrichemicals reduce fish habitats day by day. Thus, fish are facing continuous stress and are in threat of decline (DoF 2005).

Furthermore, rights to fish in these water bodies have in many cases been leased to rich and influential community members. Government preference is given to fisher cooperatives but very often, either directly or by bidding through a cooperative, control is awarded to the highest bidder, which favors elites. Under the current leasing system poor fishers have failed to gain fishing rights mainly because they have high transaction costs and are less able to enforce property rights than more socially powerful lessees who can prevent unauthorized fishing by threat and social pressure. Thus the livelihood of poor fishers remains unchanged, while the wealthy, which pay high prices and want quick returns, fish as much as possible. As a result, fish stocks in Bangladesh are in danger of collapse in the near future, which will deprive working fishers of access to resources (DoF 2005).

Considering all the above-mentioned potentials, possibilities, and limitations, the only way to fulfill demands for fish in Bangladesh is to properly manage open water

bodies through community-based fisheries management. In the last decade, wetlands co-management has been implemented by government organizations in collaboration with various non-governmental organizations (NGOs). Management of Aquatic Ecosystems through Community Husbandry (MACH) is one such project. Supported by the United States Agency for International Development (USAID), MACH has worked closely with the Department of Fisheries (DoF) since 1998 with the aim of establishing community-based fisheries management and restoring and increasing the sustainable productivity of large wetlands.

Alua Beel, the study area addressed in this paper (Figure 1), is one of the important MACH project sites. MACH started its activities here in 2000 and finished in 2008. During this time Alua Beel was managed and operated by local people with technical assistance from MACH. So it is an appropriate time to evaluate the experiences and impacts of MACH project activities with respect to local participation. This paper assesses the extent and quality of local inhabitants' involvement in Alua Beel management activities and decision-making processes. Knowledge obtained through this study can be utilized to calculate the activities and responsibilities of participants, as well as economic benefits derived. This study also makes recommendations for sustaining socio-economic benefits, profit sharing, and regulating co-management duties.

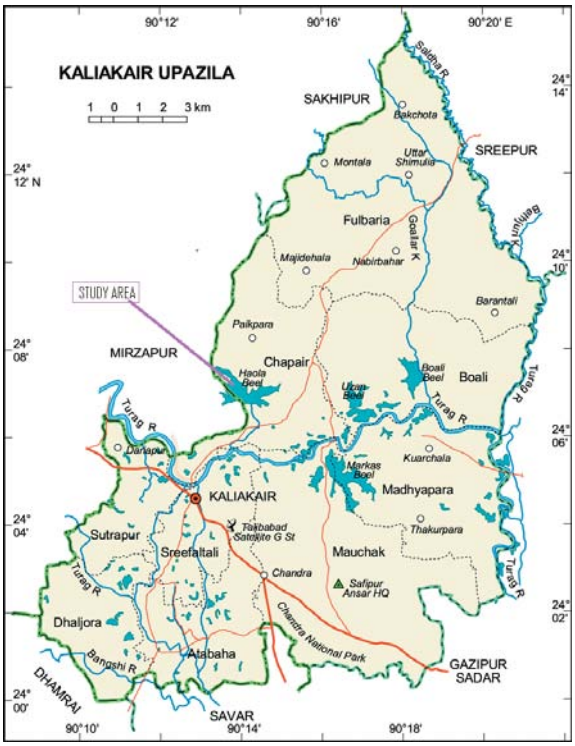

Figure 1: Map of the study area

The aim of this study is to examine how co-management programs function in wetlands to improve the livelihoods of local inhabitants. More precisely, the objectives of this study are:

- To assess activities and responsibilities of resource management organizations (RMOs) and resource users groups (RUGs) in co-management arrangements;
- To identify economic benefits derived from wetland resource management and conservation; and
- To assess fishermen awareness of wetland co-management activities and bio-diversity conservation.

Background

Alua Beel is an important MACH project for the introduction of community-based co-management of wetlands. MACH demonstrated co-management and participatory processes for planning, implementing, and monitoring sustainable wetland resource management at three sites located in Hail Haor, the Turag-Bongshi River Basin, and Kongsha-Malijhi. Each site is comprised of a different ecosystem. The study area addressed in this paper is one of the largest beels in the Turag-Bongshi River Basin; the area is also an important protected area identified by the Integrated Protected Area Co-management (IPAC) project (IPAC 2009).

The Turag-Bongshi site is located just north of the capital city of Dhaka and is typical of most low-lying floodplains in Bangladesh. The Turag-Bongshi River runs through the site, flowing between a series of beels and canals. At the beginning of the rainy season, as floodwaters enter the upstream portions of the river, water spills over the riverbanks through *khals* (canals) that connect the river to adjacent beels. Fish move through these canals from the river to the beel/floodplain areas for spawning or nursing and then later move into the deeper perennial portions of the beels or back into the river as waters recede after the monsoon season. Dry season (winter) water levels in the local rivers and beels are much lower today due to the extraction of ground and surface water for winter rice irrigation. In drought years, fish remain only in the deepest portions of the beels and the river. Annual fish production depends largely on the size of the breeding populations that survive the dry season (Chowdhury and Clementt 2006).

Within the Turag-Bongshi site, there are a total of 26 beels with a water surface area of approximately 10,000 hectares at full flood, which diminishes to less than 700 hectares at the end of the dry season. The Turag-Bongshi River runs for approximately thirty kilometers through the site and another twenty eight kilometers of canals exist within the area. Seasons in the Turag-Bongshi floodplain, like all similar areas in Bangladesh, are distinguished by rainfall and water levels, which divide the monsoon (wet season) that occurs from May to October from the dry period that lasts from November to April. Approximately 225,000 people live in 226 villages that make use of the river and floodplains (Chowdhury and Clemett 2006).

Among the twenty six beels in Turag-Bongshi, Alua is one of the most bountiful in terms of natural resources, as well as one of the largest in size, covering approximately 250 hectares in the wet season and 30 hectares in the dry season. The beel is surrounded by five villages: Medi Ashulai, Rashidpur, Ajgona, Gobindhopur, and Kanchonpur. From the beginning of the MACH project, people living in the wetlands surrounding the Alua Beel were made aware of the project's concept and its objectives. A RMO was formed among villagers living in the surrounding area to collaborate with the *Upazila* (sub-district) fisheries committee. This RMO, the Alua Beel Resource Management Welfare Organization, was established in 2000 with an office in Medi Ashulai Village, Kaliakor Upazila, Gazipur District (Registration No. Ga-0474), with support from the government and funding from USAID. For this MACH project the Center for Natural Resource Studies, an NGO, took responsibility for improving the management of wetland resources through the formation of a community-based RMO. Caritas, another NGO, was also a working partner. Caritas was responsible for the formation and mobilization of an additional group of beel fishers and other poor resource users, known as the Federation of Resource User Groups (FRUG) (Sarkar 2009).

There are 174 RMO members in Alua Beel, of whom ten percent are local area elites, twenty percent are women, and the remainder are farmers, fishers, and other professionals. There are also seven types of professionals (including business owners, service providers, and poultry and cattle farmers) involved in the RMO group, but most professionals also depend directly or indirectly on agriculture. Most of the female members are housewives. Within this RMO group two-thirds of the people are FRUG members. Management and conservation duties and responsibilities are specific for each group member.

The RMO initially established seven fish sanctuaries in Alua Beel. These are permanent fish sanctuaries where fish harvesting is restricted throughout the year. Other parts of the beel also come under restriction during the three month breeding season, during which time the fishermen are provided with support for AIG (alternative income generating) activities, which come in the form of supplies of livestock, small loans, and so forth. Another major activity of the RMO is to create awareness among the people around the beel area, which they do by holding regular monthly meetings between local people and the Upazila Fisheries Officer. In addition to village meetings the RMO Executive Committee organizes announcements, folk dramas, and rallies, in order to raise awareness among villagers and group members.

The FRUG consists of 305 members whom are mostly poor and landless people, of which about thirty three percent are women. Different types of professionals are also involved in the group. Members are directly involved in co-management activities and are provided with resources for AIG activities, as well as training and small loans (Mohammod 2009). Key informants explained to me that the activities of the Alua Beel Resource Management Welfare Organization are directed by a nineteen member executive committee. Members of the committee are elected every two years. The responsibilities of the committee and the tasks of each member are well defined. The committee organizes regular monthly meetings with a specific agenda

to review and implement effective management planning and control.

While the MACH Alua Beel project finished in 2008, a follow-up program is providing technical and institutional support through the end of 2010 through an endowment fund. The interest acquired from the endowment fund can be used to support RMO and upazila fisheries committee activities in perpetuity. Because the Alua Beel Resource Management Welfare Organization is an established MACH project site and has active RMO and FRUG groups, I was able to measure the benefits that poor fishers derive from co-management around the beel and observe to what extent their standard of living has been improved.

Methods

In this paper I draw on both primary and secondary data. Primary data were collected through field visits and observation; consultations with community leaders and key informants; facilitated focus group discussions with check lists; and semi-structured interviews using questionnaires. I gathered secondary data by consulting relevant published and unpublished MACH documents and reports from the DoF, the Department of Agriculture Extension (DAE), the Department of Environment (DoE), and other relevant organizations.

For this study I chose to collect data in three of five villages neighboring Alua Beel. These villages are Medi Ashulai, Azgona, and Rashidpur. The main criteria for choosing these villages were: 1) the villages are predominately surrounded by beel area and are easily accessible, and 2) they are home to the majority of MACH beneficiaries. At the beginning of the study I had some discussions with local inhabitants and key informants in each village concerning the background of the area, local communities, current beel conditions, local involvement in co-management activities, and present livelihood conditions. I first introduced myself to the target group in Medi Ashulai in the RMO Office, where I informed the villagers about the purpose of my survey. I completed two focus group discussions among members using a checklist. One discussion was with FRUG members and the other was with RMO members. Focus group discussions were designed to help me learn more about co-management objectives, overall beel management, yearly activity plans, distribution of duties and responsibilities, and benefits to and problems of each group.

For the semi-structured interview I selected a random sample of thirty informants from among the three villages. Both male and female members of the RMO and FRUG were selected for my study. Interviews helped me to develop household profiles of the beneficiaries group. They also helped to increase understanding about the livelihoods of fishers. The thirty informants involved in this study were combined into two major groups: 1) fishers who directly or indirectly depend on fishing and 2) non-fishers who depend on professions other than fishing. However, both groups received benefits from the co-management project either directly or indirectly. Interviews took 20-30 minutes for each participant. Basic demographic information was collected to gather information on age distribution, educational level, and the

occupations of household members. The primary research goals were to identify the knowledge and awareness of local inhabitants about co-management and to learn how beel co-management changes local peoples' lifestyles.

Results and discussion

In this section I first describe the socio-economic profile of user groups in Alua Beel, including some basic demographic information. Next I look at levels of knowledge and awareness among local inhabitants about co-management in the beel. I also examine the duties, responsibilities, and benefits derived from active participation in co-management. Data from the three villages is amalgamated since, based on research of extant data, they are reasonably similar to each other.

Demographic Characteristics of User Groups

Respondents in this study were both direct and indirect resource users. Of the 30 respondents, the largest age class was 35-44 years old (40%), followed by 25-34 (27%), 45-54 (20%), and those 55 years old and older (13%). The results also revealed the academic qualifications of the respondents, shown in Table 1.

Table 1: Academic qualification of respondents

Qualification	Number of respondents(percent)
Higher Secondary Certificate (HSC) and above	3 (10%)
Completed Secondary School Certificate (SSC)	5 (17%)
Completed class eight	8 (27%)
Completed primary school	7 (23%)
Able to sign name and do basic math	5 (17%)
Illiterate	2 (7%)
Total	30 (100%)

These data have a normal distribution, with most of the respondents having completed primary and secondary school. Among the six educational level categories, the category with the most respondents was education up to class eight. In total, just over half of the respondents had a class eight education or higher. People with this level of education can understand the purpose and benefits of co-management and they have sufficient skills to perform their duties properly.

From secondary data collected in 2008 I identified six major occupations listed for RMO members. Among the total number of RMO members, 52 percent were involved in agriculture (on either their own or other's land), 27 percent were involved in business or small trade, 13% of women were housewives (and also raised poultry and cattle), and 5 percent were fishers; in addition a very small percentage (2%) were service providers or village doctors (1%). Based on this data it can be said that the RMO is composed of members engaged in a variety of occupations, with the majority engaged in agricultural work. Figure 1 shows the different occupations of RMO members.

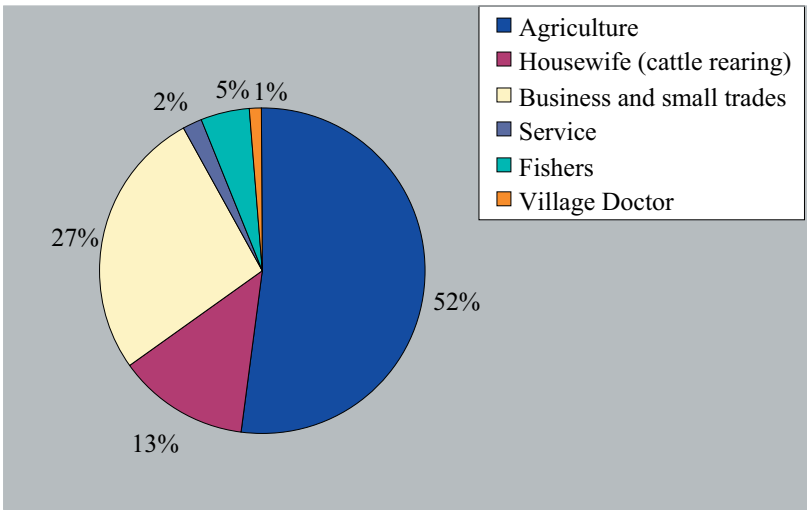

Figure 2: Main occupational status of RMO members

The occupational status of the RMO group members according to 2008 census data and the occupational status of respondents in this study were different. This is likely because I selected members of both the RMO and FRUG in my sample, whereas the 2008 census data covered only RMO members (Sarkar 2009). In addition, I intentionally selected more fishers in my sample group so that I could look more thoroughly at the direct beneficiaries of beel co-management. Among my sample group (30 respondents) the main occupations are farmer, followed by fisher, small trader, and service provider. I also interviewed four women (13%) who were housewives, but also reared poultry and cattle.

Among the fisher group, twenty three percent of individuals fish year round, while thirty percent fish on a seasonal basis according to when fish are available. It's interesting that in a study about wetland improvement, only about a quarter of respondents are full-time fishers, and only half the respondents are part-time fishers. According to respondents, agriculture was the primary source of income for most households, while agricultural labor and fishing were the next most prominent sources (Table 2). Secondary sources of household income include agriculture, agricultural labor, fishing, and poultry and cattle rearing. I found that four of the respondents, all of whom were housewives, had no primary source of income. On the other hand, five respondents had only a primary source of income with no secondary source. Only nine respondents had only one source of income, either primary or secondary, while the rest had two sources of income.

Table 2: Primary and secondary sources of income for respondents

Sources	Primary income sources	Secondary income sources
	Number of respondents (percent)	Number of respondents (percent)
Subsistence agriculture	11 (37%)	7 (23%)
Agriculture labor	7 (23%)	10 (10%)
Business and small trades	3 (10%)	0 (0%)
Poultry and Cattle rearing (housewives)	0 (0%)	4 (13%)
Service	1 (3%)	0 (0%)
Fishers	7 (23%)	9 (30%)
Other	1(3%)	0 (0%)
Total	30 (100%)	30 (100%)

Knowledge and Awareness of Users Concerning Co-management

In order to investigate levels of awareness of beel users concerning co-management I gathered information from respondents concerning co-management activities in Alua Beel. I asked respondents about the objectives of the MACH project guidelines regarding co-management and sought out information on the number of users who know these objectives. From the focus group discussion I found that respondents knew ten major project objectives. The results revealed that most respondents knew one or more objectives, but only seven percent knew all the objectives, while ten percent didn't know any of the objectives. However, when asked to list objectives, most respondents started with increasing fish production (67%), followed by alternative income generating activities (57%), and sanctuary management (50%).

Forty percent of the respondents knew about selective bans on fishing (either by area or season) and about water use for other activities. Very few respondents knew about environmental protection (27%) or the specific duties of co-management (30%). The knowledge and awareness of respondents about co-management in Alua Beel is shown in Table 3.

Table 3: Knowledge and awareness of local inhabitants about co-management in Alua Beel

Responses concerning co-management	Number of respondents (percent)
Fish production increase	20 (67%)
Alternative income generation and ot her employment activities (small trade, small credit, cattle raising, poultry, net and boat making during bans on fishing)	17 (57%)
Management of seven deep water sanctuaries (year round protection)	15 (50%)
Fishing ban on the whole *beel* (3 months during breeding season)	14 (40%)
Water use for other activities (limited amount of *beel* water for paddy cultivation)	12 (40%)
Biodiversity conservation (more types of fish available than before)	11 (37%)
Prohibition of destructive gear (small mesh size net)	11 (37%)
Aquatic habitat restoration (one -time stocking of fish, maintenance of water quality)	10 (33%)
Performance of specific activities (sanctuary maintenance and guarding, attend RMO meetings, organized trainings, etc.)	9 (30%)
Environmental prote ction (tree planting and maintenance, pit latrines, controlled use of pesticides, fertiliser, detergents, etc.)	8 (27%)
Did not know any of the above	3 (10%)
Knew all of the above	2 (7%)

*Due to multiple responses, percentages do not add up to 100%

One reason many respondents know the objectives of co-management might be that they have participated in various awareness-raising and social mobilization interventions. These initiatives were designed to help people understand the short- and long-term environmental impacts of wetland co-management. I asked people if they were involved in any such awareness-raising efforts. Respondents answered that they were involved in motivational activities to other group members as well as other villagers, family members, neighbor and also they participate in awareness meeting. Respondents' involvement in awareness-raising activities concerning the conservation and management of Alua Beel is shown in Table 4.

Table 4: Involvement in awareness-raising activities for the conservation and management of Alua Beel

Awareness-raising activities	Number of respondents (percent)
Motivate other group member	16 (53%)
Motivate other villagers	15 (50%)
Motivate family members	13 (43%)
Participation in village meeting	12 (40%)
Motivate other relatives	12 (40%)
Motivate neighbors	10 (33%)
Participation in rally	10 (33%)
Motivate neighboring village	8 (27%)
Loudspeaker announcement	2 (7%)

*Due to multiple responses, percentages do not add up to 100%

Duties and Responsibility of Respondents in Co-management

I also collected a range of information on the duties and responsibilities of respondents involved in co-management. I asked respondents about the duties and responsibilities necessary in order to get benefits from and succeed in co-management. Then I separated the duties and responsibilities into three major phases: 1) decision-making; 2) organizing/monitoring; and 3) implementation. I looked at these phases within the fisher group (16 respondents) and the non-fisher group (14 respondents).

From the focus group discussion I found that there are fifteen different types of work that participants have done. Results revealed that most respondents, in both fisher and non-fisher groups, were involved in the implementation phase. Within the implementation phase, most of fishers participated in fishing, sanctuary maintenance, and other fishing-related activities but non-fisher members mostly engaged in rice cultivation and poultry and cattle rearing. Members of both groups also did some common activities like paddy cultivation, fishing, and security patrolling (looking out for illegal fishing).

In the decision-making phase I found that respondents from the non-fisher group were more engaged than those in the fisher group. Furthermore, most of the organizing and monitoring work was done by the non-fisher group members, while only a small percentage of fishers were involved in arranging rallies, folk dramas, village meetings, and monitoring activities. The number and percent of respondents that carried out various duties and responsibilities of co-management are shown in Table 5.

Table 5: Duties and responsibility of respondents in co-management

Duties and responsibilities	Non-fisher group	Fisher group
	Number of respondents (percent)	Number of respondents (percent)
Decision making phase		
Decision making	1 (3%)	0 (0%)
Activity plan preparation	1 (3%)	0 (0%)
Budget preparation	1 (3%)	0 (0%)
Setting rules and regulations	1 (3%)	0 (0%)
Organizing and monitoring phase		
Organize monthly meetings	2 (7%)	0 (0%)
Arranging rally, folk drama, village meetings	2 (7%)	2 (7%)
Monitoring the fishing ban period, use of destructive gear, fishing quantity, etc.	2 (7%)	1 (3%)
Toll/tax collection	1 (3%)	0 (0%)
Implementation phase		
Rice cultivation	9 (30%)	6 (20%)
Fishing activity	5 (17%)	7 (23%)
Poultry and cattle rearing	4 (14%)	0 (0%)
Tree plantation and maintenance	3 (10%)	3 (10%)
Sanctuary protection and maintenance	2 (7%)	7 (23%)
Establishment of seasonal sanctuary	2 (7%)	8 (27%)
Beel protection/guarding	1 (3%)	1 (3%)

*Due to multiple responses, percentages do not add up to 100%

These results suggest that duties and responsibilities are different between the fisher group and the non-fisher group. Many action plans and decisions have been made by elites in the non-fisher group and imposed on fishers who directly participate only in the implementation phase. In this situation, it's probable that decision makers will make poor decisions that are not based on the actual needs of fishers.

It is known that the success of co-management and community based fisheries management requires community participation in order to improve fish production and the livelihoods of fishers. Hence, successful sustainable management is dependent upon the full participation of all members in all phases of management.

Socio-economic Benefits Derived from Wetland Resource Management and Conservation

I gathered different types of data to identify the socio-economic benefits derived by various users from wetland resource management and conservation. In focus group discussions I asked respondents about their reasons for joining the RMO and FRUG groups. Then I broadly categorized their reasons into two major groupings—social and economic—and sorted responses accordingly. The results reveal that most of participants joined the organization because of aspirations for economic benefits.

Under the category of economic benefits, the most frequent reasons given were a desire to increase monthly income (67%) and a desire to increase quantities and types of fish (67%). Saving money (33%) and alternative income generating activities (27%) were also reasons mentioned by respondents for joining. On the other hand, social reasons were primarily mentioned by elite members. Reasons for joining are shown in Table 6.

Table 6: Reasons for joining co-management associations

Reasons of respondents	Number of respondents (Percent)
Social reasons	
Protection from beel degradation	5 (17%)
Environmental conservation	4 (13%)
Social welfare	3 (10%)
Social empowerment	2 (7%)
Economic reasons	
Increase in monthly income	20 (67%)
Get higher quantity and more types of fish	20 (67%)
Save money	10 (33%)
Get alternative income and employment	8 (27%)

*Due to multiple responses, percentages do not add up to 100%

Next, I separated all benefits into direct and indirect benefits. In focus group discussions I asked respondents what types of benefits they actually get from co-management, and I counted how many of them were direct beneficiaries. To identify indirect benefits, I asked specific questions regarding various types of benefits. All direct and indirect benefits mentioned in the study and the number of people who reported benefiting from them are shown in Table 7.

Table 7: Respondents' views about direct benefits and indirect benefits from co-management

Direct benefits	Number of respondents	Indirect benefits	Number of respondents
Increased income	20	Improved sanitary facilities	20
Fish availability (quantity)	20	Establishment of roads, market, health centre, school, etc.	17
Increased fish intake	17	Development of housing facilities	14
Save money	10	Improved recreational facility	13
Fish availability (different species)	8	Better health facility	12
Improved skills in management activities	6	Improved educational facility	11
Alternative income source	5	Environmental protection	4
Wetland restoration	5	Social welfare	3
Employment opportunity	3	Social empowerment	2

I also collected information about changes in lifestyle of people living near the beel. These changes were definitely positive. During the project intervention, the quality of life of participants was raised. I asked respondents whether they knew what types of changes had actually resulted from co-management. Respondents gave me several different ideas regarding lifestyle changes, which I divided into four major groups: 1) economic (income, production, employment, micro-credit, etc.); 2) social (social welfare, social empowerment); 3) health and educational; and 4) other changes (increased knowledge and skills, improved environmental conditions). Twenty out of thirty people answered that their economic status had improved since joining the group (67%), but only four respondents said there had been social changes (13%). On the other hand twelve (40%) respondents observed improvements in health and education, while sixteen (53%) respondents mentioned different types of changes in their lifestyle, such as: environmental change, roads, houses, and sanitary facility development. These lifestyle changes improve the skills of those involved in co-management and thus it seems that respondents are willing to continue co-management activities with technical support. Figure 2 shows changes in lifestyle among respondents due to co-management activities.

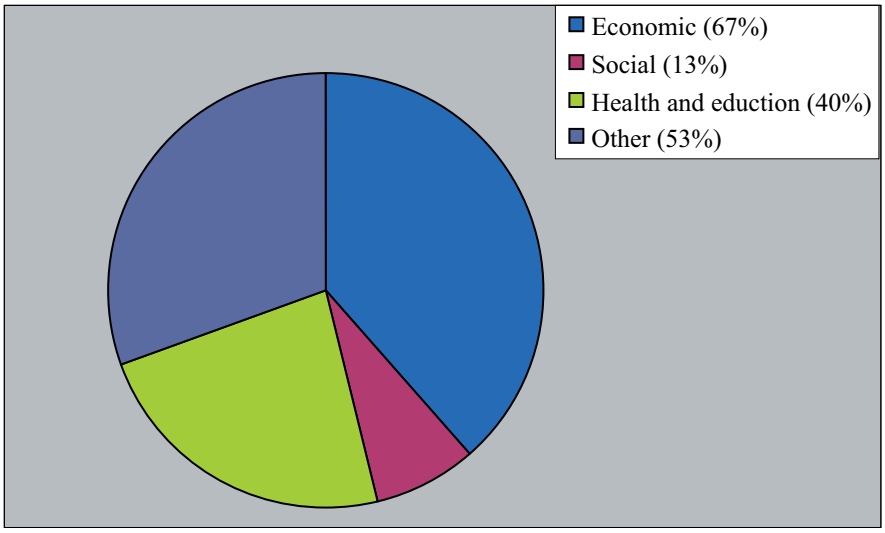

Figure 3: Changes in lifestyle among the respondents

*Due to multiple responses, percentages do not add up to 100%

As can be seen in the above results, Alua Beel co-management brings different types of economic benefits as well as social benefits for both RMO and FRUG members. Although members were not involved in fishing, sanctuary maintenance or any other types of co-management activities, they too agreed with these programs because they receive either direct or indirect benefits from them. Benefits to members included not only increased fishing productivity, but also improvements in social welfare, as well as environment, infrastructure, education, and healthcare. These results are also

supported by secondary data. During the MACH project period (2000-2008), fish production increased from the base year to 2009 from about 58 kilograms to 163 kilograms per hectare. Per capita fish consumption also increased from 29 grams to 40 grams per day. Such a robust increase in fish production is likely due in part to co-management activities.

In addition to benefits derived from co-management, eleven respondents also mentioned problems. Problems included yearly fish sanctuary maintenance, sanctuary excavation and re-excavation, lack of technical support (necessary advice and training), insufficient funds, insufficient AIG programs, and conflicts in joining and performing duties. Among respondents who identified problems, nine brought up sanctuary related problems, specifically the need for re-excavation and proper maintenance of the fish sanctuary. Six respondents specified the need for more funding to mobilize beel management, and eight suggested a need for more AIG programs. Participants are now aware of the benefits of the fish sanctuary that has increased the amount and variety of fish including some species that were nearly extinct. This suggests that if members are able to find other work, fishing pressures will be reduced and long-term sustainable fish harvesting will become possible.

Conclusion

Fisheries co-management helps ensure active participation of group members and good governance of open water bodies. This management technique can improve local livelihoods and increase the income of poor fishers by providing access rights and introducing better fisheries management strategies. Based on the findings of this study, I believe that without the active involvement of users in co-management activities, Alua Beel cannot achieve its goals of promoting conservation and improving livelihoods.

In my assessment of resource users' awareness of co-management activities, I found that approximately fifty percent of user group members know or are aware of most of the main objectives of co-management and most of them share this information with others, motivating them to participate in various co-management activities. User group members expressed that they wanted to be more involved in co-management activities. They are well qualified to do so considering that most of them have completed high school and can easily understand and perform co-management duties.

The major aim of this study was to evaluate the duties and responsibilities of both the RMO and FRUG members in Alua Beel co-management initiatives, and to identify the socio-economic benefits that group members derive from co-management. My main finding is that fishers in the user groups were not participating in the decision-making processes; rather, they were only involved in the technical activities of beel management. Some of them were participating in monitoring and in organizing co-management activities, but only non-fishers were making decisions regarding co-management programs. This top-down decision-making limits the benefits that are possible with co-management arrangements, and actually works

against co-management objectives by excluding some people from decisions that impacts their lives.

In terms of the benefits of co-management for the livelihoods of members, I found that most members joined the group for economic reasons. However, some members joined for reasons related to social welfare and empowerment. More than fifty percent of members said that along with fish production their monthly income had increased due to co-management activities. However, some of the expectations of co-management participants were not met to the extent that they had anticipated. This may be due to their low level of participation in decision-making and insufficient technical and financial support from government authorities.

Co-management is only part of the solution for fisheries management. User groups need to be involved through an ongoing process that enables them to influence decisions and help develop regulations. On the one hand, successful co-management requires that user-groups have the aspiration and capability to co-manage and take over responsibility for fisheries and, on the other hand, that an appropriate institutional arrangement is established.

Fishers expressed that they wanted co-management to continue and that without it they thought the quality of the fisheries would deteriorate. However, they felt that in order for co-management to continue it would need sustained support (both technical and financial) from the government.

IPAC is now working in Alua Beel, but the fishers do not yet know of it. There are two suggestions I would like to make to IPAC:

1) IPAC needs to share information on the importance of environmental conservation and issues of wetland pollution in Alua Beel;
2) IPAC needs to work on increasing fishers' involvement in decision-making in order to improve co-management and increase benefits for local users.

In summary, this study reveals that for Alua Beel co-management to be effective there needs to be increased participation by fishers in the decision-making phase. Without this, co-management will not be sustainable. Giving fisher organizations the right to be part of decision making will increase the responsible performance of these organizations as they encourage their members to comply with rules. Thus, user groups can see the economic benefits of cooperation in both the short- and long-term. These benefits can improve the livelihoods of the poor and empower them in society.

References

Berkes, F., and Folke, C. 1998. *Linking social and ecological systems for resilience and sustainability.* In Berkes, F., and Folke, C. (eds.), Linking Social and Ecological Systems, Cambridge University Press, Cambridge, pp. 1–25.

Borrini-Feyerabend, M., Pimbert, M.T., Farvar, A., Kothari & Renard, Y. 2004. Sharing Power: Learning by Doing in Comanagement on Natural Resources throughout the World, IIED and IUCN/CEESP, Cenesta pub., Tehran, Iran.

Chowdhury, N. and Clemett, A 2006. Industrial pollution and its threats to mukesh beel wetland in Kaliakore, MACH technical paper 3.Winrock international, Dhaka.

DoF, 2006., Community Based Fisheries Management Project 2000-2006, Department of Fisheries, Bangladesh.

DoF, 2005. *Annual Report*. Department of Fisheries, Government of the People's Republic of Bangladesh.

IPAC, 2009. Integrated Protected Area Co-Management. URL accessed [24 June 2009]: http://www.nisorgo.org

Mohammod, S. 2009. Personal communication. 19 September, 2009

Nielsen, J.R. 1996. Fisheries Co-Management: Theoretical Aspects, International Experiences and Future Requirements. Paper Presented in Annual Finnish Fisheries Conference. Turku, Finland. November 28-29, 1996.

Ostrom, E. 1990. Institutional analysis, design principles and threats to sustainable community governance and management of commons. In Pomeroy, R. S. (ed.), Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences, *ICLARM Conf.Proc*. 45, *ICLARM*, Manila, pp. 34-50.

Pomeroy, R. S., and Berkes, F. 1997. Two to Tango: The Role of Government in Fisheries Co-management. *Marine Policy* 21(5): 465–480.

Sarkar, P. 2009. Personal communicaton. August 22, 2009

Sultana. P and Thompson, P. 2004. Methods of Consensus Building for Community Based Fisheries Management in Bangladesh and Mekong Delta, *CAPRi working Paper* No 30, World Fish Centre, Bangladesh.

Thompson, P. and Colavito, L. 2007. Economic value of Banagladesh wetlands, MACH Technical Paper 6. Winrock international, Dhaka.

Fish-market Chain and Fishers' Incomes in Sherpur District, Bangladesh

Md. Aminul Haque[1]

Abstract

In Bangladesh the fish-market chain, which links fishers and retailers within the country, as well as with other countries in the subcontinent, is exclusively controlled by the private sector. Fishers are often exploited by middlemen because of their isolation and the difficulties they face due to poor roads, lack of transportation, and limited communication. Middlemen can exploit fishers because they control access to the market chain and the consumer. Therefore, significant income differentials exist in the market chain, and these differentials pose a great disadvantage to local fishers. I argue that there is a need to identify an alternative market chain that is more equitable towards local fishers. In this paper I seek to: 1) describe the existing market chain and the income status of the various actors within it; 2) examine the impact that high-value fish species have on the market chain; and 3) identify an alternative market chain, as well as perceived barriers to using this chain. Ultimately, I hope this paper will lead to an improvement in the livelihoods of fishers, and other members of the market chain.

Introduction

In Bangladesh the fish-market chain is exclusively controlled by the private sector, which links fishers and retailers within the country, as well as with other countries in the subcontinent. The fisheries sector plays an important role in respect to income, employment, consumption and also exportation. It constitutes 3.74 percent of Bangladesh's gross domestic product (GDP), 20.87 percent of the total agricultural sector, and 4.04 percent of export earnings. In addition, 12.5 million people in Bangladesh are either directly or indirectly employed in the fisheries sector. A great number of people, many of whom are living below the poverty level, find employment in the domestic fish market chain as fishers, traders, intermediaries, day laborers, and transporters (Ahmed, *et.al.* 1993). There are three levels to the market chain that can be observed in the distribution of captured fish. These are the primary, secondary, and consumer levels. Primary marketing places are at fish catching points where fishers operate, while the secondary levels involve a variety of ancillary actors, such as *paikars, beparies,* retailers and *arotdars* (see Box 1). These actors control the fish-market chain and are commonly known as middlemen. Arotdars procure fish with the help of local brokers (*dalals*) who receive a commission from local paikars.

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Arotdars sell fish to beparies; beparies sell fish to retailers; and retailers sell fish in the consumer market. Figure 1 shows the general marketing chain and linkages among traders.

Fishers are often exploited by middlemen because of their isolation and the difficulties they face due to poor roads, lack of transportation, and limited communication. Middlemen can also exploit fishers because they control access to the market chain and the consumer. However, the most serious market differentials seem to occur in remote communities that lack transport, ice, and road facilities, and where the fishers are in a particularly weak position in relation to intermediaries (Rahman 1997). Rahman *et al* (2009) argue that middlemen have established a fish-marketing chain based on extreme exploitation of fishers through intermediaries at different levels. Harvesting, processing, and marketing of fish are sources of income for over 100 million people in Bangladesh, about 80 percent of whom are considered part of low income or poverty groups (World Bank 1992). Fishers live sub-human lives and are the most deprived and poorest class (Chowdhury 1993) and past studies have made it clear that fishers' incomes are generally low (Cunningham 1994). As a result, significant income differentials exist in the market chain; these differentials pose a great disadvantage to local fishers.

Box 1: Definitions of major actors in Bangladesh's fisheries sector

Fishers	:	Can be independent owner/operator; an employee of a boat owner (salaried); or work on a share bases.
Paiker	:	Small-scale middlemen who collect fish from small markets and end them to bigger markets, or to near-by *arotdars*.
Beparies	:	Small-scale middleman who collect fish from fishers or local markets and export to wholesale retail markets or todistant urban wholesale markets.
Dalals	:	Brokers who operate at the local level to procure fish for paikers for a commission.
Arotdars	:	Large-scale middlemen who are permanent shopkeepers and commission agents having their own premises and staff in the markets. They are the middle functionary between beparies and retailers.
Retailers	:	Small-scale middleman who buy fish from arotdars or from beparies and sell directly to consumers. Retailers sell fish from permanent or non-permanent shops or stalls in retail markets.

Capture fisheries represent a huge market nationally and internationally. All actors in this market depend on captured fish for their livelihoods. However, at present the income levels of the various actors in the market chain have not been documented and little is known about the relative benefits derived by different actors. I argue that there is a need to identify an alternative market chain and examine the possibility of fishers using such a chain. Accordingly, this paper seeks to: 1) describe the existing market chain, and the income status of the various actors; 2) examine the impact that high-value fish species have on the market chain; and 3) identify an alternative market chain and perceived barriers to using this chain. Ultimately, I hope this paper will lead to an improvement in the livelihoods of fishers, and other members of the market chain.

Figure 1: Fish-market chain

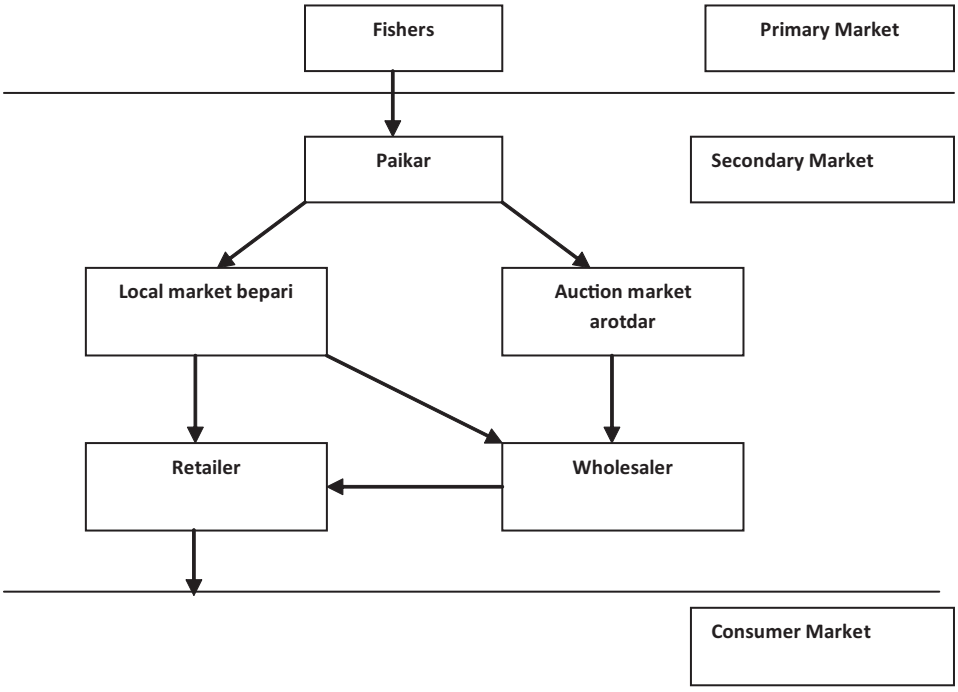
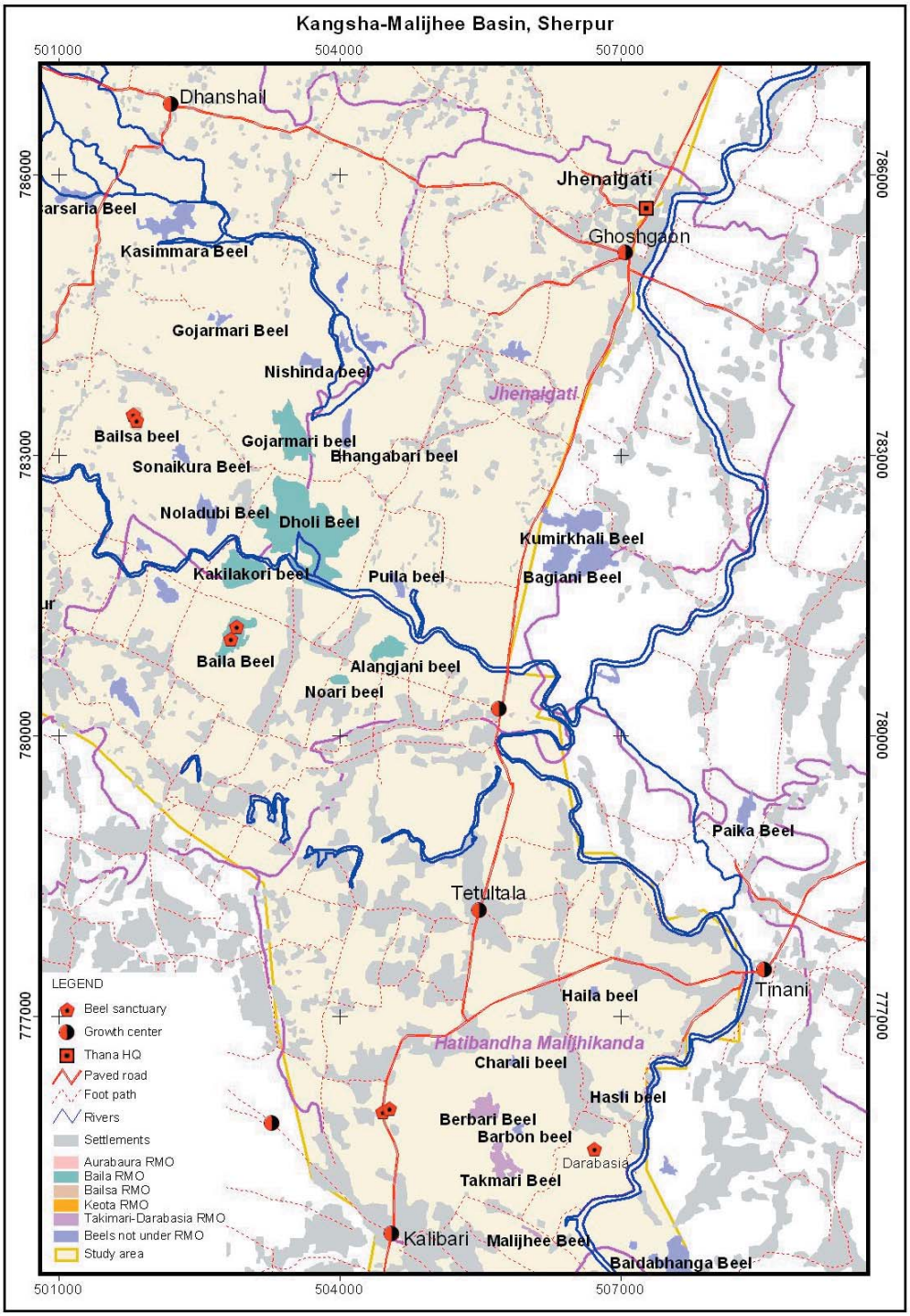


Figure 2: Map of the study area



Background

The study area is located in north-central Bangladesh in the Sherpur District. Geographically the area is a part of the Garo and Tura hills and includes the catchment area of the upper Kangsha and Malijhee watersheds. Jhenaigati Upazila is located on a large flood plain where flash floods occur regularly; the upazila is full of various bodies of water, such as *beels* (a low-lying body of water that is connected to rivers or canals and inundated during the rainy season), canals, rivers, and narrow hill streams (*jharna*) that flow from upstream rivers. Because these bodies of water lie at the lower end of the hilly Kangha-Malijhee watersheds they are greatly affected by siltation. The upazila covers 231 square kilometers, including expanses of water. Employment opportunities in the upazila are limited, but a large number of people engage in fishing. Villagers in the upazila who reside near water are mostly fishers.

In 2000, the United States Agency for International Development (USAID) and the Government of Bangladesh initiated the Management of Aquatic Ecosystems through Community Husbandry (MACH) project. This project, which ran through 2008, sought to improve the livelihoods of fishers and local people while protecting aquatic ecosystems through activities like establishing fish sanctuaries, addressing siltation, and developing tree plantations. Today, the activities MACH initiated continue under the Integrated Protected Area Co-management (IPAC) project. As a result of these projects, indigenous fish populations have increased and other fish species have been introduced. However, the incomes of fishers, to their disappointment, have not increased significantly. Therefore, it is appropriate to study the fish-market chain and its impacts on the incomes of fishers in Jhenaigati Upazila.

Methods

For this study I carried out a market chain assessment for capture fisheries in Kangsha Malijhee and Sherpur districts, which are part of Jhenaigati Upazila. The study was conducted between August 2009 and January 2010. I began by making general observations of the study area in August 2009, and then collected detailed data between September and December 2009. I worked in three beels-Dhali, Baila, and Bailsha-where I surveyed seven villages. I also worked in the Takimari-Darabasia beel area where I surveyed another six villages. Within the upazila I surveyed five rural markets and two market towns to get an overview of the fish-market chain and its actors. I collected data from twenty fishers in two villages-Darikalinagar and Chenguria-ten paikars from the two beel areas, fifteen beparies from three rural markets (Jhenaigati, Kalibari and Tinani Bazaar), fifteen retailers from the same three rural markets, and six arotdars from Sherpur and Jamalpur district markets.

I conducted focus group discussions (FGD) with fishers, paikars, beparies, retailers, and arotdars to get an overview of the fish-market chain; in total I conducted five FGD (one in each of the villages where I interviewed fishers, and three in each of the market places where I interviewed the middlemen). Each FGD contained between ten to fifteen people (no women were included because women do not participate in the market chain in this area).

In addition, I conducted a survey using a close-ended structured questionnaire. Households and middlemen were selected by random sampling. I crosschecked responses to the questionnaire with key informants such as consumers, local elites, local leaders, public representatives, MACH staff members, IPAC project members, and government officials. Finally, I used quantitative methods to analyze income differentials between fishers and the various middlemen in the fish-market chain.

Results

Fish-market Chain and the Economic Status of Various Actors

The fish-market chain in Bangladesh, which is both traditional and complex, plays an important role in connecting fishers to consumers through a chain of middlemen. Coulter and Disney (1987) suggest that fresh fish are marketed through different chains that include primary, secondary, and final consuming markets.. In this section, I will focus on these three levels of the chain. The primary markets of the study area are situated at the seven beels where fish are caught. Arotdars procure fish from fishers with the help of local dalals who receive a commission. I found that some portions of catches are sold locally by fishers and beparies, and that sometimes fishers are even able find a way to sell their catch directly to the secondary market. The secondary market is large and includes traders that operate nationally, commission agents, wholesalers, fish processors, and exporters. I found that the arotdars collect fish from their own networks, mostly from paikars at the upazila level and other parts of the country. The arotdars also buy fish directly from fishers where roads for transportation are available. Local beparies buy fish from arotdars and also from paikars. In the secondary market beparies sell fish to retailers in the local markets. At the consumer level most inland fish are consumed fresh due to strong consumer preference. I found that the beparies buy fish from the secondary markets and sell them to retailers in upazila and village level markets, and then finally to consumers. Figures 3 and 4 show two different representations of the market chain; Figure 3 shows the actors in the chain and Figure 4 shows where the transactions occur.

Figure 3: Actors in the market chain of the study area

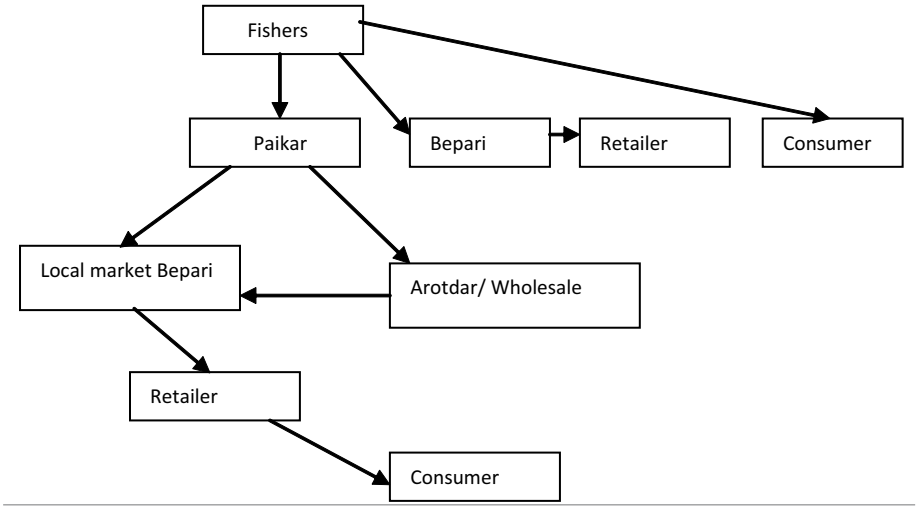
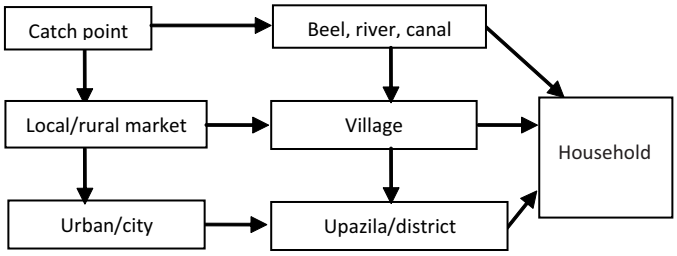


Figure 4: Transaction locations in the market chain of the study area



Differences in income in the study area are reflected in the housing used by various actors in the market chain. Four categories of houses were identified in the study area; these are summarized in Table 1. I found that fishers do not own improved houses (Housing Status Categories 3 and 4); paikars do not own any unimproved homes (Housing Status Category 1); and beparies do not own any of the most improved homes (Housing Status Category 4). As the highest beneficiaries in the fish-market chain only arotdars own improved homes (Housing Status Categories 3 and 4). Retailers belong to a marginalized stratum of the society and their housing condition is more like the fishers (Housing Status Categories 1 and 2). I found that the housing conditions of fishers are very poor and relatively the same as the retailers. The housing status of paikars and arotdars is better than that of other actors in the fish-market chain.

Table 1: Housing status of fishing-market chain actors

Category	Fishers	Paikars	Beparies	Arotdars	Retailers	Total
1. Earthen floor, straw roof, no tube well or sanitary latrine	11 (55%)	0 (0%)	1 (7%)	0 (0%)	8 (53%)	20 (30%)
2. Earthen floor, tin roof, no tubewell or sanitary latrine	9 (45%)	3 (30%)	11 (73%)	0 (0%)	7 (47%)	30 (45%)
3. Earthen floor, tin roof, tubewell and sanitary latrine	0 (0%)	6 (60%)	3 (20%)	4 (67%)	0 (0%)	13 (20%)
4. Cement floor, tin roof and tubewell and sanitary latrine	0 (0%)	1 (10%)	0 (0%)	2 (33%)	0 (0%)	3 (5%)

According to my analysis, fishers have an average household size of 7.55, paikars 5.7, beparies 5.9, arotdar 5.5, and retailers 6.73 people per household. Among members of the fish-market chain fishers have the largest families and arotdars have the smallest. I found that one factor affecting family size is level of education, which is linked to awareness of family planning procedures (Joadder 2008). Figure 5 illustrates that fisher households have the largest percentage of illiterate members and arotdars have the highest percentage of members who have completed classes VI-X. Another factor influencing family size is the belief among fishers that more children will improve their ability to increase their income.

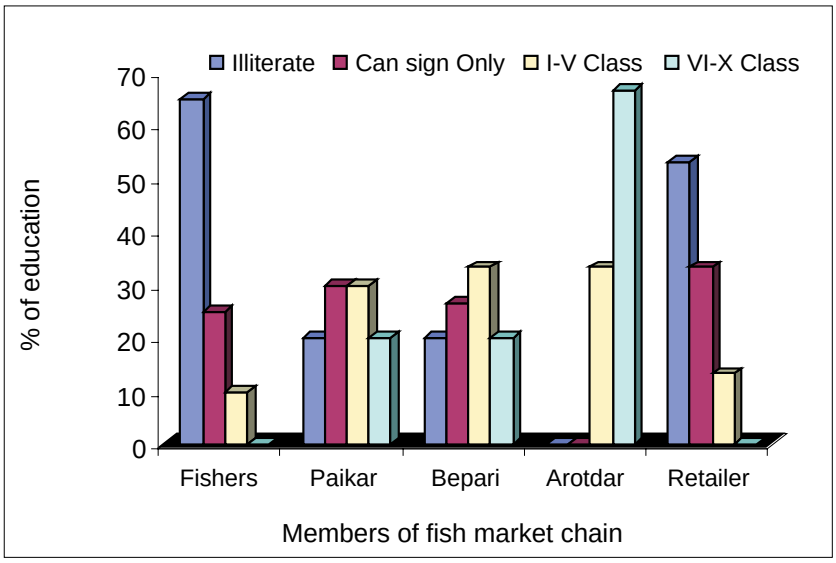


Figure 5: Education levels among actors in the fish-market chain

In part due to the reason discussed above, education is an important socioeconomic indicator. I classified members of the fish-market chain into four categories of education level: 1) illiterate; 2) can sign their name only; 3) attended classes I-V; and 4) attended classes VI-X. I found that among the twenty fishers 65 percent were totally illiterate, 25 percent can sign their names but cannot read, 10 percent had attended classes I-V, and no one had gone beyond primary school. In contrast, none of the arotdars were illiterate, 33 had attended classes I-V, and 67 percent had attended classes VI-X (Figure 4). Retailers had education levels similar to fishers; 53 percent of retailers were illiterate and 33 percent can sign their name but cannot read.

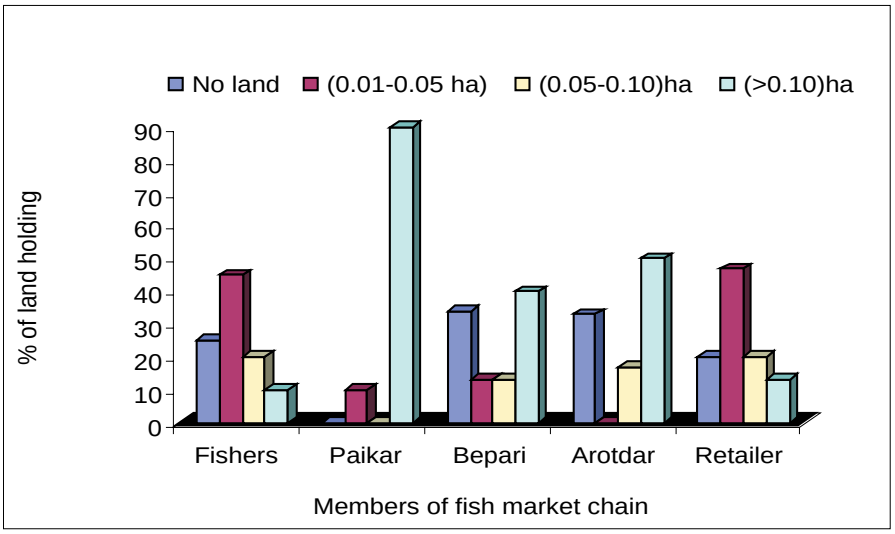


Figure 6: Landholdings among members of the fish-market chain

Figure 6 shows the land holdings of the various actors in the fish-market chain. I classified land holdings into four categories: 1) landless (0 hectares); 2) small (0.01 - 0.05 hectares); 3) medium (0.05 - 0.10 hectares); and 4) large (>0.10 hectares). I found that among the twenty fisher respondents 25 percent are landless; 45 percent are small land owners (own only their homestead); 20 percent are medium land owners (own their homestead and a small agricultural plot) and only 10 percent are large land owners. Retailers had land holdings similar to fishers. On the other hand, 90 percent of paikars and 50 percent of arotdars had more than 0.10 hectares of land. Approximately one-third of the beparis and arotdars are landless. These people live in rented homes in urban areas and rural market towns.

In the surveyed area some actors in the fish-market chain have sources of income in addition to fishing, though fishing usually remains their main source of income. Some actors earn income from day labor, working their own agricultural land, and other sources. In this study I classified annual incomes in 2009 from all sources in four categories: 1) less than 50,000 BDT (720 USD) per year, 2) 50,000 to 100,000 BDT (720 to 1,441 USD) per year; 3) 100,000 to 200,000 BDT (1,441 to 2,882 USD) per year; and 4) more than 200,000 BDT (2,882 USD) per year. Approximately 55 percent of fishers had an annual income of less than 50,000 BDT and 45 percent of the fishers had income between 50,000 and 100,000 BDT. In fact none of the fishers had an annual income that exceeded 62,000 BDT (893 USD) from all sources. I found that 100 percent of paikars had annual incomes between 100,000 BDT and 200,000 BDT; 93.3 percent of beparies had annual incomes between 50,000 BDT and 100,000 BDT; 66.7 percent of arotdars had annual incomes greater than 200,000 BDT; and 100 percent of retailers had an annual income between 50,000 and 100,000 BDT. Figure 7 illustrates that fishers had the lowest incomes in the market chain. Small investors in the market chain, such as beparies, paikars, and even retailers had highly satisfactory incomes. It is well known that arotdars are the big investors in the market chain and accordingly they receive the biggest profits.

In the survey I asked respondents to estimate their average annual income in the previous 3 years (2006 through 2008). The aim was to determine whether respondents reported any increases in income between this period and 2009. Figure 8 shows that 65 percent of fishers reported an average annual income during the years 2006-2008 below 50,000 BDT and 35 percent reported an income between 50,000 and 100,000 BDT. In comparison, all arotdars reported an income between 100,000 and 200,000 BDT. A comparison of Figures 7 and 8 shows that in 2009, 10 percent more fishermen reported an income of 50,000 to 100,000 BDT than reported this level of income for the years 2006-2008; 50 percent of the paikars reported an increase in their income; 67 percent of the arotdars reported an increase in their income to more than 200,000 BDT. When comparing average annual income in the 2006-2008 periods with annual income in 2009, the incomes of paikars and arotdars grew more than the incomes of the other actors. This suggests that the fish-market chain benefits paikars and arotdars more than other members of the chain; fishers, in particular, are the most deprived. Indeed it has been suggested that it is essential to lessen the role of middlemen in order to increase the incomes for the fishers (Katiha and Chandra 1990).

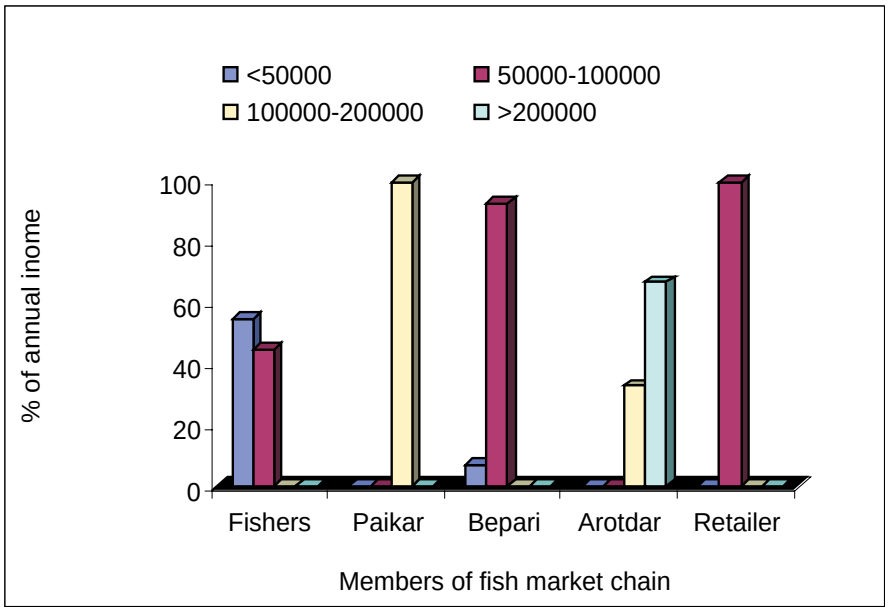


Figure 7: Annual income of members of the fish-market chain in 2009 (from recall)

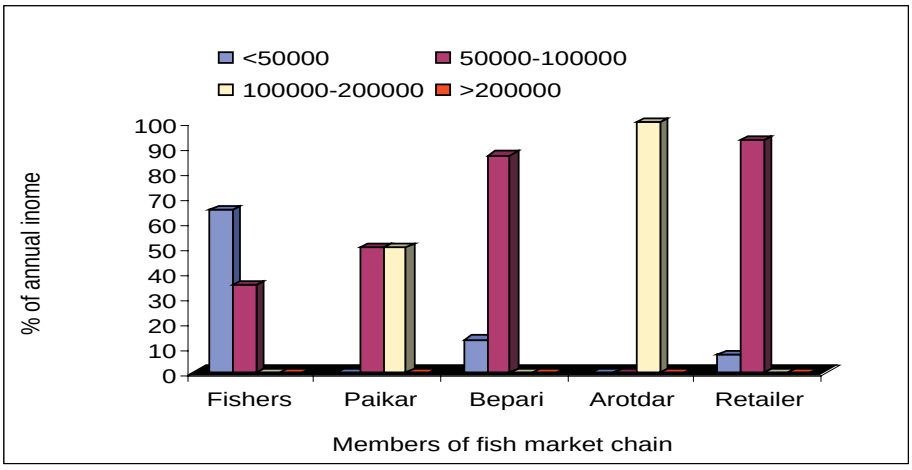


Figure 8: Average total annual income of members of the fish-market chain between 2006 and 2008 (from recall).

To further clarify the economic status of members of the fish-mark chain I also investigated studied major food items consumed. Here I consider four key food items: 1) fish, 2) meat, 3) lentils (*dal*), and 4) milk. I define food consumption as the average number of days a particular food was consumed in a month. I found that fishers consume fish only 12.5 days per month and retailers 12.93 days per month. In comparison arotdars consume fish 25.5 days per month. In all 4 food categories fishers and retailers consume less of each item than other members of the chain. Arotdars followed by paikars consumed the most of each item and beparies were in between. Discrepancies in consumption are depicted in Figure 9.

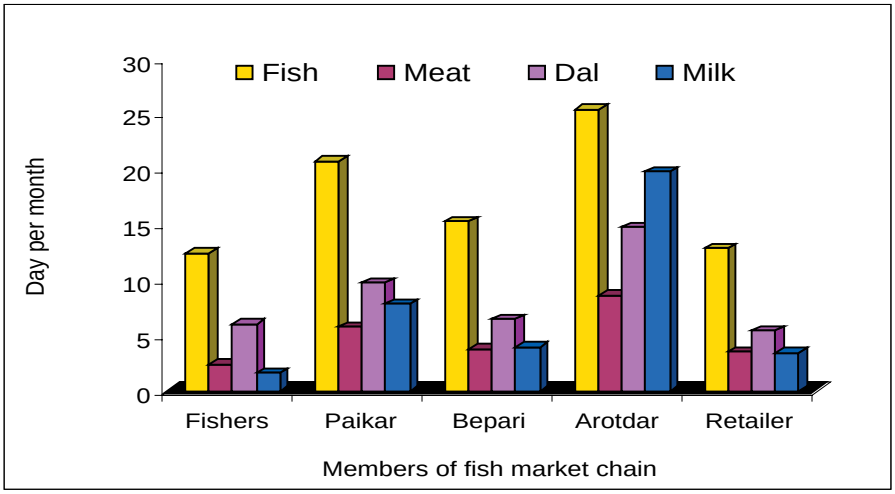


Figure 9: Food consumption among members of the fish-market chain (average number of days per month each food is consumed).

Impact of High-value Fish Species on the Market Chain

Every fish species has market value, but prices vary according to species. Low value fish have short market chains (from fisher to nearby consumers), while higher value fish have longer market chains as they make their way to wealthier consumers in urban areas. I observed that some high value fish species, e.g. modhu pabda (*Ompak pabda*), tengra gulio (*Mystus cavasius*), ruhu (*Labeo rohita*), bowal (*Wallago attu*), tengra (*Batasio tengara*), batashi (*Pseudeutroptus atherinoides)*, baim (*Mastacambelus armatus*), tara baim (*Macrognathus sculeatus*), kal baosh (*Labeo calbasu*), go through longer market chains. These fish are highly valued for their taste, high protein content, and ability to maintain freshness for a long period of time; they are well received by most consumers. These fish species have a longer market chain with many intermediary steps and many actors involved in their processing. As a result of this longer market chain, the marketing of high value fish employs more people than that of low value fish. The longer market chain which employs more people also means that the end price is higher. As a result, even though the cost to consumers is higher, fishers receive less benefit from high value fish than do the numerous middlemen. High valued fish impact the market chain by providing more employment opportunities, but the chief beneficiaries from these fish are powerful intermediaries.

Alternative Market Chain and Perceived Barriers

I did not find that any alternative market chains existed in the study area; fishers have no choice but to sell their catch through traditional markets. I observed that fishers catch fish from beels, khals, and rivers near their homes. I also observed that the fishers tended to sell their fish to paikars near fishing sites because their small catches did not make it profitable to transport them to market. However, by selling to nearby paikars they received lower prices. For their part, paikars sometimes form syndicates to group their fish into larger catches in order to fetch higher prices. So, the lack of alternative market chains influences the income of the paikars as well.

Conclusion

According to my findings, fishers lack bargaining power, which allows middlemen to control the fish-market chain. Fishers are the poorest actors, with the lowest annual incomes in the fish-market chain. The main constraints they face are a lack of bargaining power and access to market information. Arotdars and paikars have the highest incomes and economic status and hence benefit the most from the existing market chain. Beparies hold an intermediate position, while retailers are only slightly better off than fishers. Fishers have not been able to maintain, let alone improve, their comparative economic status over the years.

A central problem is that the existing fish-market chain is fully controlled by the private sector and government supervision is poor. I found that most bodies of water were owned by members of the local elite, politicians, and other non-fishers. Fishers are not able to lease any of the open bodies of water and open access fisheries no longer exist. Fishers' abilities to access water resources are thus limited, giving them few opportunities to catch fish for enhancing their incomes.

Fishers' incomes are not only limited by their position in the market chain but also by the fact that fish resources are declining. As a result their daily catches have decreased in size.The small size of their catch, the distance to market, and the lack of facilities for preserving fish forces fishers to sell their catches to nearby paikars at lower prices than they would fetch at a market. Moreover, fishers are often illiterate, lack training in other occupations, and have few alternative income sources. They do not know about primary methods for preserving fish, and have little market information. Intermediaries in the fish-market chain are very powerful and they have established a market chain that exploits fishers. Fishers cannot go directly to secondary markets to sell their catch due to the constraints described and the existing market-chain system.

Recommendations

In Bangladesh the fish-market chain is totally controlled by the private sector and the government has little ability to manage it. Government agents have not taken any steps to establish a market chain that would benefit low-income fishers. In the present market chain, fishers are extremely exploited and their annual incomes are declining. I would like to make a number of specific suggestions to the government for developing and improving the existing marketing chain in order to increase benefits to fishers. These are: 1) establish community managed bodies of water where only fishers are allowed to catch fish; 2) release more fish in open waters every year; 3) improve site specific transportation and preservation facilities; 4) supply non-destructive fishing equipment; 5) reduce the number of market chain steps; 6) support free education up to the Secondary School Certificate (SSC) level and skill development training for alternative income generation; 7) provide fishers with access to bank loans to invest in small businesses during the off season; 8) develop fisher co-operative societies; 9) build roads that connect main bodies of water; 10) provide adequate knowledge on family planning; and 11) develop public-private relationships to improve the existing market chain.

References

Ahmed, M., Rab. M.A. and Bimbao, M.A.P. 1993. Household Socioeconomics, Resource use and Fish Marketing in two Thanas of Bangladesh. Manila, Philippines: ICLARM, pgs. 4-17.

Chowdhury, A. 1993. Socio-economic analysis of fisher community. Mimco, Dhaka: Department of Fisheries.

Coulter, J. P. and Disney, J. G., 1987. The handling processing and marketing of fish in Bangladesh. Overseas Development Natural Resources Institute (ODNRI), *Bulletin* NO.1.

Cunningham, S. 1994. Fishermen's Incomes and Fisheries Management. *Marine Resource Economics* 9(3).

Joadder, A.R. 2008. Socio-economic Condition of Fishers of the "Mail Beel" under Mohanpur Upazila of Rajshahi District in Bangadesh. *Research Journal of Biological Sciences* 3 (10):1178-1181.

Katiha, P.K. and R. Chanda, 1990. Carp fish marketing. *Indian Journal of Aquaculture Marketing,* 4(2):113-118.

M.M.Rahman, M.M.Hossain, S.M.Rahman, and M.H.Alam 2009. Fish-marketing system in Khulna, Bangladesh.

Rahman,A.K.A.,1997. *Fish marketing in Bangladesh: Status and issue.* The University Press Ltd: Dhaka, Bangladesh.

World Bank 1992. A strategy for fisheries development. Fisheries Series Discussion Papers No. 135,Washington, DC: World Bank.

Fisher Livelihoods in the Sundarbans

Khalekuzzaman Sarker[1]

Abstract

In this paper I investigate the livelihood strategies of fishers in two villages of the Sundarbans, a mangrove forest located at the southern extremity of the Ganges River Delta. Data were collected using questionnaires and focus group discussions to elicit responses from area fishers and shrimp enclosure owners. I first note that fishing is a primary occupation for many households in the Sundarbans, and next identify several problems related to fisher livelihoods, including health and sanitation, drinking water, money lending, and natural disasters. I argue that the livelihoods of fishers will improve only with a focus on practical livelihood issues and conclude with recommendations for improving the livelihood conditions of fishers in the Sundarbans.

Introduction

The Sunderbans is the world's largest contiguous mangrove forest, covering about 600,000 hectares in Bangladesh alone. It serves as habitat for around 334 species of flora and 375 species of fauna, including the endangered royal Bengal tiger (Wikipedia 2010). The Sundarbans is a World Heritage site and is composed of three wildlife sanctuaries: Sundarbans East Wildlife Sanctuary, Sundarbans South Wildlife Sanctuary, and Sundarbans West Wildlife Sanctuary. The total area of the World Heritage site is 1,400 square kilometers, out of which 910 square kilometers is land and 490 square kilometers is water (Banglapedia 2005). The three sanctuaries are intersected by a complex network of tidal waterways, mudflats and small islands of salt tolerant mangrove forests. The Sundarbans has been recognized globally for its importance as a reservoir of biodiversity.

Located in the southern extremity of the Ganges River Delta, the Sunderbans plays a significant role not only in the local livelihoods of Bangladesh's southwestern region but also in the national economy. Approximately 2.5 million people live in small villages surrounding the Sundarbans. During certain seasons of the year the area provides a livelihood for an estimated 300,000 people working as wood-cutters, fishermen, honey collectors, and leaf collectors (UNESCO 2010). Recently, population pressure and rural infrastructure development have resulted in rapid depletion and degradation of natural resources and biodiversity, threatening the very survival of the Sundarbans, as well as the livelihoods of many rural people.

The fisheries sector in Bangladesh's coastal zones provides an important source of income and employment. In 2002-2003, a total of 445,000 tons of marine fish were

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harvested in Bangladesh. The coastal zone also accounts for forty percent of total pond-fish production and thirty six percent of inland capture fisheries (MoF 2003).

In this paper I explore the livelihoods of fishers in the Sundarbans, focusing specifically on fishing activities, the local money lending system, and the roles of fishers in resource management. My goal is to provide policy makers and NGO personnel with information that will allow them to implement more effective poverty alleviation programs for fisher communities.

Background

Burigoalini Union in Satkhira District is famous for its mangrove forests that lie directly adjacent to the Sundarbans. Burigoalini Union is sixty five kilometers from the Satkhira District Center. The majorities of people living there are directly or indirectly dependent on fishing, with river fishing and shrimp enclosures providing the main occupations. A large number of women and children also collect shrimp fry and crabs. There are 2,800 shrimp enclosures in the study site, which covers an area of 2,125 hectares. The area has highly productive fisheries.

Little information is available in Bangladesh on natural fisheries and even less is available on fishers and their livelihoods. Policy decisions are often based on national level priorities that tend to overlook the needs of local people, especially the poor, and this poses a severe threat to local livelihoods (Chowdhury 2005).

Fishing is a major contributor to the livelihoods of poor fishers in Bangladesh, including pregnant women. A study of fishers' livelihoods along the lower Khul Patua and Chunar Rivers in western Bangladesh suggests that a majority of fishers are involved in fishing or wild crab harvesting (Ahmed *et al*. 2010).

The Fish Act of Bangladesh 1983 states that no person shall manufacture, fabricate, import, market, store, carry, transport, own, possess or use monofilament synthetic nylon fiber nets (known as *current jal*). The act also prohibits the destruction of, or any attempt to destroy, fishes by the poisoning of waters, as well as the depletion of fisheries with pollution caused by trade effluents or otherwise. Finally, the act prohibits or regulates the erection and use of fixed engines (DoF 2002).

Though laws regarding fishing practices exist, fishers' awareness of appropriate practices (fishing methods, tools, seasons, laws, and so forth) is low. Several studies have determined that set bag net fishing is highly destructive to natural resources (Islam *et al.* 1993, Khan *et al.* 1994), however these nets are still widely used for harvesting post-larvae shrimp. This is because during periods when fishing is banned, fishers have no other options for work. Indiscriminate fishing of wild fish, shrimp, and crabs with high levels of by-catch has an impact on biodiversity in the Sunderban ecosystem. A prohibition against this practice has, however, not been firmly enforced because of the lack of alternative livelihoods for poor fishers, lax enforcement, and personal gains to elites from illegal harvesting.

The WorldFish Center (2008) suggests that money lending has a strong negative effect on fishers' livelihoods. Informal sources of credit still play vital roles in Bangladesh's rural economies. Though moneylenders (*mohajon*) generally lend money at interest rates of 120 to 240 percent per annum, most fishers still resort to them for financing. In order to repay their loans fishers often have to hand over their entire catch to the moneylenders. Often they do not even know the price of fish on a particular day and so are unaware of potential revenues. Although micro-finance institutions and local NGOs provide access to micro credit, a majority of fishers utilize traditional informal loans from moneylenders (WorldFish Center 2008).

In this paper I address three key issues: 1) poverty and fisher livelihoods; 2) the role of fishers in resource management in terms of their fishing practices; and 3) how the local money lending system affects both poverty and resource management. This information is vital for alleviating poverty and creating better fisheries management in the Sundarbans.

Methods

Data for this paper was collected in two villages, Burigoalini and Abadchandipur, located in Shyamnagar Upazila, Satkhira District, which is adjacent to the Sundarbans West Reserve Forest (Figure 1). In addition, I collected secondary data from various sources including the internet, journals, publications, and government and NGO reports. Some demographic data was also collected from Union Parishad sources.

I began data collection by visiting Shyamnagar Upazila and consulting with the Senior Upazila Fisheries Officer, community leaders, and key informants; as well as members of the local government. These initial visits offered me a better understanding of local livelihoods, socio-economic conditions, and fishery activities. Prior to choosing a study area, I made a preliminary visit to two villages in Shyamnagar Upazila. For primary data collection I developed a questionnaire which I used to elicit responses from participants. I drafted a set of interview questionnaires for eliciting desired information from fishers according to a format developed by Mukherjee (1995). I pre-tested the questionnaire by interviewing several fishers; I then rearranged the questionnaire and modified it to reflect the realities of the study site. The final questionnaire included questions about the sample fisher's family size, age, sex, occupation, educational level, fishing practices in rivers and shrimp enclosures, shrimp fry collection methods, and financial and economic situation (Appendix 1).

I selected twenty fishers from each village as respondents for the questionnaire. Out of the twenty respondents in each village, five were shrimp farm owners and fifteen were fishers; about half were male and half female. I selected shrimp enclosure owners systematically in order to have spatial separation between enclosures. Fishers were selected based on their availability for interviews. I also selected fishers according to the diversity of their occupations in order to cover different livelihood patterns in the villages. Respondent belonged to one of three categories: 1) shrimp

enclosure owners, 2) male fishers, and 3) female fishers. The two villages' total number of shrimp enclosure owners was 120, while the total numbers of fishers were 180 males and 100 females. The numbers and category of sample fishers in the two villages are shown in Table 1.

Table 1: Number and type of fishers in each village interviewed in the survey

Village	Shrimp enclosure owners	Fishers (male)	Fishers (female)	Total
Burigoalini	5	8	7	20
Abadchandipur	5	7	8	20
Total	10	15	15	40

After an initial visit and discussions with the selected fishers and shrimp enclosure owners I prepared a data collection schedule. Data collection was done two times per month at the convenience of the respondents. The study was conducted from August to December 2009. I set up appointments to meet with respondents for interviews so that they would be available and conducted semi-structured interviews with each respondent individually. Upon completion of each interview the questionnaire was checked and verified to make sure that answers to each item listed had been properly recorded.

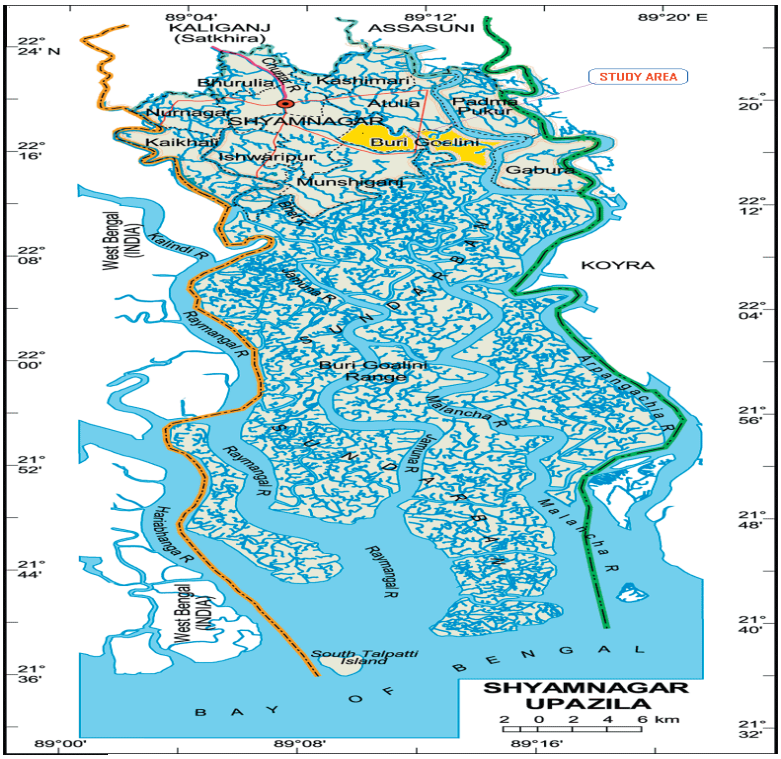


Figure 1: Map of the study area

In order to crosscheck interview data as well as gain an overall impression for each village, I also used participatory research assessment tools such as focus group discussions (FGD). I conducted three FGD in each of the two survey villages (one FGD for each fisher category). In addition to the selected respondents, family members from each group also participated in FGD. I used a checklist of structured questions for the FGD, which corresponded to the topics covered in the individual interviews.

At each stage of the survey, data were checked, edited, coded and transferred into computers at the field site. Some data collected were in local units of measurement familiar to respondents, so these units were converted into international units before transfer to the computer. Data were processed using Microsoft Excel. Preliminary data sheets were compared with the original coding sheets to ensure accuracy during data entry.

Results

Poverty and Fisher Livelihoods

The average family size of surveyed households was 5.6, which is slightly higher than the average of 5.48 for Satkhira District (BBS 1995). The average family size of shrimp enclosure owners, male fishers, and female fishers were 5.1, 5.8, and 5.8 respectively.

Most fishers live in very poor housing conditions. In terms of construction materials, two categories of houses were found, *katcha* buildings (temporary huts made of mud, bamboo, and Nypa palm (*Nypa fruticans)* thatching, with dirt floors) and *pacca* buildings (permanent homes made of bricks or tin sheets). Many poor people live on *khas* (government owned land) where tin housing materials are provided by the local government's engineering department. Out of thirty fishers (both male and female), twenty five live in katcha houses and five live on khas land. All shrimp enclosure owners had permanent pacca or semi-permanent housing.

I classified land holdings into three categories: landless (0 hectares); small (0.01-0.05 hectares); and large (more than 5.0 hectares). I found that among the thirty fishers, both men and women, that five were landless and twenty five were small landowners (own only their homestead). All ten shrimp enclosure owners were large landowners; their landholdings including shrimp enclosures and agriculture land. The average land holding size of shrimp enclosure owners was 22.48 hectares. The largest and smallest land area of the shrimp enclosure owners were 40 hectares and 6 hectares.

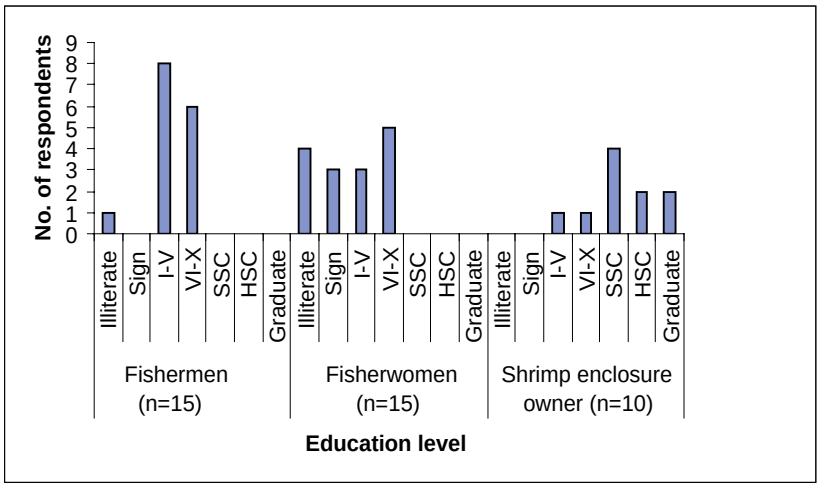
The Sundarbans is vulnerable to natural catastrophes such as cyclones and floods. Frequent cyclones and floods, such as cyclones Aila and Sidr, have destroyed the homes of residents along with other livelihood assets such as fishing gear. During such catastrophes many lives are lost and physical infrastructure, such as roads, bridges, and transport links, are wiped out. The lack of adequate cyclone shelters in the vicinity seriously affects the lives and livelihoods of the fisher community. Cyclones have high costs in terms of human and physical capital. According to

Haque and Blowfield (1997) coastal fishing communities, by their very nature, are more exposed to severe weather hazards than most agricultural areas.

I found that shrimp enclosure owners have the most education, and that fishers have the least. In general the lowest level of literacy for a shrimp owner is equivalent to the highest level that fishers have reached. Of the fishers, the women have a much higher level of illiteracy and semi-literacy (47%) than male fishers (7%); on the other hand, none of the shrimp enclosure owners is illiterate or semi-literate. Among the 15 male fisher respondents, most have been to primary school but no one received a Secondary School Certificate (SSC) or attended any other form of higher education. Approximately 7 percent of male fishers are illiterate and cannot write their names; approximately 53 percent have attended grades I-V; and the remaining 40 percent have attended classes VI-X. Among the 15 female fisher respondents very few went to school. Most of the women attended primary school, but very few completed it. According to my survey, among female fishers 26 percent are illiterate and cannot write their names, nearly 20 percent are semi-literate (can sign their names), about 20 percent have attended grades I-V, and the remaining 33 percent have attended grades VI-X. Among the 10 respondents who owned shrimp enclosures no one was illiterate. Most owners have completed their SSC, a few have received their high school certificate (HSC), and a few have education beyond high school (Figure 2).

From interviews, I learned that health facilities in the surveyed sites are inadequate. There are no government hospitals or health centers near the villages. People frequently suffer from diarrhea, fever and other diseases. Shortage of clean drinking water is a common phenomenon. There are no tube wells in either village, and all interviewees said that they generally drink rain or pond water. Following Cyclone Aila people avoided drinking pond water because of contamination. After Aila some NGOs provided small amounts of drinking water, but the supply is insufficient for the villagers, and it must now be purchased.

Figure 2: Education levels of different household categories in the Satkhira study area.



All the fishers whom I interviewed lacked basic knowledge of health and sanitation and incorrectly answered questions on topics such as water-borne diseases and hand-washing. There were no latrines in many of the households in the villages, and as a consequence residents suffer from various diseases. Shrimp enclosure owners, on the other hand, do not face these types of problems. All the owners I interviewed have built sanitary latrines and reservoirs for capturing rain water near their homes. They also have first priority in taking water from the village reservoirs provided by NGOs. In this way the shrimp enclosure owners unfairly take over essential resources meant for everyone.

I found that primary sources of income are diversified, with fishing (both of cultivated and wild fish) as the dominant income source. When I asked respondents to specify their primary occupations, 70 percent of respondents reported fishing as their primary occupation; 10 percent reported being engaged in agriculture, approximately 5 percent reported different government and non-governmental jobs; and approximately 8 percent reported being involved in some kind of business. Landless and marginal (have only homestead land) fishers reported that their main occupation is daily and seasonal labor in the shrimp enclosures, fish/shrimp fry collection, and crab harvesting. Seventy percent of female fishers were employed by a shrimp processing factory (Figure 3). The main incomes of the shrimp enclosure owners come from shrimp cultivation.

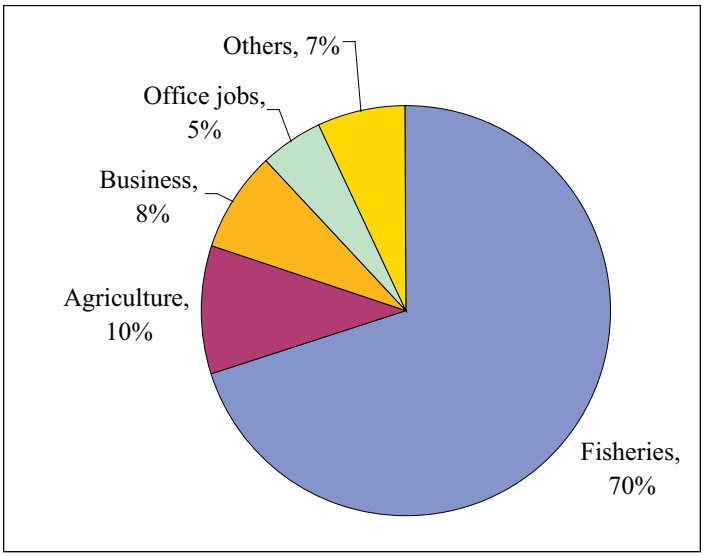


Figure 3: Occupation of households in the surveyed area (n=40)

I also looked at gender differences between male and female fishers. I found that women are engaged in food preparation, child care, washing, family health care, and shrimp processing, while men are in charge of decision making and firewood collection. Almost everywhere else in the world, wood collection in rural areas is traditionally a woman's job. But here in the Sundarban the case is different. When

men enter the forest for crab harvesting, they collect fuelwood at the same time. Women never enter the forest for fuelwood because these areas are very prone to tiger attacks.

As might be expected, fishing is the most important income source for male fishers. In contrast, the main source of income for female fishers is daily labor in shrimp enclosures and factories. Daily wages in the enclosures and factories vary from 70 BDT (1.01 USD) to 130 BDT (1.87 USD), with women receiving lower wages for the same work (Table 2). Harvesting shrimp/fish fry and crabs from natural sources also contributes to the incomes of fishers. Poor people often fish and collect crabs in canals and ditches in the vicinity of their villages as secondary sources of income.

Plate 1: Female fishers working in a shrimp processing factory

Plate 2: Collecting post-larvae shrimp from a natural source

The main expenditures among fishers are for food, followed by health care, clothing and loan repayments. Shrimp enclosure owners save their money for developing their houses, improving sanitation conditions, and other housing assets. The income of female fishers is lower for two reasons: one is gender-based wage differences, and the second is that women are restricted from fishing from boats.

Table 2: Monthly income and expenditure of the study area

	Average Income (BDT)	Average Expenditure (BDT)	Highest (BDT)	Lowest (BDT)
Shrimp enclosure owner	16,700	12,200	24,000	10,000
Fishers (male)	2,487	2,487	3,000	1,800
Fishers (female)	1,473	1,473	1,800	1,000

Most fisher households suffer from food deficiencies two to three months each year. But in 2009 food shortages lasted from four to six months because of Cyclone Aila. During this period no work was available in the shrimp enclosures. From the questionnaire-based interviews, I found that shrimp enclosure owners consume three

meals a day, while fishers, both men and women, only have sufficient food for two meals per day. Shrimp enclosure owners frequently consume fish, meat and milk, but fishers consume only small amounts of fish protein and seldom eat meat or drink milk.

Fishers' Role in Resource Management: Awareness and Fishing Practices

Fishers in the Sundarbans use a variety of different traps (set bag net, push net, cast net, and hooks and lines). From June to August fishing is banned in natural areas and there are also bans on many types of destructive fishing tools, such as set bag nets (*behondi*), monofilament nets, and so forth. During periods when fishing is banned no alternatives sources of food or income are available to fishers. My survey found that all fishers other than shrimp farm owners have to catch fish illegally in order to meet their daily needs when fishing is not tenable. No other alternative income generating activities are available in the off season or during bans. I also found that all the fishers I interviewed are indifferent about fishing laws and regulations-that is, they know about the laws but are forced to disregard them in order to feed their families during restricted periods.

Local fishers have been offered various training and awareness raising programs from the upazila administration and some NGOs in the area. The topics of these programs include health, water and sanitation, and fisheries techniques and laws. Most shrimp enclosure owners that I interviewed have received updated information, knowledge, technology, and training, and have also participated in social and cultural activities related to all of these topics. However, I found that fishers who do not own shrimp farms have less access to these resources. They received no training in fishing methods, even if those trainings were targeted towards them. They are also less aware than shrimp farm owners of prohibitions against fishing in sanctuaries and other fishing laws. Hence, they are less responsive to these rules.

Dadon, the Local Money Lending System

All fishers use credit obtained from different sources. Formal credit is provided by different NGOs (BRAC, Susilon, Gonomokhi, Gono Unnayon Federation). Informal credit also plays major roles in mitigating household financial crises. The interest costs of capital from money lenders are very high in the informal sector (5 to 15% interest rate per month). Fishers have to sell their catches to buyers (*paikars)* through shops/warehouses (*arot)* of moneylenders (*dadondar*) where they are charged a 5 to 10 percent commission on their sales. Strict requirements imposed by banks mean that even larger-scale operators in the fisher community do not have easy access to bank credit.

During the crab harvesting season, fishers depend on NGOs and moneylenders for funds. This is a big problem for fishers. Poor fishers collect crabs and then sell them to moneylenders at a lower rate. The moneylenders then sell the product to the market at higher rates. Ultimately profit from the harvesting of crabs goes to moneylenders.

Conclusion

The present study has identified the livelihoods of the fishers and shrimp enclosure owners who inhabit the western region of the Sundarbans. I found that both male and female fishers live with poverty and do not reach their daily basic livelihood requirements. They are also exploited and oppressed by shrimp enclosure owners. In general, poverty remains a major obstacle to poor fishers' ability to gain and maintain access to critical livelihood assets. Among fishers, respondents expressed that declining income from fishing, due in part to recent cyclones, as well as the low rate of household savings, suggests that fishers likely cannot improve their living standards. Based on these results, I conclude that the livelihoods of fishers can improve only if policy makers focus on practical livelihood problems, such as the lack of alternative income generating activities during bans on fishing; money lending systems and the capture of resources by elites; and serious lacks in infrastructure for health and sanitation, especially during cyclones.

Recommendations

I would like to make a number of specific suggestions for improving and developing fisher livelihoods in the Sundarbans. I observed that alternative income generating activities are non-existent in the study area. The government needs to support free education and skill development training for alternative income generation during periods when fishing is restricted.

Also, though there have been government and NGO sponsored training and social activities directed at poor fishers to increase their awareness of fishing laws, health and sanitation, conservation, and social issues, these have usually been limited to shrimp enclosure owners. Donor agencies should investigate this further and be more vigilant about the allocation of these activities in order to make them more fruitful.

Another reason that poor people in the Sundarbans cannot improve their livelihoods is because they cannot escape the local system of money lending. The creation of special banks or other financial institutions that can supply easy loans to fishers would also help to reduce unfair money-lending and exploitation.

Lastly, a cyclone center is critical to the well-being of residents of the study area. When storms strike the most pressing issue is drinking water. There is an urgent need to establish a large number of rainwater reservoir tanks, so that drinking water is available even in the event of a natural disaster. There should also be filters supplied to clean pond water. The government and NGOs play an important role in supplying pure drinking water at all times.

Acknowledgements

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References

Ahmed, N., Troell, M., Allison, E.H., and Muir, J.F. 2010. Prawn postlarvae fishing in coastal Bangladesh: Challenges for sustainable livelihoods. *Marine Policy* 34:218-227.

Banglapedia. 2005. Asiatic Society of Bangladesh: Dhaka, Bangladesh.

BBS (Bangladesh Bureau of Statistics). 1995. Statistical yearbook. Bangladesh Bureau of Statistics.

Chowdhury, I. 2005. Fishing Communities in Coastal Bangladesh: an Overview of Sustainable Livelihoods. Paper presented at the annual meeting of the American Sociological Association, Philadelphia, PA, Aug 12, 2005. URL: [Accessed January 20, 2010] http://www.allacademic.com/meta/p23421_index.html.

DoF (Department of Fisheries). 2002. Protection and conservation of fish (Amendment) Ordinance, 2002 (Ordinance no. XX of 2002).

Haque, N. and Blowfield, M. E. 1997. Socio-Economic Methodologies for Coastal Communities: The Example of Set Bagnet Communities in Bangladesh; *Information Bulletin* 10, DFID Post-Harvest Fisheries Project: Chennai, India.

Islam, M.S., Khan, M.G., Quayum, S.A., Sada, M.N.U. and Chowdhury, Z.A. 1993. The Estuarine Set Bagnet Fishery. In Studies of Interactive Marine Fisheries of Bangladesh. Bay of Bengal Programme: Madras, India, BOBP/WP/89. 19-50p.

Khan, M.G., Islam, M.S., Mustafa M.G., Sada, M.N.U. and Chowdhury, Z.A. 1994. Bio-socioeconomics assessment of the effect of the estuarine set bagnet on the marine fishes of Bangladesh. Bay of Bengal Programme: Madras, India. BOBP/WP/94 28pp.

MoF (Ministry of Finance). 2003. Bangladesh Economic Survey 2003. Ministry of Finance. June 2003.

Mukherjee, N. 1995. *Participatory rural appraisal and questionnaire survey;* Comparative field experience and methodological innovations. Concept Publishing Company: New Delhi, India.

UNESCO. 2010. World Heritage Nomination-IUCN Technical Evaluation: Sundarban Wildlife Sanctuaries (Bangladesh). URL: [Accessed January 19, 2010] [http://whc.unesco.org/archive/advisory_body_evaluation/798.pdf).

Wikipedia. 2010. Sundarbans. URL: [Accessed January 19, 2010] http://en.wikipedia.org/wiki/Sundarbans

WorldFish Center. 2008. Sunamganj Community Based Resource Management Project (SCBRMP)-LGED. WorldFish Center: Dhaka, Bangladesh

Appendix I
Study on livelihoods of Shamnagar Upazila Fisheries Communities

District		Upazila	

1.0 FISHERMEN IDENTIFICATION

Village-	Union-	Religion-
Name of Head of Household		
Name of Spouse		

2.0 DEMOGRAPHY & HOUSEHOLD INFORMATION (JOINT/SINGLE FAMILY)
2.1 Family Structure:
Family members (No.): Adult Male: Adult Female: Children under 16:

2.2 Occupation and Employment Status Family Members

No.	Name	Age	Sex	Education	Occupation
1					
2					
3					
4					

3.0 FISHERIES

Issues		Answer/Code	Fish/ Shrimp culture	PL Catc hing	Fish/Crutacean sp. catching		
					Crab	Open water (Species)	Gher (Species)
1		2	3	4	5	7	8
3.1	Are any members of your household involved in fishing/fish culture?	1-Yes 2-No					
3.2	How many members involved?	Person (number)					
3.3	What type of fishing gear you use?	1- Caste net, 2- Seine net, 3- Set-bag net, 4- Current net, 5- Gill net, 6- Hook and line, 7- Pots and traps					
3.4	Ownership of fishing net used	1- Own net, 2-Rented net, 3- Net on rent					
3.5	Type of fishi ng boat used	1- Mechanized boat 2- General boat					
3.6	Number & name of months involved in fishing activities?	Months/year					
3.7	Wage rate during fishing season	Tk/day					
3.8	Total earning per day during the season? *(Al members)*	Tk/day					
3.9	Do you faced any constraints related to access to fishing resources?	1-Yes 2-No					
3.10	If yes, specify	1-Govt. ban on fishing for certain period 2 Lack of fishing boat, net etc. 3-Limited access to soft credit 4-Shift of fishing ground due to climate change 5-Others, specify					

3.1 Marketing of Fish

Issues		Answer/Code	Cultured fish	PL	Crab/Shrimp
1		2	3	4	5
3.1.1	Where do you sell your fish?	1-Mohajon (dadonder), 2-Local market 3-Distant market, 4- Other			
3.1.2	Do you taken any money as advanced sell *(Dadon)*?	1-Yes 2-No			
3.1.3	Do you face any restriction to sell fish any where/open market?	1-Yes 2-No			
3.1.4	What is the benefit if you able to sell fish in open market?	1-Get fair price 2-Others, specify			
3.1.5	Do marketing structure sufficiently developed in the locality?	1-Yes 2-No			
3.1.6	If not, specify	1-No developed landing station. 2 -Poor road communication 3-Poor marketing facilities. 4 - Others, specify			
3.1.7	Are fish processing facilities available in the locality?	1-Yes 2-No			
3.1.8	If not, specify	1-Limited number of ice plant in the locality 2-Insufficient supply of storage and packaging materials 3- Lack of electricity, 4-Others, specify			

3.2 Income

	Income heads	Annual income (Tk)
1. Fisheries		
2. Forest		
3. Livestock		
4. Agriculture Land		
5. Others		
6.Total		

4.0 FARM HOLDING

Computer Code	Parameter		Response
	4.1 Total land holding		
	FI: Convert the local measurement unit like Bigha/Pakhi/Kani etc to decimal) 1 local unit ……. …….. decimal	Homestead area	
		Water body	
		a) Cultivated land	
		b) Land rented	
	4.2 Number of livestock and birds (c ïmcú` I cvL-cvLvjxi weeiY) : msL¨vq		-
Buffalo-	Cattle-	Goat-	Sheep-

5.0 INCOME FROM FOREST AND WILDLIFE:

Sl. No.	Issues	Answer code	Fire wood	Honey	Others
5.1	Are any members of your household involved in forestry?	1-Yes 2-No			
5.2	How many members involved?	Person (number)			
5.3	Number of months involved in a year?	Month			
5.4	Total earning during the year *(All members)*	Tk			

6.0 SOCIAL AND TECHNICAL TRAINING AND SKILLS

6.1 Formal/informal Training

Sl. No.	**Training Subject**	**Time (year)**	**Training Provider**	**Application level (Effectively-1, Moderately- 2 Not applied-3)**	**Remarks**
1					
2					

7.0 Additional Livelihood Skills:

What additional livelihood skills (Net making, stitching, handicraft, etc.) you possess?

8.0 FOOD SECURITY

8.1 HH Food Securities

Sl. No.	Issues	Number of month(s)
8.1.1	Number of months HH has adequate food to feed its entire members	
8.1.3	Months most difficult to provide adequate food for HH (put tick mark)	

8.2 HH Food Consumption

Food	Rice	Flour	Potato	Dal	Fish	Meat	Egg	Milk	Dried fish	Leaves	Vegetables	Fruits	Others
Peak													
Lean													

Code: 1 = Daily, 2 = 1-3 days/week, 3 = 4-6 days/week, 4 = 1-3 days/month, 5 = Irregular, 6 = Never

9.0 HOUSEHOLD ASSETS

Sl. No.	Type of assets	Code	Estimated market value of stock (TK) (indicate number where relevant)
1	Houses (1 -Pacca, 2 -Kancha, 3 -Tin, 4 -Bamboo, 5 -Wood, 6-others)	1	
2	Latrine (1-Pit, 2-Sanitary/ring-slub, 3-Pacca, 4-Open, 5-others)	3	
3	Drinking water (1-Tube well, 2-Pond water, 3-others)	2	

10.0 SHOCKS AND COPING STRATEGY

Did your household experience any kind of shocks or crisis during the last one year?	Yes No	1 2	
f yes, please mention the type of shocks faced by your household, and coping strategies adopted for each			

	List of shocks	Indicate shocks specifying magnitude	How it was coped with
1	Serious disease of any member	-	
2	Displacement due to Flood/cyclone/ tornado		
3	Serious problem in Gher		
4	Loss of crop due to flood/salinity		
5	Loss of business/investment		
8	Others (specify)		

11.0 PROBLEMES/RESTRICTIONS IN FISHING:

Sl. No.	Issues	Response
1		
2		

12.0 MEMBERSHIP WITH NGOs /SAMITEES:

Sl. No.	Issues	Response
12.1	Do you belong to any group(1.NGO,2. CBO,3. Cooperatives, 4. Samitee, 5. Fisheries Association, 6. Others)?	
12.1.1	If yes, Name the group/association.	
12.1.2	What are the main functions of the society or association?	
12.2	What benefits the society or asso ciation render to you in connection with your business?	

13.0 GENDER ISSUE

13.1 Gender Involvement in Home-based Activities

Sl. No.	Family members involved (No)	% Of involvement		Remarks
		Male	Female	
1	Food preparation			
2	Child care			
3	Washing and cleaning			
4	Decision making			
5	Fuel and fire wood collection			
6	Family health care			
7	Others			

Name of Enumerator: Date:

Co-management Participation, Livelihood, and Status among Fishers in Baikka Beel, Bangladesh

Bishwajit Kumar Dev[1]

Abstract

Baikka Beel, a 100 hectare water body in Bangladesh, has been identified by local community members in conjunction with the Management of Aquatic Ecosystem through Community Husbandry (MACH) project as an area that could be protected as a wetland sanctuary without disadvantaging poor resource users. The sanctuary is protected through the Baragangina Resource Management Organization, which is comprised of members from 45 villages. In this paper I compare the statuses and livelihood patterns of fishers participating in the MACH project with those not participating. I also assess fishers' awareness and knowledge of state laws and regulations affecting fishing and fisheries management and examine the access that fishers have to water and associated common property resources. Study results suggest that the livelihoods (income, assets, and food security) of MACH fishers are better than that of non-MACH fishers. I also note differences between MACH and non-MACH fishers in terms of resource use, access to alterative income generating activities, socioeconomic status, and social perspectives.

Introduction

In Bangladesh wetlands are highly productive environments that support the livelihoods of millions of poor people. Bailey (1994) notes that fisher's and their families in South and Southeast Asia often are considered to be among the poorest of the poor. Hannan (1994) too states that fishers are traditionally poor and that fishing is considered to be a low-class profession. This despite the fact that for generations millions of rural people have depended on Bangladesh's flood plains, *beels* (deep depressions where water remains yearlong), rivers, *haors* (big depressions or low-lying floodplains that are inundated during the monsoon season creating vast sheets of water) and other wetlands for food and income. About 80% of rural households catch fish for personal consumption or sale (Thompson and Hossain 1998). The four million hectares of inland water bodies and floodplains in Bangladesh are among the world's richest fisheries. The Bangladesh flood plains have been divided up into over 12,000 state owned *jalmohals* or water estates (Islam 1999). These water bodies and floodplains support some 260 fish species (Rahman 1989).

As in most of the world's fisheries, Bangladesh's inland capture fisheries have been declining in recent years. Population pressure and over fishing are key threats, with many species in decline and 54 species threatened (IUCN Bangladesh 2000). Roads, embankments, drainage, flood control, pollution, factories and towns,

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wetlands conversion, and natural siltation, along with over fishing, are commonly cited as causes of declining fish resources (Ali 1997, Hughes *et al* 1994). These trends continue and are very real threats to wetlands and their productivity.

Local community members working with the Management of Aquatic Ecosystem through Community Husbandry (MACH) project have identified Baikka Beel as an area that could be protected without disadvantaging poor resource users. Because the beel is part of the larger Hail Haor, it is argued that these users could fish and collect aquatic plants in other parts of the 3,000 hectares of water that exist in the haor through the dry season (Chakraborty *et al*. 2005). Protection of Baikka Beel as a sanctuary is undertaken by members of the local community who belong to the Baragangina Resource Management Organization (BRMO) (one of eight such organizations overseen by the MACH project and managing different parts of Hail Haor). The BRMO is comprised of members from 45 villages, including fishers, farmers, women and local leaders. BRMO members follow a management plan that was prepared through consultation with local people and approved by a committee comprised of local officials, *union parishad* (lowest administrative unit in rural areas) chairmen, and leaders of community organizations. With the approval of resource management committees and the local government, MACH program members have successfully excavated select spots in the sanctuary and planted native swamp forest trees to restore a greater diversity of habitats.

Since 2004, fishing, hunting, and collecting aquatic plants have been banned in the sanctuary through the assistance of the community. Sanctuary status has played an important role in increasing fish catches in Bikkha Beel to a level above that of other locations in the haor from 170 kilograms per hectare before any interventions to 390 kilograms per hectare. If wetlands are to survive and the people of Bangladesh are to continue enjoying the visual beauty of wetlands and the flavors of about 260 freshwater fish species, more needs to be done. Declaring areas to 'protected' is relatively easy, but there are numerous examples of areas that are protected on paper but where overexploitation and degradation continue unabated. The Protection and Conservation of Fish Act (1950) restricts using certain gear and fishing for juvenile fish; however, in the absence of any incentives for cooperation by either leaseholders or fishers, enforcement and compliance have been poor (Farooque 1997).

The key lesson to be learned from management experiences in Baikka Beel is not that wetlands can be protected and successfully restored, but how this can be done. Cooperation between residents of different economic status, and between local leaders, councilors, and officials, has been vital. A Fisheries Strategy (DoF 2006) created by the Ministry of Fisheries and Livestock encouraged the development of local institutions for fisheries protection and management. The emphasis of this strategy, as well as the National Fisheries Policy and Water Policy (MWR 1999), is reserving wetlands in order to protect fish.

It is important to establish a forum that brings all stakeholders (including community leaders, policy makers, local government officials, local people, small businessmen,

landowners, teachers, and also poor fishing families and the landless) into a system of resource management that values the benefits of fisheries and wetland biodiversity in haor areas. Community-based fisheries resource management has been practiced in a number of projects around the world and in 116 wetlands in Bangladesh (Mustafa and Halls 2006). The expectation of community-based co-management approaches in fisheries resources management is that they wil result in greater security of access and in cooperation leading to enhanced sustainability of resources, more equitable distribution of benefits, improved conflict resolution among fishers, enhancement of fishers' status in relation to other stakeholders, sharing of information between co-managers, and higher levels of voluntary compliance (Pinkerton 1989).

Research aims and objectives

My aim in this paper is to identify the present status of wetland fishers' livelihoods, to determine the benefits they receive from co-management activities, and to gauge their responsibilities in wetland biodiversity conservation and management. Therefore, my objectives are to:

1. To understand the livelihoods of households included in the MACH project as well as households not included in the MACH project in traditional fishing communities;
2. To assess fishers' responses to factors affecting their livelihoods (occupation, education, health, training, credit, market chain, gender development, socioeconomic conditions, and income generating activities);
3. To assess fishers' awareness and knowledge about fish laws and fishery management;
4. To study the access of fishers to water and common property resources.

Background

Hail Haor in the Sreemangal administrative sub-district in northeast Bangladesh is a wetland region fed by fifty-nine hill streams and renowned for its fish and birdlife. The haor covers about 14,000 hectares in the wet season, but in the dry season the area falls to under 400 hectares restricted to about 130 beels and narrow canals. More than 172,000 people in 30,000 households live in sixty villages surrounding the haor. Over eighty percent of those households fish in the haor, many as a regular profession (Chakraborty *et al* 2005). Local people also depend on the haor for grazing and as a wet season source of fodder, building materials, and plants for human food and medicine.

For many years the natural productivity and biodiversity of the haor has been declining because of agricultural drainage, intense fishing pressure, and hunting. The haor has also been threatened by siltation and soil erosion caused by farming practices in the surrounding hills. The life of poor villagers and local residents, who depend on fish and aquatic plants for food and income, has grown increasingly desperate. Households compete fiercely to buy fishing rights from local elites-mostly large landowners and businessmen who control access to beels by purchasing government leases and then charging fishers for access.

Baikka Beel has been reserved by the Ministry of Land as a permanent sanctuary for conserving and maintaining the biodiversity and productivity of Hail Haor. It has since been developed as a safe haven for fish, birds, and other wildlife. Baikka Beel Sanctuary is managed by the BRMO in conjunction with the MACH project through an agreement with the government in order to restore and protect wetland habitat. In addition to protecting the sanctuary members of these organizations educate the broader community concerning the need for its conservation and wise use.

BRMO members seek to ensure sustainable use and protection of the haor and Baikka Beel Sanctuary and to influence resource users to behave responsibly in surrounding areas (CNRS 2007). Members of the BRMO have set up small fish sanctuaries, excavated silted areas, planted swamp forest trees, stocked threatened fishes, stopped harmful fishing practices such as dewatering, and overseen fishing bans when fish are spawning. Baikka Beel has received special protection as a permanent wetland sanctuary and is the largest spawning area of the haor. As a result, the fish catches throughout the haor have doubled and locally extinct fish, birds and plants are returning to the haor.

Study area

The survey was conducted in the Hajipur and Baruna villages of Kalapur Union, part of Sreemangal Upazila in the District of Moulavibazar, Bangladesh. The villages are adjacent to Hail Haor very near Baikka Beel on the west side of the Sreemangal-Moulavibazar Highway, about five kilometers northwest of Sreemangal and twenty kilometers southwest of Moulavibazar Town. Baikka Beel was once famous for its rich capture fisheries, as a very healthy breeding and spawning ground, and as one of the most important fish sanctuaries in Hail Haor. Due to their close proximity to the beel all forty households in the Hajipur and Baruna villages are engaged in fishing as their main occupation; they also depend on their fish catch to meet personal food needs. Gradually declining fish resources have caused village residents considerable hardship. Although some of the households involved with the MACH project are still engaged in fishing, it is becoming a part-time seasonal occupation. This study investigates the livelihoods of fisher households included in the MACH project, as well as those not included in the project in Hajipur and Baruna. Traditionally, residents in both of these villages caught fish throughout the year and sold them to middlemen on the riverbanks or took them to nearby markets by themselves. In this study I look at changes that have occurred as a result of the declining fisheries and the implementation of the MACH project.

Methods

Data for this study were collected using interviews, semi-structured questionnaires and participatory rural appraisal (PRA) methods such as focus group discussions. Forty respondents were selected from among fishers and members of the Federation of Resources Users Groups (FRUG) in the two villages. Twenty of the respondents were participants in the FRUG and the MACH project (MACH fishers), while the other twenty were not participants in either the FRUG or the MACH project (non-MACH fishers). Respondents were interviewed using a semi-structured

questionnaire that utilized blueprint and learning process approaches (Pimbert and Pretty 1995). Fieldwork was conducted over a period of six months from August 2009 to January 2010. All respondents were interviewed, regardless of their participant status. PRA methods were used to get an overview of particular issues such as catching fish, catching fry, marketing, employment, income, credit access, gender disparity, health, and education. In addition, secondary interviews were conducted with as many respondents as possible to cross check answers. Most of the interviews were conducted in fishing areas, the villages, the Resource Management Organization's office, or in local fish markets. Information given by fisher respondents was considered to be representative of their respective households. Therefore, I also collected basic household information and data, including information on income, education, health, capital, occupation, gender issues, and involvement in local institutions (Messer and Townsley 2003).

I also collected secondary data from the Department of Fisheries (DoF), Department of Forest and Environment, Department of Water Resources Development, Department of Agriculture Extension (DAE), Department of Livestock (DoL), WorldFish Center, and other concerned government organizations and NGOs that have been working extensively on fisheries resources management in Bangladesh.

Results and discussion

Participation in Various Development Activities and Response to Laws

Local fishers who participate in the MACH project receive training conducted by the project, the upazila administration, and other NGOs, those non-participants did not receive. This difference may be the reason for divergent responses between MACH fishers and non-MACH fishers when asked about knowledge sharing, previous educational training, and involvement in NGO and governmental programs. Households that participate in MACH projects have more financial and technical support and training. They also have more experience as members of NGOs and government-established organizations. About eighty-five percent of MACH fisher respondents had organizational memberships. Non-MACH fishers, on the other hand, seemed indifferent about the benefits of organizational and institutional memberships. Only thirty-five percent of respondents who didn't participate in the MACH project were members of separate NGO or government-established organization. Data from this study reveals that most of the MACH fishers were regularly updated with information and given opportunities to benefit from knowledge and awareness programs, technology sharing, trainings, and social and cultural activities. Due to the lack of experience with the MACH project, non-MACH fishers spent time catching fish while MACH fishers were involved in self-development activities. Perhaps because they had not been involved in such activities, non-MACH respondents did not perceive themselves to be disadvantaged for not participating. All of the respondents from MACH households were well aware of the fish sanctuary and fish laws, and were moderately aware of and interested in attending trainings and being involved in alternative income generating activities. In addition, a higher percentage of respondents from the MACH group

expressed the importance of participation regardless of gender. On the other hand, many of the non-MACH fishers appeared indifferent about fishing laws and a much smaller percentage showed interest in educational trainings, sanctuary management, and organizational memberships.

Similarly, a smaller percentage of non-participant respondents expressed feelings that increased female participation was important (Figure 1).

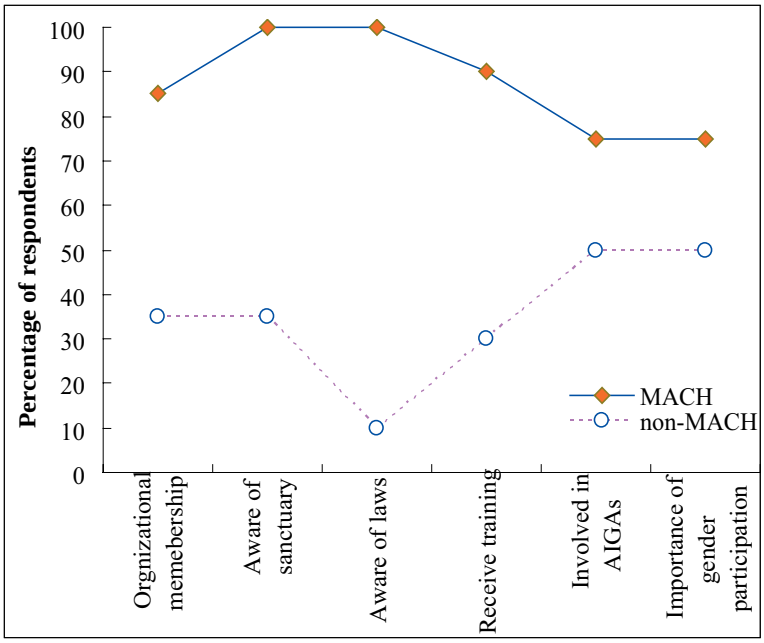

Figure 1: Response by fishers to various development activities and laws

Perceived Usefulness of Co-management Activities

Data from an extensive survey of fishers concerning responsibilities for conserving beel resources reveals that most fishers participating in the MACH project recognize a responsibility to protect existing resources for future use. However, non-MACH fishers reported receiving little information on these issues and responded less frequently on the importance of conserving wetlands. My analysis suggests that the responses of MACH fishers were more thought out and optimistic.

I used nine factors to determine the perceived usefulness of co-management for conserving and managing wetland biodiversity. These are: 1) observing fishing bans; 2) conserving wild birds; 3) beel protection; 4) sanctuary protection; 5) non-use of destructive fishing gear; 6) paying fishing fees; 7) observing annual fish campaigns; 8) seasonal rice cultivation; and 9) controlled use of pesticides. Out of the twenty MACH households, most of the respondents very actively observed closed seasons, supported the conservation of wild birds, and were in favor of stopping the use of destructive gear. In addition, these respondents reported moderate participation in

beel sanctuary protection and management by paying tolls, observing fish campaigns, practicing rice cultivation, and being careful when using pesticides. Non-MACH households, on the other hand, had lower responses regarding these nine factors, as shown in Figure 2.

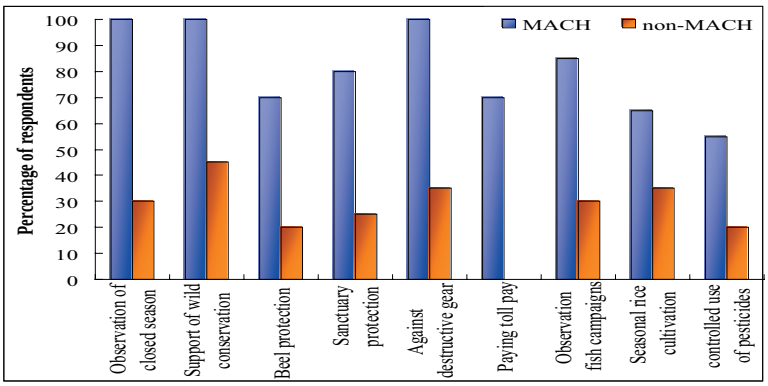

Figure 2: Response by fishers to management and conservation factors

Living Conditions, Livelihood, and Status

Most of the respondents in this study, whether involved in the MACH project or not, experience poor housing conditions. The majority of houses in the villages are constructed adjacent to one another. Landless fishers typically construct their huts on land belonging to their relatives, neighbors, or fellow fishers. Target households in this study were located nearby beel and/or haor areas some distance away from local markets. To determine the quality of housing, a method of categorizing houses by their construction materials was used for this study. Based on the construction materials, homes were categorized into 'temporary' huts made of mud, bamboo, *Nypa* palm leaves for roofing and an earthen floor (*katcha*); 'semi-permanent' houses made of bamboo and wood with a tin roof and concrete floor (*semi-pacca*); and 'permanent'houses made of bricks, roller compacted concrete, and concrete (*pacca*).

The physical condition of homes in Hajipur and Baruna, based on the above categorization scheme, are shown in Figure 3. Out of the twenty households involved with the MACH project, 55 percent live in temporary homes, 35 percent semi-permanent, and 10 percent permanent. In contrast, out of twenty general households not involved in the MACH project, homes are 95 percent temporary and 5 percent semi-permanent, with no permanent homes. In other words, MACH fishers had better quality living facilities.

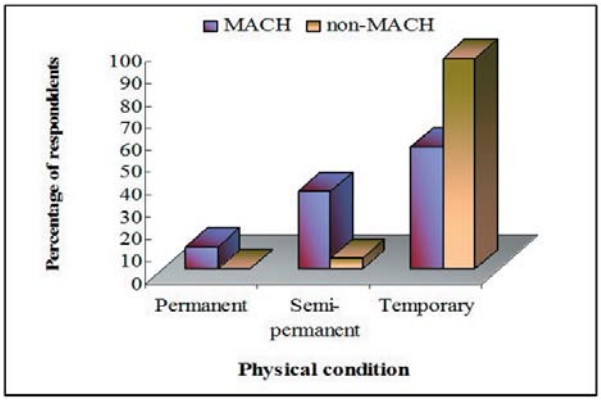

Figure 3: Housing conditions of wetland fishers

Educational status also differed between MACH and non-MACH fishers. Among MACH fishers I found that about ten percent were illiterate and could not write their names, fifty-five percent were semi-literate and could only write their names, and the rest of the fishers (35%) had received some primary education or higher. Conversely, among non-MACH fishers I found that about fifty-five percent were illiterate and could not write their names, twenty-five percent were semi-literate and could only write their names, and the rest of the fishers (20%) had gone to primary school or higher (Figure 4).

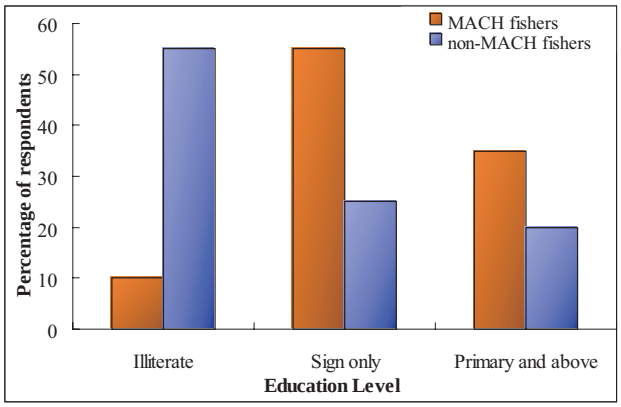

Figure 4: Educational status of respondents

In addition to collecting data on the education level of fishers, I also collected data on the education level of the fishers' families. Out of 136 members of the twenty MACH fisher households, about 1% were found to be illiterate and could not write their names, 14% were semi-literate and could only write their names, 51% had gone to primary school, 17% had studied in secondary school, and 1% went on to tertiary level education. The last 15% were below the age of five ('others'). Out of ninety-one members of the twenty non-MACH households, about 14% were found to

be illiterate and could not write their names, 13% were semi-literate and could only write their names, 38% had studied in primary school, 8% had studied in secondary school and the rest (26%) were aged five-years-old or younger ('others') (Figure 5).

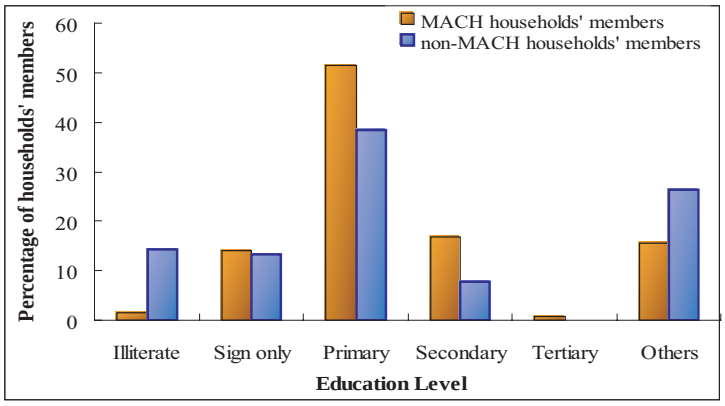

Figure 5: Educational status of households (all household members)

I also analyzed children's education in fisher households. Out of sixty-nine children of the twenty households belonging to MACH fishers, sixty-five (94%) were attending school at different levels, while out of thirty-three children of the twenty non-MACH households, twenty-three (69%) were still getting an education. About 61% of the participant household children that attended primary school completed it, and 30% also completed their secondary level education (up to Secondary School Certificate, SSC), 3% attended tertiary level school (above SSC), and 6% dropped out before completing their primary education (Figure 6).

Children's education levels in non-MACH households were considerably different. Although 58% of the children completed their primary level education (similar to the MACH fisher group), only 12% attended secondary level school (up to SSC), and no children in the sample attended tertiary level school. The most significant statistic is that 30% of the children from non-MACH households dropped out of school before completing their primary education (compared to only 6% for children from MACH households). Rahman (1994) notes that in Bangladesh most of the fishers are illiterate and only a few have a primary level education. This study reveals that most MACH and some non-MACH fishers want their children to receive an education so that they can obtain good employment and thus improve their social and economic status. However, often non-participant fishers pull their children out of school to fish in order to help support the family.

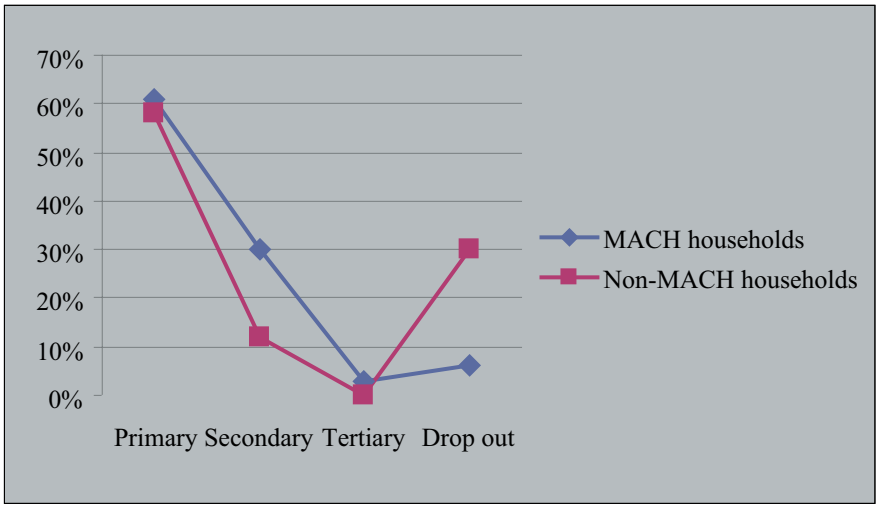

Figure 6: Educational status of respondents' children

Through my study survey I identified the primary occupations of MACH and non-MACH fishers in Hajipur and Baruna villages. Analysis revealed that out of the participant households 30% are engaged in fishing as their main occupation, 20% in livestock rearing, 9% in fish cultivation, 16% in agriculture, 7% in work in government or non-governmental institutions, and 18% in business (Figure-7). Among non-MACH households 63% are directly involved in fishing, 19% in cattle rearing, and only a few households in other activities (Figure 8). These data demonstrate that fishers who participate in the MACH project are engaged in other occupations (cattle rearing, occasional fishing, agriculture, and other businesses) apart from their main occupation of fishing. MACH fishers receive physical and financial supports from the MACH project and others organizations. They also receive trainings organized by the MACH project, the upazila administration, and others NGOs. They thus have a means of gaining financial support from their FRUG cooperatives. However, non-MACH fishers often show indifference about gaining assets, savings, training, and others financial inputs from sources unrelated to fishing.

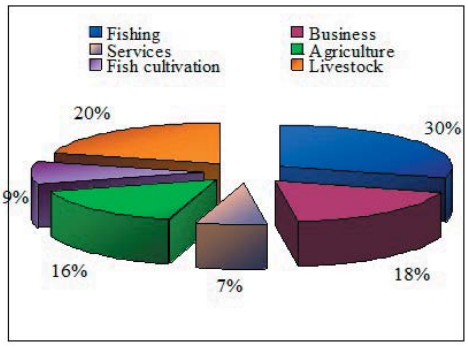

Figure 7: Occupations of MACH households

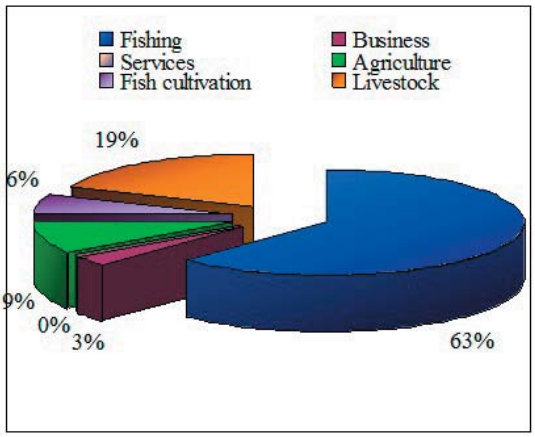

Figure 8: Occupations of non-MACH households

Fishers in the study area face severe health and sanitary problems, which are amplified by the fact that there is no local hospital. Therefore, people often suffer from diarrhea, fever, and other diseases. The nearest health center is at Sreemangal, about eight kilometers away, but there are no efficient means of transportation from the village to this or other urban areas. On the other hand, there is no lack of drinking water in the villages. A few of the wealthier households own tube wells that can be used by neighbors so most fishers use tube-well water for drinking and other household purposes.

Though clean drinking water doesn't appear to be an issue, this study suggests that fishers near Hajiur and Baruna lack knowledge of and proper access to health and sanitation. There are no latrines in some of the households in the village, and as a consequence, fishers suffer from various infectious diseases. As part of this study I analyzed which types of latrines are used by fishers from Hajipur and Baruna and divided them using the following categories 1) permanent (pacca), made of bricks and concrete; 2) semi-permanent, made of bricks and tin or leaves; 3) temporary (katcha), made of packed earth; and 4) no latrine. Among MACH fishers household latrines could be categorized as follows: about 20% permanent, 60% semi-permanent, 20% temporary, and 0% no latrine; among non-MACH fishers categories of latrine were 0% permanent, 30% semi-permanent, 55% temporary, and 15% no latrine (Figure 9).

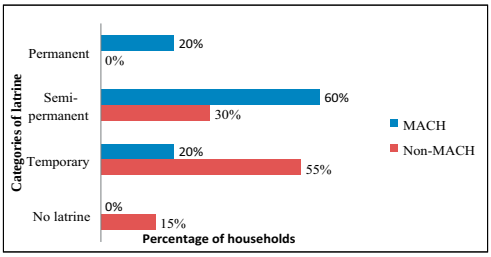

Figure 9: Latrine quality among participant and non-participant households

Socioeconomic Conditions of Fishers

There is no set marketing chain in the villages of Hajipur and Baruna. Marketing channels vary from season to season and place to place. Any person can purchase or sell fish to any other person, however the general pattern of the marketing chain begins with local fishers selling their fish to middlemen, known as *foria.* The *foria* bring fish to wholesalers, who then sell the fish to retailers through auctions. Retailers then sell fish to consumers at market places (Figure 10). There is no licensing system for fish retailers and middlemen. Fishers and fish farmers can sell their fish directly to wholesalers or even to consumers. However, lack of transportation constrains local fishers from selling directly to consumers in the city market.

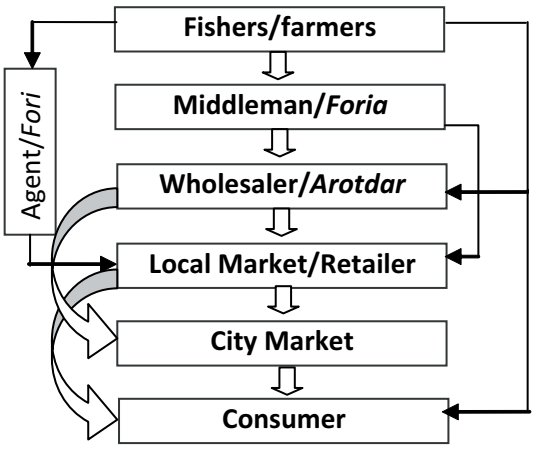

Figure 10: Local supply chain of fish marketing

In this study respondents revealed that most fishers bring their fish catch from the beel by foot to local markets approximately six to eight kilometers away. For this reason, some of the fishers sell to middlemen closer to the beel. These fishers receive the prices lower than those they could receive by selling directly to consumers at the market. Almost all of the fishers find it challenging to make a living given the low cost of fish coupled with decreasing catch sizes. Poor fishers in Bangladesh have challenging lives due to the nature of fishing as a profession. These fishers are made more vulnerable due to factors such as lack of capital, lack of preservation and processing facilities, and uncertainty in fish marketing and pricing systems.

Traditionally although fishing is the major and, in some cases only, source of income for fishers, individuals occasionally undertake a variety of supplementary activities which constitute a substantial part of their annual income. These income-augmenting opportunities, however, are limited. Fishery-related activities carried out in the village include fish marketing and trading, gear and craft maintenance, and repair. In addition, there are limited options for non-fishery related activities such as wage labor in other sectors like agriculture, construction, and livestock and poultry farming.

The highest average daily income among MACH households was 872 BDT (12.52 USD) and the lowest was 125 BDT (1.79 USD). According to my analysis the average daily income of MACH households is as follows: 125-150 BDT (1.79-2.15 USD) (25%); 150-200 BDT (2.15-2.87 USD) (25%); 250-300 BDT (3.59-4.31 USD) (20%); 300-400 BDT (4.31-5.75 USD) (10%), above 400 BDT (5.75 USD) (40%).

The highest average daily income was 256 BDT (3.68 USD) and the lowest was 103 BDT (1.48 USD). My analysis of non-MACH households also revealed that about eighty percent of households had an average daily income of between 103-150 BDT (1.48-2.15 USD), and the remaining twenty percent of the households' average daily income was between 150-250 BDT (2.15-3.59 USD).

The income of marginal fishers has decreased over the years due to reduced availability of carp and other fish in the haor. Moreover, every year more people from neighboring communities are getting involved in fishing as a seasonal or part-time occupation. As a result, fishing pressure is continuously increasing. In addition, environmental degradation caused by late rains, heavy river siltation, agricultural and industrial pollution, and other environmental factors further intensify the problem. The consequence has been a decline in fish populations that has thrown the fishers into hard times.

My analysis of the monthly average incomes of MACH and non-MACH households shows that the gross average income of MACH households is comparatively higher than non-MACH. The highest average monthly income over a six month period was 26,167 BDT (376.78 USD) for MACH households and 7,667 BDT (110.40 USD) for non-MACH, while the lowest was 3,750 BDT (54.00 USD) and 3,083 BDT (44.39 USD) respectively. It is also apparent that although there was a spectrum of monthly incomes, on average MACH households made more than non-MACH households (Figure 11). Income variation between months was also greater for MACH households, while the average monthly income of non-MACH households was more or less steady. In the MACH group, thirty percent of the households depend solely on fishing, with the remaining households generating income from other activities such as agriculture, cattle rearing, fish cultivation, poultry, small businesses, and various other services. On the other hand, sixty-three percent of non-MACH fishers depended solely on fishing. Thus, involvement in alternative income generating activities was relatively higher in MACH than non-MACH households.

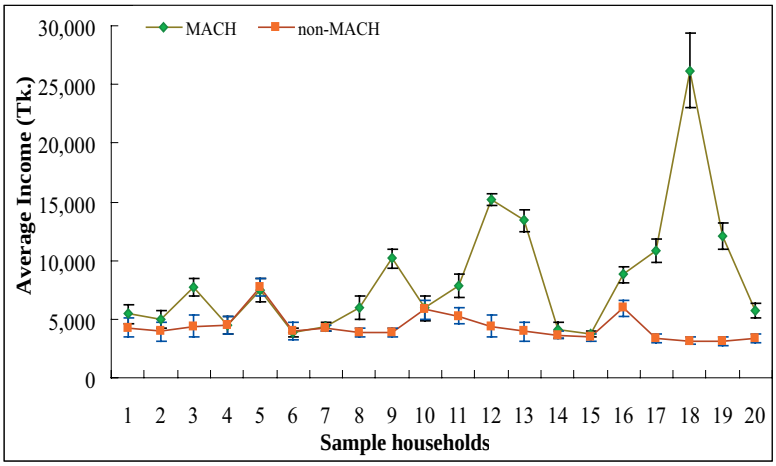

Figure 11: Average monthly income of MACH and non-MACH households from fishing, fishery-related activities, and non-fishery-related activities

In order to understand levels of dependency within fisher households I calculated a dependency ratio by dividing the total number of dependent household members by the total number of household members that earn a living. In this case, dependent members refer to those family members who have no principal occupation (including students). The percentages of earners to dependent members of the fisher's households were 1 to 2.24 for MACH households and 1 to 2.96 for non-MACH households. The data from this part of the study show that out of 136 members of MACH households, about 94 dependents (69%) rely on 42 earners (31%). On the other hand, out of 91 members of households not participating in MACH, about 68 dependents (75%) rely on 23 earners (25%). It is evident that non-MACH fishers have a relatively higher dependency ratio than participant fishers (Figure 12).

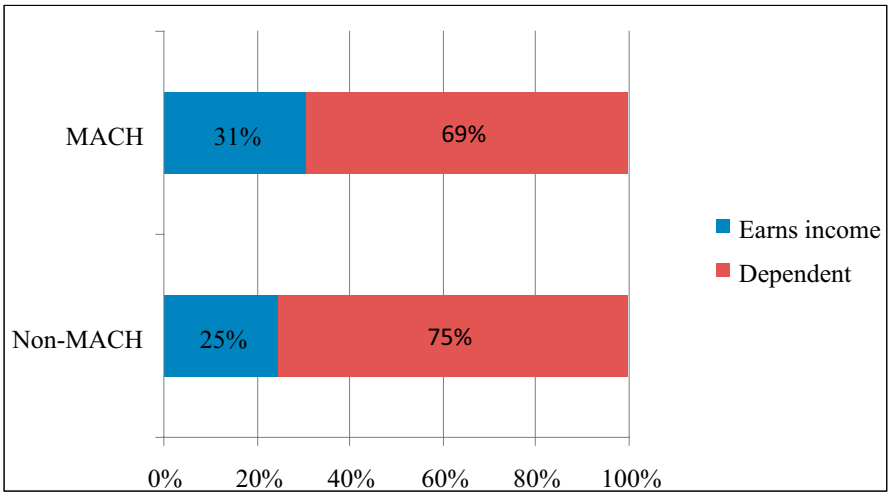

Figure 12: Dependency ratio of among participant and non-participant households

Though ownership of fishing and non-fishing assets among fishers is limited, most MACH fishers have been able to develop their assets through physical and financial support from cooperatives and other organizational activities and projects. Based on a study of the socioeconomic conditions of fishing communities in Bangladesh, Hannan (1994) states that fishers are a highly neglected class in society and lived a-hand-to-mouth. The present study both confirms and challenges Hannan's conclusion. Survey results from this study reveal that MACH fishers who own their nets and boats enjoy self-employment and get comparatively more remuneration than non-MACH or hired fishers. However, I also found that most of the non-MACH fishers cannot afford three meals a day for their families.

The lean season (mid-May to mid-October) is the hardest time of the year for fishers. During this season, there is a fishing ban in Baikka Beel. The beel area shrinks and becomes crowded by aquatic weeds and the floodplain becomes completely dry. The fishable water areas shrink, and most of what remains belongs to the sanctuary. As a result, fishers face unemployment and have little choice but to become day laborers in the agricultural and construction sectors. In addition, some fishers have migrated

to urban areas for work either temporarily or permanently. Meanwhile, some relatively better-off MACH fishers have been able to save some money during the peak-fishing season and through other income-generating activities. This has enabled them to invest their money in fish trading, agriculture, and others business ventures during the off-season. The main constraints on improving fishers' living standards are lack of inputs and persistent debt to the usurious traditional credit system, which binds them to their communities and occupation (Ruddle 1994).

Informal and formal credit markets are sources of financial capital that are available to poor fishers. The chief actors in the informal credit market are local moneylenders, while NGOs are the main providers of formal credit. Fishers in the study area have no access financial credit offered through banks because of a lack of sufficient collateral. Local moneylenders lend money with interest rates for which there is no regulation, meaning that rates vary widely between seasons and from lender to lender. In spite of this, fishers have easy access to credit from moneylenders with flexible repayment terms so these loans can be used for a wide range of needs. On the other hand, national and local NGOs provide credit only to their members and only offer subsequent loans after full repayment. It is often argued that the amount of credit being provided by NGOs is insufficient and is not commensurate with the actual needs of poor people. Fishers reported that the primary problems with the micro-credit systems of NGOs are 1) weekly installment system; 2) inflexibility of credit recovery periods; 3) insufficient amounts of credit to invest in fishing and other fishery-related activities; and 4) high rates of interest. Respondents stated that they generally use loan money to procure inputs for fishing and non-fishing activities like beef fattening, cattle rearing, poultry raising, house building, and marriage expenses. These activities do not generate income on a regular, weekly, or even monthly basis. As a result, fishers must defer repayment of loans. However, due to persistent demands for installments by NGO representatives, many households have to turn to informal credit markets or sell their assets in order to pay back NGO loans. Wealthier fishers in the study areas also act as moneylenders for fellow fishers. MACH fishers are better off, because they have been directed by MACH on how to build cooperatives for savings. They can use cooperative financing for a given time span when needed at a pre-set rate of interest, which is the same for all fishers. In addition, BRMO has helped organize and manage the financial dealings among the cooperatives.

Gender Participation

Gender inequality is prevalent in every sphere of life in the study area. Biases prevail between sexes in regards to household responsibilities, cooking, washing, decision-making, income, and education. From birth, girls are considered less capable than boys in their ability to earn an income and in other ways as well. Unequal treatment of females and gender discrimination are common in Bangladesh's traditional fishing societies. There is a general preference for sons because it is thought that boys will grow up to join their fathers in fishing and will earn money for the family while girls will only add responsibilities and financial burdens.

In fishing communities, girls typically get married between the ages of twelve and fifteen. After marriage, women are encumbered with responsibilities in their own as well as their in-law's households. It is typical for women to eat their meals after feeding everyone else in the family. This study reveals that about sixty percent of cooking and over ninety percent of washing is done be females. Males remain engaged in fishing and non-fishing activities for eight to ten hours a day, while housewives are busy for fifteen hours or longer each day maintaining the entire household. Despite this, society shows considerable reluctance to recognize the importance of the work that women do for their families. Rural women in Bangladesh have long been an unrecognized contributor to economic productivity (Ahmed *et al* 1996). This study shows that forty-five percent of MACH household females and thirty percent of non-MACH females took part in decision-making in family matters. Even if housewives earned some money through income-generating activities like rearing cattle or poultry, in many cases they did not possess the freedom to spend the money for themselves or even for something of their own choice. My analysis suggests that about fifteen percent of females in MACH households and eight percent of those in non-MACH households contributed to family earnings (Figure 13).

Concerning educational status responses suggest that girls have far less opportunity for schooling than boys. About twenty-four percent of girls in non-MACH households get the chance to go to school whereas forty percent of MACH household girls go to school. Fishers have a positive attitude about educating male children, but female education beyond primary school is still unthinkable among most fisher families. This is largely due to early marriages and the lack of social security for female children.

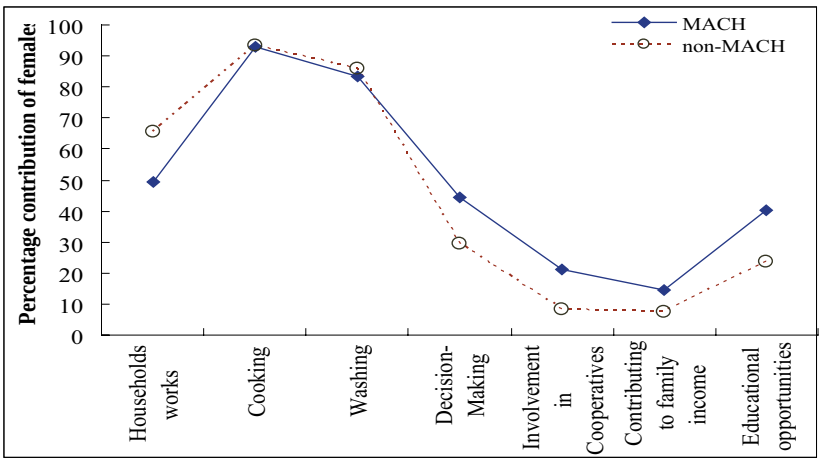

Figure 13: Females' involvement in various household and socio-economic activities

Training programs

Training programs are a part of the repertoires of many NGOs that are meant to empower local resource users. As part of my study I examined training programs

designed within the MACH project that focus on different subjects. Training programs were facilitated through the BRMO and created specifically for the FRUG. In order to analyze the traning programs, I collected data from individuals who are members of the FRUG (here labeled 'MACH fishers'). MACH fishers received training on group management, leadership, nutrition, health, agriculture, fisheries, and livestock organized by MACH, the upazila administration and NGOs such as CARITAS and BRAC. Meanwhile, non-MACH fishers received some similar training from organizations other than the MACH project and they were engaged in cooperatives. The MACH project offered training to FRUG members on how to develop income generating activities so that they can survive periods of lean fishing and be empowered to seek and develop others sources of income. MACH fishers also received training on agriculture (80%), fisheries (75%), and livestock (70%) which are considered common alternative sources of income. Finally, they also received training on group management, leadership, and nutrition and health issues. Conversely, non-MACH fishers had few chances to benefit from these types of trainings. However, non-MACH fishers involved in other organizations and/or cooperatives did have some training opportunities. The figure below shows the trainings attended by both MACH and non-MACH fishers (Figure 14).

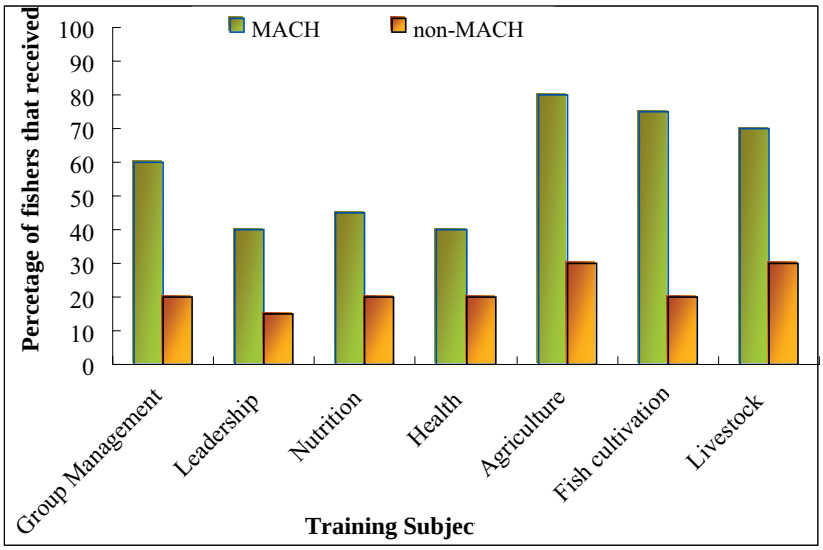

Figure 14: Percentage of fishers receiving various trainings

Conclusion

Future management and development plans for Baikka Beel and Hail Haor need to be geared towards improving the socio-economic condition of local people while also conserving and restoring the environment upon which fisheries (and fishers) depend. The beels adjacent to fishing communities are important components of this region's ecosystem. There are several fisher groups in Baikka Beel that traditionally engage in fishing as their full time occupation. The results of this study suggest that the livelihoods of MACH fishers are better than those of non-MACH fishers, and

according to some indicators far better. There are differences between MACH and non-MACH fishers regarding resource use, access to alternative income generating activities, socioeconomic status, and social perspectives. Development activities appeared to have a considerable impact on the quality of people's livelihoods and fishing practices. Based on the data I've presented in this paper I conclude that MACH fishers are doing better that non-Mach fishers in terms of income, assets, and food security. The problems faced by communities in Baikka Beel likely reflect problems faced by traditional fishing communities throughout the country. To make a positive impact on the socio-economic conditions of fishers, it is essential that living standards, health and sanitation, housing, education, and credit availability are all improved and that there are an increased number of alternative employment and income-generating activities for fishers during off- seasons. Moreover, fishers would benefit from trainings and technical support through different government and non-government organizations.

This study is encouraging because it suggests that the livelihoods of MACH fishers have improved as a result of initiatives and activities supported by the Bangladeshi government, NGOs, the upazila administration, local government agencies, and the efforts of community members themselves. Thus, with careful planning, institutional development and community co-management of natural resources can make a positive impact on the livelihoods of fishers.

In depth, long-term studies are urgently needed to gain greater insights into the livelihood needs of fishers and ways to empower this traditionally marginalized group. Such research is important for biodiversity conservation and natural resource management too. This kind of research is needed both for planning and for raising awareness amongst policymakers, government agencies, NGOs, and the general public. Well-informed natural resource and development planning will lead to increased protection of biodiversity and help people whose livelihoods depend on natural resources find more sustainable livelihood approaches for the future.

References

Ahmed, F., M.H. Rahman and Begus, S. (1996). Role of NGO in upgrading status of rural women: evidences from RDRS programmes in the selected area of Bangladesh. *Bangladesh Journal of Training and Development* pp. 31-35.

Ali, M. Y. 1997. *Fish, Water and People*., University Press, Dhaka.

Bailey, C. 1994. Employment, labour productivity and income in small-scale fisheries of South and Southeast Asia. In: *Socio-economic Issues in Coastal Fisheries Management*. Proceedings of the IPFC Symposium, Bangkok, Thailand, 23-26 November 1993; FAO Indo-Pacific Fishery Commission (IPFC), No. 8. pp. 24-45.

Chakraborty, T. R., Adrika, A. and Hussain, M. B. 2005. Fish and wildlife of the Chanda Beel area. IUCN Bangladesh Country Office, Dhaka, Bangladesh, viii+44pp.

CNRS (Center for Natural Resource Studies). 2007. Year planner 2007. Dhaka, Bangladesh.

DoF. 2006. Inland capture fisheries strategy. Department of Fisheries, Dhaka.

Farooque, M. 1997. Regulatory regime on inland fisheries in Bangladesh: issues and remedies. Bangladesh Environmental Lawyers Association, Dhaka.

Hannan, M. 1994. Fisherfolk organization in Bangladesh. In: *Socio-economic Issues in Coastal Fisheries Management*. Proceedings of the IPFC Symposium, Bangkok, Thailand, 23-26 November 1993; FAO Indo-Pacific Fishery Commission (IPFC), No. 8. pp. 216-222.

Hughes, R., Adnan, S., and Dalal-Clayton, B. 1994. Flood Plains or Flood Plan? International Institute for Environment and Development. Research and Advisory Services, London.

Islam, M. N. 1999. Fishery rights, government revenue and community management. Paper presented at the national workshop on community based fisheries management and future strategies for inland fisheries in Bangladesh. Dhaka, Bangladesh.

IUCN Bangladesh. 2000. *Red book of threatened fishes of Bangladesh*. IUCN (The World Conservation Union), Dhaka, Bangladesh.

Messer, N. and Townsley, T. 2003. Local Institutions and Livelihoods: Guideline for Analysis. Rural Development Division. FAO, Rome.

Mustafa, M.G. and Halls, A. S., 2006 (edited by Malcolm Dickson and Alan Brooks). Community Based Fisheries Management-Fisheries Yields and Sustainability. *Policy Brief 2, WorldFish Center*, Bangladesh and South Asia Office, 4p.

MWR. 1999. National Water Policy. Ministry of Water Resources, Dhaka.

Pimbert, M.P. and Pretty, J.N. 1995. Parks, peoples and professionals: putting 'participation' into protected area management. Discussion paper no. 57. United Nations Research Institute for Social Development, Geneva.

Pinkerton, E. 1989. *Cooperative management of local fisheries*, University of British Columbia Press, Vancouver.

Rahman, A. K. A. 1989. *Fresh water fish of Bangladesh*. Dhaka University, Dhaka.

Rahman, A.K.A. 1994. The small-scale marine fisheries of Bangladesh. In: *Socio-economic Issues in Coastal Fisheries Management*. Proceedings of the IPFC Symposium. Bankok, Thailand, 23-26 November 1993; FAO Indo-Pacific Fishery Commission (IPFC), No. 8. pp. 295-314.

Ruddle, K. 1994. Changing the Focus of Coastal Fisheries Management. In: Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences (ed. R.S. Pomery) pp. 189. *ICLARM Conf. Proc.* 45.

Thompson, P. M., and Hossain, M. M. 1998. Social and distributional issues in open water fisheries management in Bangladesh.

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

Afrin Akter[1]

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[2] . 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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[2]. 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.

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.

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*[3], 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. Baids, in contrast, are low lying areas located between chalas that flood seasonally. Each year some baids are inundated with water from rainfall and flooded rivers. During most of the year, low baids that remain filled with water are used for fishing. High baids, on the other hand, are used for cultivation. During high tide, water flows through channels between rivers and beels.

[3] .A type of administrative district denoting a land area within which there may be one or more settlements.

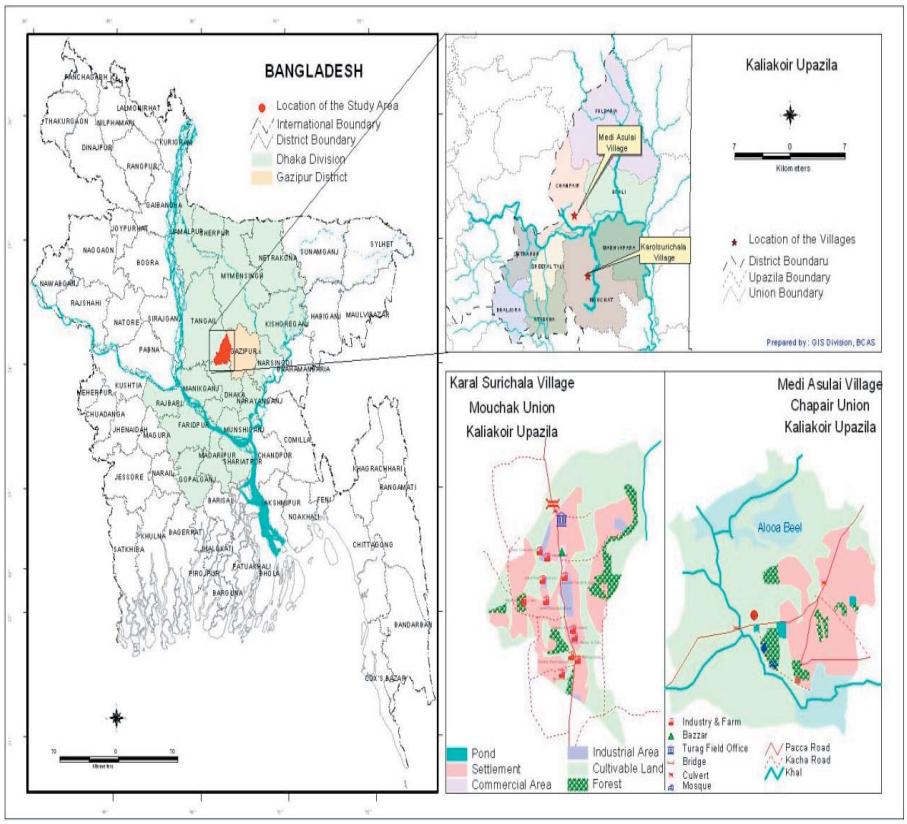

Figure 1: Map of study area

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 Chapire 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).

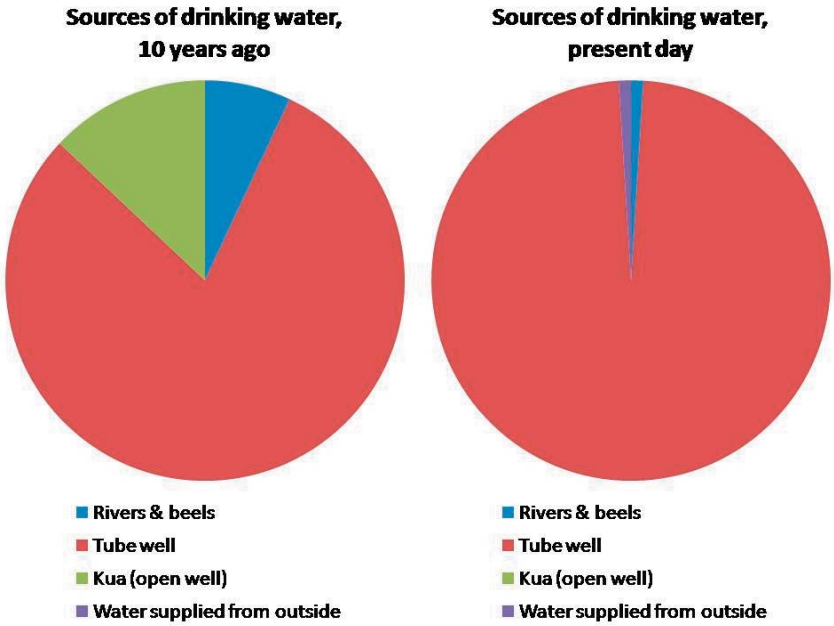

Figure 2: Sources of drinking water in study area, 10 years ago and present day

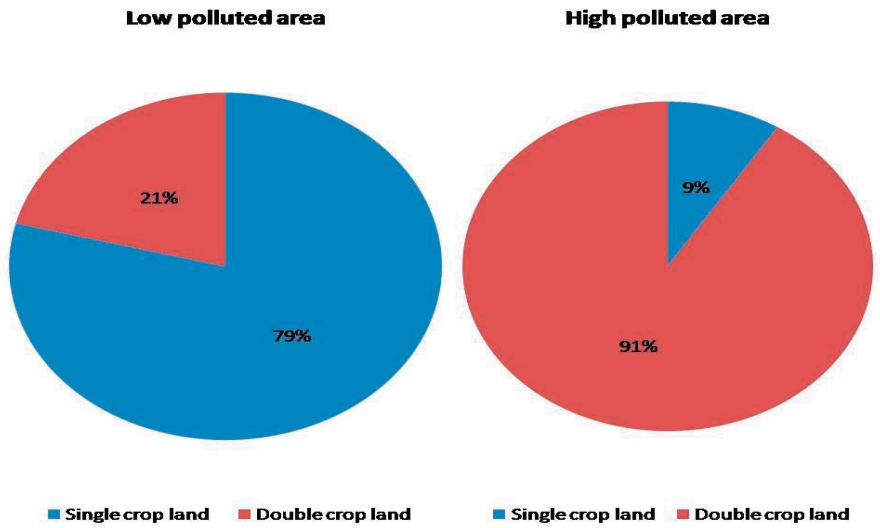

Figure 3: Intrusion of polluted water into croplands in low and high polluted areas

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

Name of diseases	Increase in cases	Same	Decrease in cases
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.

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

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 Mokesh Beel

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

Acknowledgement

I would like to express my indebtedness and deepest sense of gratitude to my reverent teacher Dr. Jefferson Fox, from East West Center for his keen interest, untiring efforts, active guidance, constant encouragement and thoughtful suggestions throughout the progress of my research report.

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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.

Non-timber Forest Products and Livelihoods in the Sundarbans

Fatima Tuz Zohora[1]

Abstract

The Sundarbans is the largest single block of tidal halophytic mangrove forest in the world. The forest lies at the feet of the Ganges and is spread across areas of Bangladesh and West Bengal, India, forming the seaward fringe of the delta. In addition to its scenic beauty, the forest also contains a great variety of natural resources. Non-timber forest products (NTFPs) play an important role in the livelihoods of local people in the Sundarbans. In this paper I investigate the livelihoods and harvesting practices of two groups of resource harvesters, the bauwalis and mouwalis. I argue that because NTFP harvesters in the Sundarbans are extremely poor, and face a variety of natural, social, and financial risks, government policy directed at managing the region's mangrove forest should take into consideration issues of livelihood. I conclude that because the Sundarbans is such a sensitive area in terms of human populations, extreme poverty, endangered species, and natural disasters, co-management for this site must take into account human as well as non-human elements. Finally, I offer several suggestions towards this end.

Introduction

A biological product that is harvested from a forested area is commonly termed a "non-timber forest product" (NTFP) (Shackleton and Shackleton 2004). The United Nations Food and Agriculture Organization (FAO) defines a non-timber forest product (labeled "non-wood forest product") as "A product of biological origin other than wood derived from forests, other wooded land and trees outside forests" (FAO 2006). For the purpose of this paper, NTFPs are identified as all forest plant and animal products except for timber. The harvesting and processing of NTFPs provides major employment opportunities to poor rural populations worldwide. In Bangladesh, this amounts to a contribution of about 1.3 billion BDT (18.7 million USD) annually to the economy and employment for nearly 300,000 people (Basit 1995).

Bangladesh is home to the world's largest mangrove forest, the Sundarbans, which is not only beautiful to look at, but also contains a great variety of natural forest resources. The Sundarbans plays an important role in the economy of the southwestern region of Bangladesh, as well as in the national economy. It is the single largest source of forest products in the country, constituting forty one percent of total forest revenue and about forty five percent of all the timber and fuelwood outputs of the country (FAO 1998). Considerable employment and income

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generation opportunities for at least half a million poor coastal people come from the various NTFPs and tree plantations of the Sundarbans. Besides these productive functions the forest also provides natural protection against cyclones to the coastal population of Bangladesh (Banik 2004).

Harvesting from the Sundarbans is the traditional occupation of many people living along the periphery of the forest. This paper attempts to better understand the livelihood conditions of two groups of resource harvesters, *bauwalis* and *mouwalis,* and to investigate their harvesting practices in the forest. Bauwalis are harvesters of *golpata* leaves (*Nypa fruticans*) and *goran* wood (*Ceriops decandra*), which is used as fuelwood. Mouwalis, on the other hand, are harvesters of honey and wax. For clarity, in the remainder of this paper I refer to bauwalis as "wood harvesters" and mouwalis as "honey harvesters". Focusing on these two groups of harvesters, I seek to answer the following research questions: 1) what is the livelihood condition of the NTFP harvesters; 2) are there any possibilities for alternative income activities; 3) to what extent are harvesters dependent on moneylenders; 4) which NTFPs are preferable to harvesters and why; and 5) what are current rules for NTFP gathering, and do harvesters try to follow these, why or why not?

Background

The Sundarbans is the largest single block of tidal halophytic mangrove forest in the world. The forest lies at the foot of the Ganges and is spread across areas of Bangladesh and West Bengal, India. It covers 10,000 square kilometers, of which about 6,000 square kilometers are in Bangladesh. Thirty percent of the Sundarbans is comprised of water bodies and the area is divided by three rivers, the Kalindi, Raimangal and Hariabhanga. In addition, the forest is inundated regularly by tidal water, which shapes the area's floral diversity, wildlife, human livelihood patterns, and forest management. Though the Sundarbans has a human population of over four million, much of the area is free of permanent human habitation (FAO 1998).

Table 1: Timber trees and non-timber forest products harvested from the Sundarbans forest

	Bengali name (common name)	Scientific name	Type of resource/Uses
Timbers trees (harvested until 1989)	Sundry	*Heritiera fomes*	--
	Keora	*Sonneratia apetala*	--
	Kankra	*Bruguiera gymnorhiza*	fuelwood
	Passur	*Xylocarpus mekongensis*	furniture making
	Gewa	*Excoecaria agallocha*	--
Non-timber forest products	Golpata	*Nypa fruticans*	leaves / thatching
	Goran	*Ceriops decandra*	Fuelwood
	Keora	*Sonneratia apetala*	fuelwood/fruit
	sun grass	*Imperata cylindrica*	Thatching
	Hental	*Phoenix paludosa*	leaves/thatching
	Hogla	*Typha elephantica*	Leaves
	Malia	*Cyperus javanicus*	bedding mats
	various mangrove barks	--	Tannin
	medicinal plants	--	medical treatments
	honey and beeswax	--	--
	Fish	--	--
	Crabs	--	--

The Sundarbans was declared a reserve forest under the Forest Act of 1927, so entry into the forest is restricted by the Forest Department. Previously, timber harvesting took place in the forest, but was banned in 1989 (Banik 2004). At present, only NTFPs are harvested from the forest. Table 1 lists the major timber varieties harvested until 1989, as well as the NTFPs currently harvested.

People living around the Sundarbans depend on the forest in many ways. They are generally poor and have little education. They harvest NTFPs from the forest for personal use in the household, as well as for sale in the local market. Golpata is known as "poor man's roofing tin" because the poor coastal people use the leaves as a thatching material. Goran, on the other hand, is used as a fuelwood, as it has a very high calorific value and burns with little smoke. People also harvest honey and wax from the forest, which constitutes approximately fifty percent of the honey production in Bangladesh (Zmarlicki, 1994).

Harvesting patterns in the Sundarbans are strongly seasonal. NTFP harvesters harvest golpata and goran during the winter season and harvest honey and wax during summer. During other parts of the year, when not engaged in harvesting NTFPs, people harvest fish, crab, and shrimp fry. In addition, harvesters sometimes engage in agricultural work, shrimp farming, and other small businesses. However, they always wait for the next harvesting season, when they borrow money from moneylenders (known as *mohajons*) and NGOs so that they can harvest NTFPs. Harvested NTFPs,

are then sold to moneylenders at a low rate. In addition to moneylenders, several NGOs[2] that work in the area also provide funds, however, they concentrate primarily on micro-credit for the very poor to improve their livelihoods.

Methods

Study area

I conducted this study in the Satkhira Range of the Sundarbans. Bordered by agricultural land to the north, the Khulna Range to the east, the Indian Sundarbans and twenty four *pargana zila* (districts) to the west, and the Bay of Bengal to the South, the Satkhira Range is the largest administrative range in the Sundarbans (Banik 2004). The Satkhira Range lies within the Shamnagar Upazila of Satkhira District (Figure 1). Shamnagar Upzila consists of thirteen union parishads, with a total population of 313,781 people. About 14,588 people are involved in agriculture, forestry, and livestock, while 8,135 people are engaged in fishing (BBS 2001)

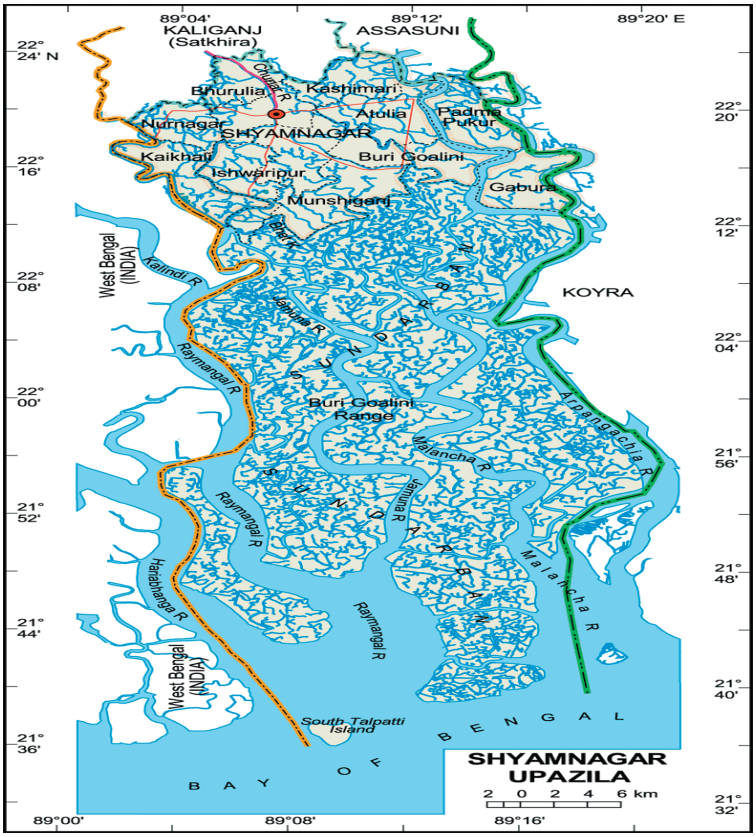

Figure 1: Map of the study area

[2]. NGOs include: BRAC, Noabeki Gonomukhi Samabay Samity, Shushilan, LEDARS, Setu, CARITAS, Nakshi Kantha Mohila Unnayan Sangshtha and Bharasha

Data Collection and Field Techniques

I collected primary data from September 2009 to November 2009. I used questionnaires to profile the community and to learn about NTFP harvesting practices. I chose to collect data in Gabura Union, Atulia Union (Noabeki market), and Burigoalini forest station because most harvesters live in the area, and they come to the Burigoalini forest station to obtain boat licenses and harvesting permits.

I began collecting data at the local forest station office in September. I also collected data in Gabura Union and Atulia Union, where I found many wood harvesters preparing their boats for the next harvesting season. Interviewees were selected through opportunistic sampling. Using a semi-structured questionnaire, I conducted interviews and focus group discussions. I narrowed my interviewee sample to only those who were primary NTFP harvesters and who were harvesting on a valid permit. In November, I made my second trip and visited the Atulia Union and Burigoalini forest station offices. The NTFP harvesters came with their boats to the office to get boat licenses and permits. Through opportunistic sampling I selected amongst the harvesters coming to the Burigoalini forest station, and carried out semi-structured interviews and focus group meetings. Using this sampling technique from September to November 2009, I collected data from a total of fifty nine NTFP harvesters belonging to Atulia, Gabura, and Kashimari Unions. I used simple statistic analysis (such as determining means, averages, percentages, et cetera) to analyze the data.

Results and discussion

NTFP Harvesting Rules

The Bangladesh Forest Department has established rules to govern the collection of NTFPs. In the case of golpata, regulations state that it should not be cut during its growing season, that flowers and fruits should not be damaged, and that the central leaf, as well as one supporting leaf of the central leaf should be spared during harvesting. Cutting should be done at least 9 inches (22.5 cm) from the ground and dead or damaged leaves should be removed from the stand during harvesting.

There are two types of goran in the Sundarbans. Those with a base diameter of more than one inch (2.54 cm) are called *bachai goran*, meaning "selected", while those with a base diameter of less than 1 inch are called *khadi goran*. Selected goran is used for simple construction, roof support, wall structuring, and as a brace to keep young seedlings straight. Khadi goran is most often used for fuelwood. About ninety percent of the goran harvested from the Sundarbans is of khadi quality. When harvesting, at least one individual goran stem should be left in the stand.

For honey harvesting Forest Department rules state that the bee colony should not be permanently damaged and the portion containing larvae should be left during harvest. Honey harvesters should not burn the hive and should take care to only harvest the part of the hive containing honey (Banik 2004).

Harvesting Practices

Wood and honey harvesters work separately from one another but both work in groups of five to ten persons, depending on the size of the boat. Moneylenders contract harvesters for a whole season and pay them a fixed amount of money for each harvesting trip. For wood harvesters, one person acts as a leader or head boatman (known as a head *majhi*). During harvesting, wood harvesters act as day laborers, with the head boatman getting a third of the profit. Sometimes the moneylender may act both as a money lender and as a wood harvester, participating in the harvest.

When harvesters enter the forest, they take all of their supplies, such as drinking water, rice, lentils, vegetables, medicine, and cigarettes to last them for two weeks to a month. All of their daily necessities are paid for by the moneylender. They cook, eat, and sleep on the boat. Sometimes they catch fish from the river, which they cook for meals. A harvesting area, or *gher*, is allotted to smaller groups for harvesting during the day, but all of the harvesters reconvene at night and twenty to twenty five boats stay together. Harvesting is done on the banks of small channels. Because the main boats cannot enter these small channels, harvesters use smaller boats or dinghies to carry the harvested material back to the main boat. Harvesters enter the small channels at low tide and return at high tide with harvested products.

Golpata harvesters cut the base of the leaf and take only an upper seven to ten foot portion of the tree. Then they divide the whole leaf through the midrib and pile them one on top of the other. Harvested golpata is purchased from the government by weight, but sold to the markets by number. Eighty golpata stems make a *pon* and sixteen *pon* equals one *kahon*. After harvest, the product goes to the moneylender and the wood harvesters prepare for the next trip (Banik 2004).

Wood and Thatch Harvesting

The harvesting season for golpata and goran fuelwood runs from November to March. An annual harvesting area is known as a coupe. Every year one forest officer is assigned to each coupe. This officer is assisted by one other coupe officer, some forest guards, and boatmen. At the beginning of the season, the Management Plan Division estimates the harvestable product based on coupe area sampling and guidelines prescribed in the Integrated Resource Management Plan for the Sundarbans Reserved Forest, which is produced by the government. Based on this estimate, the Deputy Chief Conservator of Forests from the Forest Management Plan Division makes a decision on the total amount of harvesting allowed. Wood harvesters who want to obtain a new boat license send a request to the Divisional Forest Office (DFO). With permission from the DFO, the station officer issues new licenses and renews old ones on a first come first entry basis. One inspection officer from the DFO's office checks licenses while cross checking boat dimensions. Government revenue for a single boat license certificate is 3 BDT (0.04 USD) for each twenty five cubic maund[3] (932.5 kilograms or 2057 pounds). Entry permits into the forest are given on the 12th, 13th, 14th, 27th, 28th, and 29th of each month of harvesting (Doe and Hasan 2009).

[3]. A maund is a unit of weight. One maund is equal to 37.3 kg or 82.28 lbs.

Table 2: Duration boats are permitted to stay in the Sundarbans (Forest Department 2009)

Boat capacity (maunds)	Number of wood collectors allowed	Total time in coupe (days)	Time for travel to coupe (days)	Time for boat mill (days)	Time for travel from coupe (days)	Fridays	Total time permitted (days)
25 to 100	2	9	3	1	3	-	16
101 to 200	3	10	3	1	3	-	17
201 to 300	3	14	3	1	3	-	21
301 to 400	4	16	3	1	3	1	24
401 to 500	5	18	3	1	3	1	26
more than 500	5	24	3	1	3	2	33

After coming from the coupe area, the wood collectors must surrender their certificate to the station office. In exchange they receive a certificate of transit for their harvested materials. The station officer issues a forest case for those who do not surrender their certificate. The present government revenue system for goran fuelwood and golpata are shown in Table 3.

Table 3: Revenue system for goran and golpata (Forest Department 2009).

Product	Amount	Revenue inBDT (USD)
Selected goran	one hundred maund	1200 (17.26)
Khadi goran	one hundred maund	1000 (14.38)
Goran stem	one stem	4 (0.58)
Golpata	one hundred maund	400 (5.76)
Golpata central leaf.	one piece	25 (0.36)
Damaged golpata	one maund	10 (0.14)
Golpata (pon)	one pon	9 (0.13)
Golpata supporting a central leaf	one piece	10 (0.14)
Golpata (clump)	one maund	100 (1.44)

If a boat stays for up to three extra days in the forest, the boat is charged an extra twenty five percent of their revenue. For another three days, the charge is an extra fifty percent of revenue. Each boat is allowed to take four *gewa* logs (*Excoecaria agallocha*), two pieces on each side for buoyancy, but a percentage of the revenue is also collected for this wood (Forest Department 2009).

Honey Harvesting

The harvesting practice of the honey harvesters is somewhat different from that of the wood harvesters. During harvesting, one person stays in the boat while the rest of the group follows a leader, called the *sajuni*. They walk in a row into the forest and search for beehives. The person on the left side of the row is known as the *kor*, and the person on the right side is called the *bair sata*. The *katuni*, who cuts the bee hive, and *ariowala*, who carries the pot, remain in the middle of the row.

The main bee species in the Sundarbans is *Apis dorsata*, but sometimes *Apis cerena* are also found. *Apis dorsata* is a giant bee that is very aggressive in nature and cannot be domesticated. On the other hand, *Apis cerena* is small in size, more passive, and more often found in human settlements. Bees move through the forest in different ways. When searching for flowers, they move indirectly back and forth until they reach a flower. However, when the bees travel from the flower to the hive, they travel in a straight line. In the forest, the honey harvesters follow returning bees until they reach the hive. When one person finds a hive, he calls for the others. The group prepares smoke to drive off the bees by burning *hental* leaves wrapped in a bundle, called *karo*. Finally, they cut down part of the beehive for the honey and beeswax (Karim 2009). Previously, honey collectors used earthen pots called *motka* to store honey, but now they use plastic containers.

The Sundarbans contain a great variety of flowering plants, but bees do not harvest nectar from all of them. The main tree species for honey production are listed in Table 4.

Table 4: Main honey producing trees in the Sundarbans (Banik 2004, Basit 1995).

Bangladeshi name	Scientific name	Remarks
kholshi	*Aegicerus corniculatum*	best quality
baen	*Avicennia officinalis*	
kankra	*Bruguiera gymnorrhiza*	
goran	*Ceriops decandra*	common
gewa	*Excoecaria agallocha*	common
jhana	*Rhizophora apiculata*	
keora	*Sonneratia apetala*	common
soela / ora	*Sonneratia caseolaris*	
poshur	*Xylocarpus mekongensis*	
hargoja	*Acanthus illicifolius*	
shingra	*Cynometra ramiflora*	

Ninety percent of the honey and wax produced in the Sundarbans is harvested from the Satkhira Range (Banik 2004). The harvest time is from the first of April to the thirtieth of June. Permits for harvesting are given up to the fifteenth of June.

The total amount of revenue to the government for honey and wax is calculated on the basis of the numbers of harvesters in each boat. Presently, the government revenue system is as follows: each person on a harvesting boat pays 200 BDT (2.88 USD) per month for up to one maund of honey harvested and 150 BDT (2.16 USD) per month for up to one maund of wax harvested. This amount is paid at the station office before harvesting trips. When additional honey and wax is harvested in excess of what was originally paid for, additional revenue is harvested at the same rate without any extra charge (whereas for goran and golpata, additional harvest is charged at double the base rate). No refunds are given if the trip returns empty.

When honey harvesters go to the forest they also gather golpata for thatching to protect their boat's contents from sun and rain. However, in recent years the Forest Department has encouraged the use of plastic sheets for protection rather than natural thatching. When golpata is gathered the Forest Department also collects revenue (Forest Department 2009).

Honey harvesters also use moneylenders to cover expenses for excursions into the forest, later selling harvested products back to the moneylender. The total profit is divided equally among the harvesters, with one share for the boat (this share goes to the moneylender). For example, if there are seven harvesters, the total share will be eight. Harvesters have the right to sell honey to the market, but generally they sell it to the moneylender at the market price. Later on moneylenders sell it to other traders coming from different areas of Bangladesh.

Cultural Practices of Harvesters

Before leaving to harvest, the wood and honey harvesters conduct some religious rituals. Muslims pray to Allah and to the prophet Muhammad. Hindus prepare statues of their goddess, *Bon Bibi*, and pray to her. In addition, they sometimes take a special small piece of red cloth, or paper indicating the blessings from a nearby famous religious person known as a *pir*, or saint, in this case the *Noapara pir*. The wives and mothers of the harvesters also perform some religious activities. They fast and pray for their husbands and sons. All of these activities are for their safety in the jungle while harvesting. All the harvesters take their first step onto their boat in the name of their creator. Sometimes people from one religion will also take on the practices of another before going into the forest. For example, both Hindus and Muslims observe rituals honoring *Bon Bibi* as well as the *Noapara pir* (Karim 2009).

Products from Satkhira Range

As shown in Table 5, the majority of honey, wax and goran fuelwood produced in the Sundarbans is harvested from the Satkhira Range.

Table 5: Total amount of honey and wax production and revenue earned in the Satkhira Range (Forest Department 2009)

Year	Number of permits	Number of honey harvesters	Honey		Wax		Total Revenue (BDT)
			Amount (maund)	Revenue (BDT)	Amount (maund)	Revenue (BDT)	
2008-09	157	1,114	2,910	438,000	547.50	164,250	602,250
2007-08	198	1,452	2,675	535,000	668.75	200,625	735,625
2006-07	227	1,770	3,380	676,000	485.00	253,500	929,500
2005-06	151	1,200	2,051	410,200	512.75	153,825	564,025
2004-05	168	1,305	2,372	474,400	593.00	177,900	652,300
2003-04	132	1,081	2,186	437,200	546.50	163,950	601,150
2002-03	121	963	1,867	373,400	466.75	140,025	513,425
2001-02	84	663	1,358	282,080	339.50	105,370	387,430
2000-01	112	883	1,803	180,300	450.75	67,612	247,912
1999-00	227	1853	3,718	371,800	929.50	139,425	511,225
1998-99	138	1,165	2,330	233,000	582.50	87,375	320,375
1997-98	111	8,71	1,742	174,200	435.50	65,325	239,525

Livelihood Status of the NTFP Harvesters

The demographic profile of the unions studied (Table 7) shows that the average age of NTFP harvesters is more than forty years old for the three unions. This indicates that the younger generation prefers income generating activities other than NTFP harvesting. The average number of family members in Gabura Union (9) is higher than in the other two unions (6 in each).

An average of fifty percent of respondents in Gabura Union was found to be illiterate; this figure is comparatively low in Kashimari and Atulia Union, at forty three percent and thirteen percent respectively. In Kashimari Union twenty one respondents were found to be educated up to secondary school but no one in Atulia or Gabura Union had reached this level.

Table 6: Demographic profile of unions studied

Criteria	Description	Kashimari (N=14)	Atulia (N=31)	Gabura (N=14)
Average age of respondents		40	41	48
Average number of family members		6	6	9
Traditional occupation		Golpata harvest (wood harvesters)	Goran harvest (wood harvesters)	Honey and wax harvest (honey harvesters)

Literacy (%)	Illiterate	43	13	50
	Can only sign their names	22	74	43
	Primary school	14	13	7
	Secondary school	21	0	0
Housing materials (%)	Katcha: clay and wood huts thatched with golpata	86	90	100% (on the riverside in temporary shanties)
	Semi-katcha: clay huts with tin roofs	7	10	0
	Pacca: brick and cement	7	0	0
Ownership of residence (%)	Own	79	87	100 (government land)
	Others	21	13	0
Sanitary latrine facilities (%)	Yes	86	77	100 (open on the river)
	No	14	23	0
Sources of drinking water (%)	pond sand filter	0	81	100
	Tube –well	100	19	0
Access to boat (%)	Own boat	57	32	0
	Moneylender	43	68	100
Years of experience harvesting NTFP (average)		20	25	23

In Kashimari Union, an average of seven percent of interviewees live in brick houses while no one in Atulia Union has a brick house. Eighty seven percent of respondents in Atulia Union live on their own land, while this figure is only seventy nine percent in Kashimari Union.

Considerably high numbers of the respondents found in Kashimari and Atulia Union use sanitary latrines, (86% and 77% respectively). One hundred percent of harvesters in Kashimari Union use tube-well water for drinking; this figure is only nineteen in Atulia and zero in Gabura.

NTFP harvesters sometimes depend on moneylenders for boats in order to enter the forest area; this was most prominent in Gabura Union, which had a one hundred percent dependency. On the other hand, dependency on moneylenders in Atulia and Kashimari Union was sixty eight percent and forty three percent respectively. Respondents had over twenty years experience in all three unions; and the average number of family members going to harvest was 1.0, 1.1 and 1.3 in Kashimari, Atulia and Gabura Union respectively.

This demographic profile of the NTFP harvesters suggests that they have a low standard of living. Rarely do they live in brick houses with proper sanitation facilities. They have to travel long distances to harvest drinking water, regardless of whether it is from a pond sand filter or tube-well. Respondents from Gabura Union

had the worst standard of living of the three unions.

My findings regarding livelihoods in Gabura Union are strongly reflective of the effects of Cyclone Aila, which struck the coast of Bangladesh on May 25th, 2009. The cyclone destroyed houses, livestock, and food and water sources for many people in the study area, especially those in Gabura Union. At the time of my survey the residents of Gabura were found living in temporary sheds. Residents had to cross a big river in order to harvest drinking water, and were using open latrines built on the river. They were unable to go back to their own homes, which were still under tidal water.

Income Status and Dependency on Moneylenders

I collected data on the average daily income of NTFP harvesters from Atulia, Kashimari and Gabura Unions during the off-season, when NTFP are not gathered. Income came from activities other than gathering NTFP. On average, the respondents of Kashimari Union had a higher income than the respondents of Atulia and Gabura Union, as shown in Figure 2. Respondents of Atulia Union earned more than those of Gabura Union, but less than the respondents of Kashimari Union (Figure 2). This data suggests that the respondents of Gabura Union are poorer than the respondents from the other two unions.

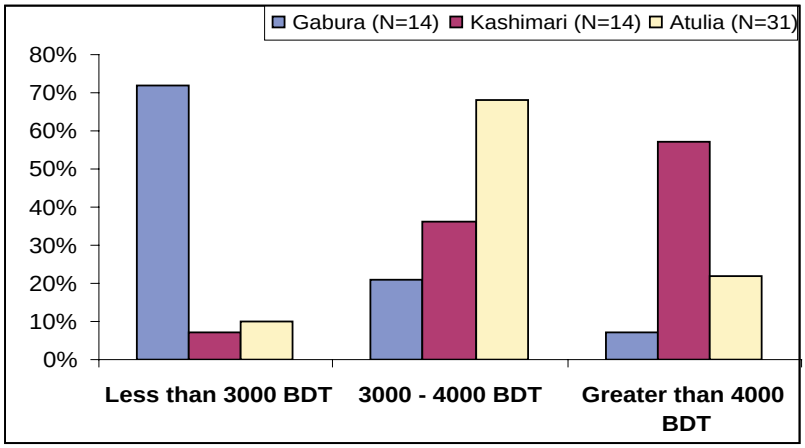

Figure 2: Monthly income status of NTFP harvesters during off-season

During harvesting season, NTFP harvesters depend on NGOs and moneylenders for funds. As shown in Table 8, just less than three quarters of harvesters in Atulia and Kashimari unions depend on moneylenders for loans, while in Gabura Union all the harvesters I interviewed depend on moneylenders for funds. Dependency on NGOs in Atulia and Kashimari unions appears to be higher compared to Gabura Union. Several NGOs work in the study area; they provide funding with the goal of improving the living standards of poor people there.

Table 7: Sources of funds for NTFP harvesters during harvesting season.

Union	NGOs	Moneylenders
Atulia (N=31)	26	74
Kashimari (N=14)	29	71
Gabura (N=14)	0	100

Over the last 8 years, in the Satkhira Range 7,528 people harvested golpata and 14,975 people harvested goran on valid permits (Table 8). However, most NTFP harvesters depend on moneylenders for funds, which causes problems. Harvesters harvest NTFPs and sell them to moneylenders at a low rate, who then sell the products at market at a higher rate, so the profit from NTFPs ultimately goes to the moneylenders. Though this pattern has continued for years, at present it appears that there is the potential for change because many NGOs are now working in the area and harvesters are eager for interest free flexible loans with easy repayment systems. The harvesters have to work in a risky forest environment and so donors should take this into consideration.

Though many people (10 out of 14) in Gabura are members of NGOs such as BRAC, Grameen Bank, or Noabeki Gonomukhi Samabay Samity, the credit facilities of the NGOs are less flexible for harvesters. NGOs strongly enforce timely repayment of loans, which does not fit the income patterns of most NTFP harvesters, as they are in a high-risk occupation that requires a lump sum at the outset. A single harvesting trip

Table 8: Forest product and revenue collection records from Satkhira Range over the last nine years (Forest Department 2009)

Forest Produce	Year	Number of Permits	Number of persons	Amount of produce	Revenue collected (BDT)	Remarks
Golpata (maund)	2008-09	347	1,940	140,211	560,844	
	2007-08	-	-	-	-	Extraction banned in 2007 -08 due to Cyclone Sidr in 2007
	2006-07	255	1,080	92,951	371,804	
	2005-06	326	1,341	108,799	435,196	
	2004-05	165	699	60,566	242,264	
	2003-04	140	625	56,888	227,552	
	2002-03	182	836	78,432	470,592	
	2001-02	222	1,007	95,422	417,828	
Goran (maund)	2008-09	-	-	-	-	Extraction banned in 2007 -08 and in 2008-09 due to Cyclone Sidr in 2007
	2007-08	-	-	-	-	
	2006-07	569	2,540	223,580	2,282,864	
	2005-06	609	2,632	222,609	2,271,054	
	2004-05	556	2,275	186,581	1,929,980	
	2003-04	572	2,482	209,535	2,173,880	
	2002-03	517	2,053	200,302	2,069,124	

	2001-02	398	2,993	272,407	1,910,726	
Gewa (cubic feet)	2008-09	-	-	3,636.32	127,271	Gewa is extracted for buoyancy and used as a supporting pole on both sides of the goran and golpata carrying boats
	2007-08	-	-	1,009.56	49,894	
	2006-07	-	-	8,534.46	298,706	
	2005-06	-	-	5,037.02	176,295	
	2004-05	-	-	2,103.65	74,242	
	2003-04	-	-	3,761.18	132,103	
	2002-03	-	-	5,214.01	234,630	
	2001-02	-	-	10,855.98	203,890	

requires a large amount of money, but many NGOs do not give out such large amounts. Furthermore, in the harvesting season NTFP harvesters face threats from environmental calamities, bandits and wild animals. Wood and honey harvesters in particular face high risks from tiger attacks because they spend a significant amount of time in the forest interior. Sometimes these types of hazards drive harvesters to return early from harvesting trips, so they often have difficulties repaying their NGO loans. Therefore, NTFP harvesters are habituated to the traditional money lending system, even though it is not very profitable for them.

Traditional Occupations: which NTFP are Preferable and why?

Sometimes single individuals work harvesting honey and wax from April to June, while also harvesting golpata and goran from November to March. Figure 3 depicts the average numbers of harvesters from the three unions who harvest different products in different seasons. I also investigated harvesters' choices of which NTFP to gather. In Gabura Union an average of sixty four percent of harvesters were found to harvest only honey and wax, whereas in Gabura and Atulia thirty five percent reported harvesting golpata, goran, honey, and wax. An average of sixty four percent of harvesters in Atulia Union harvest only golpata. In Kashimari fifty percent of respondents harvest golpata and goran whereas only forty two percent of harvesters harvest only golpata.

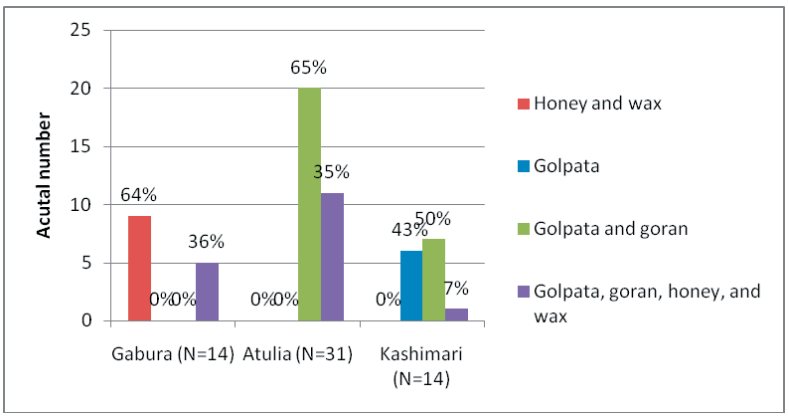

Fig 3: NTFP preferences among harvesters in study area

Though the respondents harvest different products during different times, this study found that harvesters had special preferences for particular products. In general, respondents from Kashimari Union preferred golpata, because it is their traditional profession. Also, golpata is harvested from river bank areas, while goran is harvested from the interior forest, so goran harvesting is more risky in terms of possible wildlife attacks. Respondents in Atulia Union preferred goran, as there is a high market demand for it. They think golpata is too big in size and difficult to handle in comparison to goran. Golpata is used for roof thatching, but goran is needed to build roof structures and wall supports, and for making boundary walls. Harvesting honey and wax, on the other hand, requires special techniques and skills, which is the traditional profession of residents of Gabura Union, so respondents there said they like it. Harvesting honey and wax is more risky than harvesting golpata and goran. Honey harvesters have to walk deep into the forest in search of beehives. They have to look up into the trees and get little chance to keep watch around them, which puts them in greater danger of wildlife attacks. That is why most of the respondents from the Atulia and Kashimari Union do not like gathering honey and wax.

Honey harvesting from the mangroves is a promising business, but harvesters do not have proper storage facilities and so often they cannot maintain the quality of honey. Also, they use primitive methods for extracting the honey from the combs, and a fair amount is wasted due to spoilage. Initiative should be taken to improve the quality of honey and to increase the quantity of harvests. Although beekeeping is no allowed inside the Sundarbans, value additions for the honey such as better harvesting, extraction, preservation and storage techniques should be explored

I noticed that after Cyclone Sidr in 2007, all forest extraction including golpata and goran was banned. From 2008-09 golpata extraction was again allowed but up to the time of my study, goran harvesting was still prohibited. In the meantime, Cyclone Aila struck the coastal area in 2009 and destroyed many houses. This created a high demand for goran stems for building walls and roofing structures. I found respondents from Atulia Union eagerly awaiting permission to harvest goran in order to meet the increasing demand for building materials.

Sometimes government decisions may become troublesome for harvesters; this was apparent when harvesting was banned after Cyclone Sidr (Daily Star 2007). On the one hand, Sidr destroyed houses, while on the other hand government decisions concerning harvesting limited the income generating activities of residents. Therefore,it was a very difficult time for harvesters in the region. Although harvesters believe that the government decision to ban gathering may be right for the sustainability of the forest, it did not fit well with their livelihood needs.

Alternative Income Generation Patterns

During the off-season, NTFP harvesters engage in a variety of different income generating activities. Fig. 4 shows the total numbers of respondents involved in alternative income generating activities. Among the three unions, the main off-season activities are fishing and day labor, although these activities are unevenly distributed across villages. In Gabura the top off-season occupation for respondents is river

fishing, which is absent in the other two study locations. The top off-season occupations in Atulia and Kashimari Union are land based: In Atulia most people work as day laborers, while in Kashimari people work in a wide range of different occupations. There is less diversity of occupations in Gabura than the other two unions, in other words the people there have fewer choices if their main occupations fail.

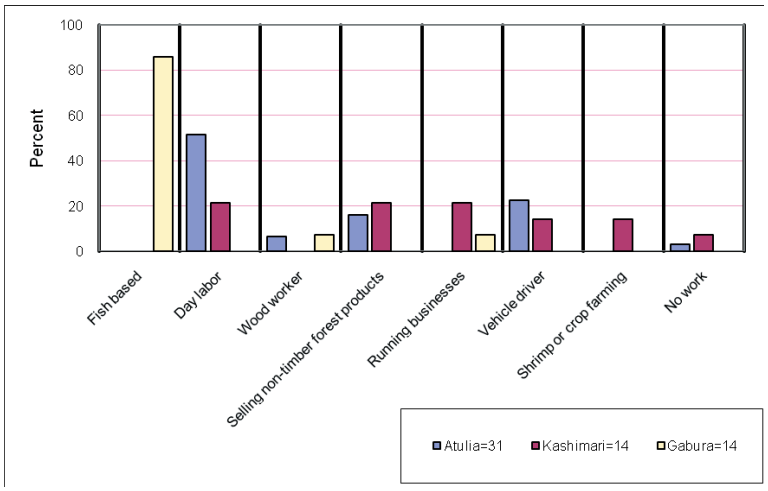

Figure 4: Percentage of NTFP harvesters involved in various alternative income generating activities

Out of fifty nine NTFP harvesters interviewed in Atulia, Kashimari and Gabura Union, eighty six percent of Gabura harvesters worked as fishers in the off-season. In Atulia fifty one percent of respondents worked as day laborers during the off-season, but in Kashimari this figure was only twenty one percent. Another twenty one percent of respondents from Kashimari engaged in selling fuelwood, vegetables, and other NTFPs, while a further twenty one percent said they run small businesses in the off-season. Twenty percent of people in Atulia reported that they drive vehicles both in the town and in the local area. About seven percent of people in Kashimari and three percent in Atulia reported being without any work during the off-season.

Do the Harvesters Follow Rules in the Forest?

In this study I found that both wood and honey harvesters do not always follow the harvesting and cutting rules in the forest. However, this is not due to a lack of awareness. All of the harvesters interviewed were aware of the harvesting and cutting rules prescribed by the government. In group discussions I found that harvesters believe that if they do not follow sustainable harvesting practices, they will not get any product during the next harvesting season. The respondents had an average of twenty three years of experience in harvesting, so they had a great deal of understanding about the forest. I contend that these harvesters are conscious about issues relating to the sustainability of the forest. But at the same time, they confessed that they cannot always follow regulations. When they enter the forest, they are often in a hurry to harvest products. This is because they compete amongst themselves to

rapidly harvest the maximum amount of product; as soon as one harvesting trip is complete, they can go for the next one. In their rush, sometimes harvesters are made to pay compensation for damage to the forest; they are charged extra by the coupe officer for damage to any NTFP.

Main Problems of Harvesters

The main problem that wood and honey harvesters face is a lack of funds. They are totally dependent on NGOs and moneylenders for funding. Other problems include bandits and the forest environment itself. This study found that all respondents have encountered bandits while harvesting. Bandits take water and food supplies and demand ransom money for captured individuals. If the harvesters fail to pay the ransom money then the bandits take one or two people from the boat as hostages and demand extra ransom money from their families. Respondents lamented that though they can get rid of tigers and crocodiles, they cannot get rid of bandits.

Furthermore, during every harvesting season some harvesters are killed by tigers, crocodiles, and other wild animals. The figure is greater for the honey harvesters, who spend much of their time working in the deep forest looking up into the treetops rather than watching the ground for danger. There is no treatment facility inside the forest area, and the nearest hospital is at least eighty kilometers away. All movement in the Sundarbans depends on tidal patterns. If anyone is injured they may have to wait a long time if the tide is against them.

Table 9: Numbers of honey harvesters who have faced tiger attacks while harvesting in the forest area of Satkhira Rain (Forest Department 2009).

Year	Injuries	Fatalities	Total
2008-09	-	5	5
2007-08	-	3	3
2006-07	-	-	-
2005-06	-	-	-
2004-05	2	-	2
2003-04	-	4	4
2002-03	1	3	4
2001-02	-	-	-
2000-01	-	6	6
1999-2000	-	6	6
1998-1999	-	-	-
1997-1998	-	-	-
1996-1997	-	-	-
1995-96	-	1	1
1994-95	-	1	1

From the Satkhira Range Office I found that between 1980 and 2009 a total of 116 villagers were killed by tigers and 27 people were injured. According to the NGO, *LEADERS*, over the last 30 years 291 people from Gabura Union were killed and 37 people were injured by tiger attacks. Research done by *LEADERS* also suggests that after cyclones Sidr and Aila the dependency of villagers on the forest has increased and therefore human/wildlife encounters have also increased (Mahmud 2010).

At the behest of the Forest Department, since about 2003, the Sandhani Life Insurance Company has set up desks at forest stations throughout Sundarban. All of the harvesters now make life insurance agreements before going to harvest. This insurance is mandatory and the premium costs 100 BDT (1.44 USD) per person. If a person is killed in the forest during harvest, their family will receive 25,000 BDT (361 USD). However, this amount is generally considered very low (Forest Department 2009).

Conclusion and recommendations

NTFPs play an important role in the livelihoods of local people in the Sundarbans region. People here use golpata and goran for building and for cooking (goran only). Honey is a great source of nutrition. By selling harvested products harvesters are able to meet the needs of their families. They complete one harvesting trip and wait for the next one.

This study found that the NTFP harvesters are poor with limited livelihood capacities. They have to walk for long distances in search of drinking water. They live in clay houses shaded with goran and golpata. Their family sizes are somewhat big and all of the members are not properly educated. During the off-season harvesters have little opportunities for other sources of income and many people move to metropolitan areas in search of jobs. NTFP harvesters in the Sundarbans live in a part of the country that very often faces environmental calamities.

In addition, I found that NTFP harvesters in the Sundarbans work in an extremely hazardous environment. They work on muddy forest floors full of pneumatophores (Roots that grow above ground) and poor harvesters do not always have proper clothing. Bandits may attack at any time, and sometimes harvesters may lose their harvested products due to environmental calamities. Wild animals are also an ever-present danger and there are no medical facilities nearby to help those injured in the forest area. Even severely injured persons must wait for a couple of days for proper treatment. Government policy should take into consideration the problems confronting harvesters.

Several steps should be taken to help NTFP harvesters increase their incomes and efficiency and improve their livelihoods. Possible actions might include value additions for honey, more favorable loan conditions for wood and leaf harvesters, improved safety and security in the forest, and better health facilities to ensure less lost work days. Perhaps most importantly, forest policy should take the plight of the local poor into consideration, especially when natural disasters occur.

This study suggests that the government and NGOs can take initiative for the betterment of NTFP harvesters in terms of their livelihood security and their personal safety, as well as their financial means. Temporary floating hospitals need to be established in the harvesting area. Patrolling by forest and coast guards also needs to be increased to control the activities of bandits. In addition, easy interest free loans are a must for the benefit of the harvesters.

To ensure the sustainability of NTFPs, harvesters should follow rules for cutting and should not break established rules; the Forest Department should take proper steps to insure this. From an administrative point of view, this means finding ways to reach the poorest harvesters, help relieve them of their dependence on moneylenders, and find other occupations for them during the off-season. This is a complex situation that should be investigated further.

The Sundarbans Biodiversity Conservation Project or SBCP (2000-2004) was a large-scale attempt at resource management in the Sundarbans. Some well-intended activities of the project put local poor people at a disadvantage due to poor planning; any future co-management efforts in the area must be cautious of this. In fact, the Sundarbans is such a sensitive area in terms of human populations, extreme poverty, endangered species, and natural disasters, that the suitability of co-management for this site must be very carefully examined.

References

Banik, H. 2004. *Bangladesher Sundarban*. Shitutuni Book House, Comilla, Bangladesh.

Basit, M. 1995. "Non-Wood Forest Products from the Mangrove Forests of Bangladesh," in Beyond Timber: Social, Economic and Cultural Dimensions of Non-Wood Forest Products in Asia and the Pacific. Proceedings of a Regional Expert Consultation held in Bangkok, Thailand, 28 November to 2 December 1994. Edited by P. B. Durst and A. Bishop, pp. 193-200. Bangkok: Regional Office for Asia and the Pacific of the Food and Agriculture Organization of the United Nations (RAP/FAO).

BBS (Bangladesh Bureau of Statistcs). 2001. Population Census, Satkhira Zila. Ministry of Planning, Dhaka, Bangladesh.

The Daily Star, 2007, "Hurricane strikes Khulna Barishal coast." *The Daily Star*, November 16, 2007. URL: [Accessed on February 7, 2010] http://www.thedailystar.net/newDesign/news-details.php?nid=11868

Doe, M. K. and J. Hasan. 2010. Telephone interview. February 2, 2010.

FAO (Food and Agriculture Organization of the United Nations). 1998. Integrated resource development of the Sundarbans reserved forest project findings and recommendations. United Nations Development Programme.

FAO (Food and Agriculture Organization of the United Nations). 2006. Responsible management of planted forests: voluntary guidelines. Food and Agriculture Organization of the United Nations: Rome.

Forest Department. 2009. Official files (compiled by author). Satkhira Range Office, Forest Department, Bangladesh.

Karim, R. 2009. Personal communication. November 24, 2009.

Mahmud, I. 2010. "Manusher bosotite bagh, bagher bone manush (Human in the forest and tigers in the locality)," in *The Daily Prothom Alo*, vol. 12.

Shackleton, C., and S. Shackleton. 2004. The Importance of Non-Timber Forest Products in Rural Livelihood Security and as Safety Nets: A Review of Evidence from South Africa. *South African Journal of Science* 100:658-664.

Zmarlicki, C.B. 1994. Draft Final Report on the Development of Apiculture. FAO/UNDP, BGD/84/056, Integrated Resource Development of the Sundarbans Reserved Forest, Khulna, Bangladesh.

Deforestation and Forest Conservation in a Tanchangya Community

Md. Abdur Rahman[1]

Abstract

In Bangladesh, people living within and near protected areas (PAs) are increasingly regarded as partners in sustainable conservation, rather than as threats to biodiversity. Accordingly, a paradigm shift is occurring in contemporary policy-making regarding management of PAs. Recognizing this shift, the Bangladesh government has strived to develop new approaches to management in an attempt to integrate the livelihoods of forest dependent people with conservation objectives. The government of Bangladesh recently adopted a co-management framework for PAs, which recommends the integration of human needs and biodiversity conservation when approving PA management plans, and this framework has taken root in internationally funded programs. In this paper I examine the livelihoods of Tanchangya peoples who live within and near the Teknaf Game Reserve (TGR) in southeastern Bangladesh and give particular attention to issues of forest management. In addition, I identify pre-requisites for interventions that can help improve and expand livelihood options for the Tanchangya community in order to boost conservation. I conclude that effective co-management of the TGR requires both long term efforts towards empowerment of Tangchaya people, as well as short term solutions to critical livelihood issues.

Introduction

Natural forests are integral parts of the habitat and socio-cultural framework of rural communities (Byron and Arnold 1999) that contribute to human livelihoods in many ways. They provide land for homesteads, agriculture, and horticulture. Also, they offer a range of goods such as fresh foods and medicinal plants that sustain households and help tide them over during seasonal or other unforeseen shortfalls. Income from the sale of forest products provides cash for paying off debts and serves as a vital economic buffer in times of stress, particularly for women, children, and the poorest households. Forests also provide essential local environmental services (such as watershed services), the loss of which often disproportionately afflicts the poor.

Globally, protected areas (PAs) play a major role in the conservation of natural forests and of biodiversity. However, traditional "fence and fine" approaches have been shown not to be effective for achieving conservation objectives. These approaches are not sustainable, fail to reduce social inequality, alienate local resource users, and often jeopardize the livelihoods of people who depend on forests. In Bangladesh, there are people living within the boundaries of almost all PAs. The ascribing of PA status to forests profoundly impacts local residents by influencing where and what types of forests exist, and who benefits from them.

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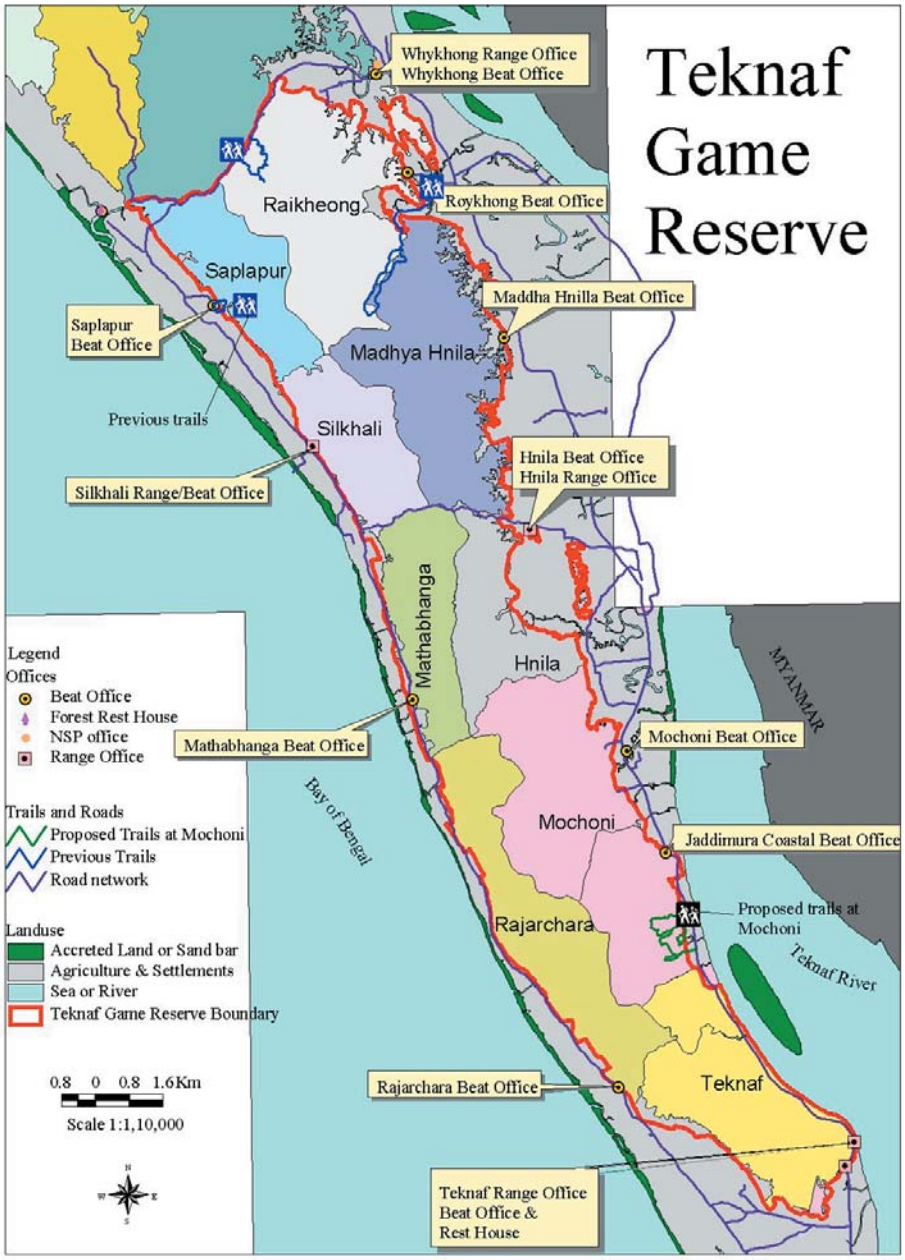
In Bangladesh a paradigm shifts is occurring in contemporary forest management practices as people living within and near PAs are increasingly regarded as partners in sustainable conservation rather than as threats to biodiversity. Recognizing this shift, the Bangladeshi government has strived to develop new policies and approaches for the management of PAs, primarily in terms of attempting to integrate the livelihoods of forest dependent people with conservation objectives. The government recently adopted a co-management framework for PAs that recommends the integration of human needs and biodiversity conservation when approving PA management plans. These programs have taken root in Bangladesh through two programs funded by USAID, namely the Nishorgo Support Project (2003-2007) and the IPAC (Integrated Protected Area Co-management) (launched in 2008). IPAC seeks to understand relationships between biodiversity and local livelihoods so that stakeholder benefits that provide incentives for conservation can be designed. Within this approach, livelihood considerations drive conservation efforts, rather than simply being compatible with them (Brown 2002).

Background

Teknaf Game Reserve (TGR) is situated in Teknaf Upazilla, a sub-district of Cox's Bazaar District located in the southeastern part of Bangladesh. It is bordered on the east by the Naf River, and on the south and the west by the Bay of Bengal. To the north it is connected with other parts of Cox's South Forest Division and Myanmar. The reserve lies between 20°52' – 21°09' north latitude and 92°09' – 92°18' east longitude (Figure 1). Cox's Bazaar runs along the entire eastern length of the forest from north to south to the Teknaf highway. The reserve can also be reached by a road that runs entirely on the western boundary of the forest, along the beach between Cox's Bazaar and Teknaf road.

TGR was established in 1983 with a reserve forest area of 11,615 hectares (Bangladesh Forest Department 2010). The reserve has long been known for its elephants and currently supports a population of approximately 15 to 100, which is 20-30% of the total number of elephants in Bangladesh (Khan *et al* 1994, Rosario 1997, Forest Department 2007). The reserve is broadly classified as a tropical evergreen or semi-evergreen forest. Originally, the reserve's vegetation consisted of tall mixed evergreen trees, dominated by unique varieties, such as *Dipterocarpus turbinatus, Anisoptera schapula,* and *Artocarpus chaplasha* (Champion *et al* 1965, Das 1990, Rosario 1997). However, at present the hills of the TGR are mostly denuded and dominated by sun-grass, herbs, shrubs, and brush woods. The hill forests of TGR support 290 plant species belonging to 212 genera and 65 families, 55 mammal species, 286 bird species, 55 reptile species, and 13 species of amphibians (Khan *et al* 1994, ADB 2002); commonly observed wildlife include elephants, deer, macaques, languor, wild pigs, pythons, wild dogs, and bears.

Figure 1: Land-use/cover map of TGR



Management of the forests that constitute TGR started with the promulgation of their legal status as reserved forests in 1907. At that time revenue generation was the imperial government's main focus for forest management. To this end permits were issued to cut selected trees based only on diameter. The first management plan for the forests of Cox's Bazaar district was prepared in 1935 wherein the main prescription was conversion of natural forest to plantations using timber species (teak, an exotic, as well as indigenous species, such as *Diptercarpus turbinatus, Tecktona grandis, Hopea odorata, Artocarpus chapalasha*). This form of management continued until 2002.

In 1997, a conservation management plan was prepared for the first time in the forest management history of Bangladesh. Forest Department personnel, however, were not enthusiastic to implement the plan because they still held traditional attitudes favoring timber plantations and were largely indifferent to the wildlife and environmental values of forests. In 2002, the Asian Development Bank (ADB) implemented a conservation management plan under the ADB funded Forestry Sector Project (1998-2004). Under this plan the reserve was divided into a central core zone with a buffer zone covering an outer strip of forest land. With community participation, a plantation of approximately 2000 hectares was successfully planted and maintained following the FD's Social Forestry Rules (amended in 2000). While the plantation initiatives were successful, nothing was done to improve the habitat of TGR's banner species, the Asian elephant, and degradation and deforestation of natural forests continued unabated. According to local residents I spoke with, present land uses in TGR include open natural forests (20%), plantation forests (20%), cultivated areas (45%), and permanent homesteads (5%).

TGR has historically been impacted by natural calamities. Velum Von Sandal (1997) reported that in 1698 a tropical cyclone destroyed ninety percent of the standing trees. More recently in 1991 and 1994 the reserve was seriously damaged by tropical cyclones which uprooted seventy percent of the standing trees. Around 10,000 households lost their homes as a result of these natural calamities.

Teknaf Upazilla has a population of 152,557 people, of these 52 percent are male and 48 percent are female; 19 percent are children, 12 percent are youth, and 69 percent are adults (18 years old or older). Levels of schooling are very low in the community a mere 17 percent of the population is literate, while only about 9 percent has attended primary school, 3 percent high school, and less than 2 percent some form of higher secondary education (BANGLAPEDIA 2006). Mollah *et al* (2004) identified a total of 115 settlements or villages, locally called *paras*, where villagers have various degrees of dependency on TGR to meet their livelihood needs. Of these villages, slightly less than half (46%) are located inside reserve boundaries. The rest are located adjacent to and outside of the forest area. Ethnic groups in Teknaf Upazilla include Bengali, Rakhaine, Tanchangya, and Rohingya refugees. The FD has not been able to stop villagers from encroaching into TGR and this has made the reserve a de-facto open access forest.

In the mid 2000s the Nishorgo Support Program (NSP) introduced the idea of co-management in the reserve. Since that time co-management committees (CMCs) exist wherein managers and local people make decisions together and share responsibilities for resource management. Through the CMCs, human well-being and elephant habitat restoration have become main foci of park management. The CMCs have been granted the right to collect revenues from forest based activities such as eco-tourism, with fifty percent of revenues generated from park entrance fees being dedicated to the CMCs to support community participation in forest conservation.

The Tangchangya

According to oral history, the Tanchangya people, called "Chakma" by the dominant Bengali population, came to Teknaf Upazilla in the mid 1800s. The first Tanchangya village was located at Kerontoli in Whykheong Union Parishad[2]. The primary livelihoods of the Tanchangya were slashed and burn agriculture (*jhum*) along with hunting and gathering of forest products and they moved their homesteads across the landscape following their *jhum* fields. When the tropical rainforest area of TGR was declared reserve forest in 1923 a ban was imposed on jhum cultivation. The new legal status accorded to the forest created dilemmas for the Tanchangya people.

After 1923 the Tanchangya settled in a village known as Amtoli with a population of thirty five households. Registered as official 'forest villagers', every family was allocated a rice plot, a homestead plot (2 hectares), and was given opportunities to participate in a *tangya*[3] agroforestry system instead of using slash and burn agriculture. This is how the mobile Tanchangya community transformed into a sedentary agricultural community. As their population grew, the Tanchangya expanded to cover more forest valleys. New sites were identified mainly by the availability of flat land for agriculture and the presence of perennial streams as sources of water. Today six Tanchangya villages exist within the game reserve, namely: Shilkhali, Monkhali, Horikhola, Lambaghona, Amtoli, and Putibunia.

The Tanchangya community presently consists of 584 households all of whom are fully dependent on forest resources for their livelihood. They depend on forests for many of their daily household needs and they also use forests as a source of cash income. Most households are involved in jhum cultivation, fuelwood and bamboo collection, and betel leaf cultivation. Though these villagers have little respect for agreements with the FD, they try to maintain good relations with staff. However, FD staff and the local Bengali community believe that the Tanchangya are the main source of deforestation and degradation within the reserve. Today the FD recognizes approximately thirty five households as descendants of the original "forest villagers" and considers other households to be encroachers even though many of these people are descendants of the original forest villagers. Some FD staff believe that the Tanchangya actively encourage outsiders (including Rohingya refugees) to settle with them in the TGR by granting them informal leases on forest land. Presently no effective rules and regulation exist for controlling occupancy of TGR lands.

[2]. A *union parishad* is the lowest unit of local governance in Bangladesh

[3]. Tangya is a system of plantation forestry in which crops are planted between the rows of tree for a few years until the canopy closes. The agricultural crops meet farmer's immediate needs such as food while trees provide long- term products.

In the last two years, local FD staff members have tried to prevent Tanchangya households from expanding their jhum plots and converting forest land to permanent agriculture by strictly enforcing regulations through training, awareness building and the provision of small incentives. However, this has been to no avail. Some Tanchangya households, however, are not involved in illegal activities.

Research objectives

In this paper I seek to:

- Examine the livelihoods of the Tanchangya community in TGR with particular focus on their interactions with forest management;
- Identify interventions and pre-requisites for improving and expanding livelihood options for the Tanchangya community in order to boost conservation.

Research methods

Primary data collection began with community workshops in all six Tanchangya villages in which I briefed villagers of my intention to learn about them. Next, I carried out focus group discussions (FGD) in the six villages using a checklist. I also walked a transect across each village to observe village life. In addition, I conducted interviews using a checklist with key informants from the FD, representatives from local non-governmental organizations (NGOs) and CMCs, and other knowledgeable people in the communities. Finally, I interviewed the heads of households at their homes using a semi-structured questionnaire. Respondent households were selected randomly (Table 1 shows the distribution of sample households). To overcome the language barrier I hired an assistant from a Tanchangya community who had completed 12 years of schooling. I gathered secondary data by examining relevant books, journals, reports, websites, and other sources.

Table 1: Number of sample households by village.

Village name	Total number of households	Number of sample households
Shilkhali	39	10
Monkhali	144	36
Horikhola	209	52
Lambaghona	84	21
Amtoli	86	21
Putibunia	26	10
Total	588	150

Results

The study revealed that among the 588 households in the 6 study villages the average family size is 6.5 persons, the average mother bears 4.5 children, while literate mothers bear on average only 3 children. Of residents, 49 percent are male and 51 percent are female. Only 36 percent of respondents were literate; 30 percent had attended primary school, 6 percent had attended junior high school, 1.5 percent had

completed high school, and only 0.5 percent had passed public examination and entered higher level schooling (Table 2). A large proportion of children (30%) are not enrolled in primary school. Respondents suggested that the poor level of literacy is due to the absence of schools within walking distance, an absence of roads, and household poverty. Many poor children work in family agricultural plots or engage in collecting fuelwood to earn money, a necessary survival strategy.

Tanchangya villages remain unconnected by roads to market places and growth centers. Villagers do not have access to radios or televisions and fewer than ten people occasionally read Bengali newspapers. None of the villages have electricity and they also lack irrigation facilities for dry season agriculture. Each village has a *Kheang* (religious centre) led by a *Bhante* (religious leader) who gives sermons and educates people in the Pali language. Tanchangya people usually build their homesteads on slopes or on the top of small hillocks. Houses are generally constructed at the centre of the homestead, with the latrine (if any) behind the house at the foot of the hill. Most houses in Tanchangya communities are made of sun grass, bamboo and wood (53%). However, wealthier families build their houses with tin (20%), and poorer families build their houses with leaves for thatching and walling (20%). A recent trend in house construction is to build walls with mud (7%) due to a lack of wood in the forest.

Table 2: Education Indicators in Tanchangya communities

ITEM	Indicator	%
Schooling	Illiterate	64
Class	Literate	
	I-V	30
	VI-VII	4
	IX-X	1.5
	Secondary School Certificate (SSC+)	0.5
	Sub-total	36
Children enrolled	% of children enrolled in school	77
Access To Schooling	Government Primary school	Available at Shilkhali
	Non-government Primary school	Monkhali, Horikhola, Lambaghona, Amtoli,
	Government High school	Not available
	Non-government High school	Not available

Most people in Tanchangya communities have limited access to health facilities (Table 3). Mothers do not have access to registered doctors during pregnancy and children are delivered at home without a trained birth attendant or registered doctor. Only twenty four percent of villagers have access to safe drinking water. Most people (75%) do not wash their hands with soap after defecating, and only fourteen percent of respondents had access to a sanitary latrine. Therefore, the Tanchangya are vulnerable to water borne diseases, such as dysentery and diarrhea.

It is important to note that because they live within TGR these Tanchangya communities have no legal title to the lands they occupy. Table 4 lists respondent households according to their land possessions. In 1907, when the Tanchangya people were settled on this land as forest villagers by the FD they were given rights of usufruct that allowed them to use the land. These rights are still recognized today. Approximately fifty five percent of households have cultivable land. Major land uses include homesteads, rice cultivation, vegetable cultivation, and betel leaf farming. Rice is cultivated by forty three percent of households in these communities, with an average plot size of 0.27 hectares, which is larger than the national average. Less than twenty five percent of households cultivate vegetables, with an average plot size of 0.15 hectares. A few households (15%) engage in betel leaf farming with an average plot size of 0.10 hectares. Betel leaf cultivation is not widespread because it requires a large amount of startup capital and a longer period to generate returns. One percent of households in these communities have neither a homestead nor a cultivable plot.

Table 3: Standard of Living Indicators in Tanchangya Community

Items	Tanchangya (%)	Bangladesh (%)
Child Immunization	80	97
Ante natal care:		
Registered doctor	5	25
Trained paramedic	25	50
Local women	70	25
Child Delivery:		
At Hospital	0	25
At home with trained attendant	0	25
At home with non-trained local attendant	100	50
Access to Medical Personnel :		
Registered doctor	1	25
Trained paramedic	25	50
Untrained paramedic	64	25
Herbal doctor	10	10
Washing hands with soap/ash after defecation	25	75
Source of drinking water:		
Tube-well	24 (safe)	72 (rural)
Ring-well(unprotected)	30 (not safe)	
Streams	15 (not safe)	
Pond	30 (not safe)	

Latrine:		
Septic	16	32
Pit	40	
Open	44	

Table 4: Land Use Practices

Land Use	% of households (average size in hectares)	Remarks
Homesteads	99 (0.20)	Landless households only in Shilkhali
Rice plots	43 (0.27)	
Vegetables plots	17 (0.15)	Not available in Shilkhali
Betel Leaf plots	15 (0.10)	Not available Putibunia
Households without cultivable land	55	
Households with cultivable land	45	

A vast majority of respondents (88%) are involved in farm-based occupations, while a smaller proportion of households (12%) depend on non-farm activities (Table 5). Non-farm activities include small-scale trading, tailoring, bamboo and cane based cottage enterprises, carpentry, and driving. This study found that people who engage in non-farm activities tend to be younger and have attended high school.

Though Tanchangya households have above average access to land compared to other parts of Bangladesh, they are poorer in terms of common development indicators, i.e. education, child healthcare, female healthcare, sanitation, housing, and food security. In this study I asked people to classify households based on poverty. Though a number of criteria are used to determine poverty and the prevalence of poverty in a community, FGD members had their own way of determining poverty based on food security during lean periods. The months of Chaitra (May/June), Bhadra (June/July), and Ashwin (July/August) at the end of the dry season and the beginning of the wet season constitute lean periods in terms of work opportunities and food availability. During the rainy season little farm work is available and there is limited range for collecting forest products due to both enhanced law enforcement by the FD and heavy rainfall, which makes much forest inaccessible. During lean periods ultra-poor families (52%) cannot secure food for household members one or two days a week; poor families (14%) can manage only one meal per day; on the other hand, wealthier households (27%) do not suffer from food shortages because they are large farmers or are engaged in non-farm activities.

Table 5: Distribution of workforce according to livelihood activities

Occupation	(%)	Remarks
Farmer	29	Farm (88 %)
Farm labor	20	
Housewife	39	
Small trader	2.88	Non farm (12 %)
Tailor	1.71	
Bamboo and cane artisan	1.71	
Carpenter	0.6	
Mechanic	0.4	
Driver	0.22	
Service	1.33	
Fisher	0.22	
Herbal doctor	0.88	
Jobless	1.33	
Wage earner	0.22	
Untrained doctor	0.22	
Mason	0.22	
Total	100	100%

Jhum fields are prepared by clearing and burning a forest plot and then using the land to grow crops such as upland rice, sweet potatoes, cowpeas, cucumbers, maize, millet, various gourds, and okra. After three or four years of cropping, the plot is abandoned to regenerate with secondary brush and shrubs. Occasionally the FD uses abandoned plots for plantations. Although illegal, the Tanchangya continue to practice *jhum* cultivation even in the face of strong prohibitions by the FD. The Tanchangya use social networks to support one another and to resist law enforcement efforts. In 2009 more than twenty five households cleared land for *jhum* agriculture (average plot size was 0.10 ha); twenty households cleared land for permanent cultivation plots (average size was 0.05 ha); and fifteen households established new homesteads (average size was 0.20 ha). These clearings defied the strongest efforts of the FD and the co-management councils. In addition, most of these households (60%) graze their cattle on forest land.

Each Tanchangya homestead can be regarded as a farm and often includes a house, kitchen, courtyard, vegetable plot, cows, goats, pigs, and poultry. Half of the households have an average of three cows, ten percent keep an average of two goats, ten percent keep an average of one pig, and almost all keep an average of eight poultry. Domesticated plants include bamboo (5 species), fruit trees (10 species), timber trees (20 species), and medicinal plants. Medicinal plants and timber trees generate naturally. Other plants such as fruit trees and bamboo are planted. Preferred fruit species include banana, tamarind, mango, jackfruit, betel palm, and *litchi*, but *jambura, bel, amra,* lemon, guava, papaya, *kamranga*, pineapple, blackberry, and other fruits are also planted. Ginger, turmeric, sweet potato and cassava are other indispensable components of a Tanchangya homestead.

Principal agricultural activities include rice cultivation and vegetable and betel leaf farming. Farmers plant two rice crops per year-one in winter using stream water

coming from the forest, and one during the monsoon, which is rain-fed. Vegetable cultivation started in 1995 after farmers received training from an NGO. Vegetable crops include pepper, eggplant (*brinjol*), radish, cabbage, potatoes, cucumber, tomato, carrot, *shalgom*, bean, long bean, taro, *arum*, watermelon, *bangi, lal shak, kalmi*, pumpkin, snake gourd, ribbed gourd, *marfa, and pulsel.*

The Tanchangya have a substantial understanding and knowledge of forests and how to derive food and other products from them. They collect wild foods (leaves, roots, shoots) throughout the year. These foods constitute a substantial share of their daily food requirement; according to my household interviews seventy five percent of households collect wild vegetables. The Tanchangya also rely substantially upon forests for health. Each village has its own *Baidhya* (hereditary herbal medical practitioner) who provides medication for mental disorders, anemia, abscesses, jaundice, snakebites, dog bites, indigestion, leprosy, orthopedic disorders, among other ailments. During key informant interviews, Baidhyas identified 22 medicinal plants (Appendix I). Tanchangya communities depend on forests for both curative and preventive measures against diseases.

The Tanchangya interact intimately with forests, entering for many purposes. In addition to wild foods and herbs, the Tanchangya also collect other forest products such as timber, poles, fuelwood, sun grass, bamboo, cane, and leaves. Table 6 lists forest products collected both for subsistence (100%) and income (60%). Focus group discussants argued that the Tanchangya have no alternatives but to make their living out of the TGR reserve. They also collect forest products in commercial quantities.

Table 6: Percent of households collecting various forest products in 2007

Items collected	For use (%)	For sale (%)
Timber	59	14
Poles	89	25
Fuel wood	100	60
Sun grass	45	10
Bamboos	59	12
Canes	50	5
Wild food	70	10
Medicinal plants	61	0
Leaves (thatching)	7	0

Table 7 lists government agencies in the Teknaf Upazilla headquarters and the services they provide to rural people in Bangladesh. The data suggest that Tanchangya communities most frequently interact with FD personnel, followed by Union Parishad and police department personnel. Conversely, villagers have limited interactions with the Department of Social Services, and the local government engineering, relief, and rehabilitation departments. Ironically, other development oriented agencies, including the departments of health, family planning, and agricultural extension, are all but absent. While this lack of services may be due to an absence of leadership in Tanchangya communities, it may also be due to the inability

or unwillingness of government officers of relevant agencies to access these communities. Government Officers are not ignorant of Tanchangya communities, but the Tanchangya live in remote areas making it difficult to reach them. It is noteworthy that the Tanchangya have no representation in the Union Parishad and that no individuals from Tanchangya villages occupy managerial positions in any government agencies. Moreover, mainstream politicians view the Tanchangya as marginal. The only time politicians visit or pay any attention to the Tanchangya community is during parliamentary elections.

The broad Tanchangya community of today began as a single sedentary village in 1907 with only thirty five households. Over the span of 100 years they have grown to 588 households. The growing population has required more land to support their livelihoods, which has lead to a loss of forest. Life in forests is never easy, and this study shows that it has been made more difficult by the lack of institutional support for basic civic amenities coupled with naturally occurring calamities (such as diseases), unemployment, and food insecurity. Moreover, male members of these communities often like to drink locally made alcohol, which interferes with work. All these problems cause poor and ultra poor families to fall prey to debt. Moneylenders and local grocers provide loans to these families at high interest rates with difficult terms and conditions. In turn, failure to repay loans causes indebted households to lease their cultivation plots and then their homesteads to others. Eventually these families end up transferring ownership (informal) of their lands to others. They then move deeper into the forest to clear new land for their jhum gardens and homesteads. This study reveals that most of the Tanchangya have shifted their homesteads at least four times.

Table 7: Services offered to Tanchangya villages by government agencies

AGENCY	SERVICES
Police Department	*law and order*
Forest Department	*land, housing materials, fuel wood, Social Forestry training in 2007, traditional weaving, etc*
Social Services Department	*old age allowances*
Department of Relief and Rehabilitation	*food for vulnerable groups*
Public Health Engineering	*sanitary latrines*
Local Government Engineering Department (LGED)	*rural roads*
Women Affairs Department	*services not available*
Youth Development Department	
Bangladesh Board of Rural Development (BRDB)	
Co-operative Department	
Bangladesh Agricultural Bank	
Family Planning Department	
Department of Agriculture Extension	

As part of this study I used data from group discussions to compile a list of the forest dependent activities of the Tanchangya community and brought FD officers, CMCs and Tanchangya people together to discuss and analyze these activities in the context of management issues. The group agreed that rampant illegal logging began in the 1980s by armed miscreants supported by powerful politicians; the Tanchangya in those days served only as day laborers. Massive degradation occurred in the cyclones of 1991 and 1994 when winds reached up to 250 kilometers per hour and seventy percent of the standing trees in TGR were uprooted. The remaining valuable trees in the natural forest were illegally felled by government appointed logging contractors in connivance with FD personnel and politicians. In addition to the above observations, discussants categorized Tanchangya activities as either causing or not causing forest degradation, as shown in Table 8.

Table 8: Forest dependent activities and their relationship to forest degradation

Activities causing forest degradation	Activities not causing forest degradation
o Jhumming o Cattle grazing o Collection of : ▪ Timber ▪ Poles ▪ Fuel wood	o Homesteads o Collection of : ▪ Bamboos ▪ Canes ▪ Leaves ▪ Wild foods ▪ Sun grass ▪ Medicinal plants

Discussants also identified major vulnerabilities among the Tanchangya, and these were discussed as being key issues. Major vulnerabilities identified by discussants include food insecurity, land and tree tenure, health, and physical security. Next, I will briefly explore each of these identified vulnerabilities.

Food Security

The Tanchangya do not have adequate food security. Every year they suffer during the three month lean season, and famine is only avoided by accessing wild foods and selling informal land "possessions". The causes of food insecurity include insufficient water in the dry season for irrigated agriculture, poor agricultural practices, lack of agricultural extension services, lack of fertilizer, and poor infrastructure that limits trade and the ability to buy food.

Lack of Formal Land Rights

As alluded to above, the Tanchangya have no formal land ownership; households listed as forest villagers have informal agreements to use land for their farms and homesteads but they have no official documentation of these agreements. More than ninety percent of households who are descendents of forest villagers, however, are not recognized as such and are regarded as encroachers by the FD. Frequent transfers of land rights to outsiders (usually Bengalis) indicate the ease with which current informal access rights can be lost. Fifty five percent of Tanchangya households have lost their agricultural plots to Bengalis.Land is the only significant physical

resource available to the Tanchangya and if they lose access to it then there is little hope for sustaining their livelihoods.

Disease

The Tanchangya are also at high risk for diarrhea, dysentery, and malaria. Most Tanchangya are not aware of how these diseases are transmitted. There appear to be no preventive measures taken by the government. My field appraisal indicated a poor level of sanitation and unsafe drinking water as the main causes of transmission.

Encroachment

Monkhali and Horikhola villages have been subject to robbery, including the violation of women and Bengali Muslims have encroached on land in the villages of Amtoli, Lambaghona, Horikhola, and Monkhali. More than ten petitions have been recorded with the Teknaf police station and with the judicial magistrate court concerning conflicts that have arisen over these encroachments. In these conflicts the Bengalis are supported over the Tanchangya by local elites.

Lack of Support

The Tanchangya who participated in this study expressed concern about a perceived lack of support from the FD. According to participants, up until the 1990s the FD was active in constructing ring wells, a necessary step to ensure safe drinking water, however neither the FD nor other government agencies have taken a more holistic view of development. Tanchangya lack knowledge of basic human rights guaranteed citizens by the Bangladesh constitution. They also do not understand the concept of advocacy, and how their issues could be presented to raise awareness and increase the likelihood of progress being made to improve their situation.

Discussion

This study reveals that the Tanchangya are aware of the impacts of deforestation and forest degradation. According to their own observations, due to the loss of natural forest in TGR they must search harder and walk further to find wild foods and medicinal plants. Today Tanchangya spend more than 400 percent more time collecting daily necessities (wild foods, medicinal plants, fuelwood) than they did in 1995. Important medicinal trees, such as *Terminalia chebula, Terminali belerica,* and *Alstonia scaphula* have become rare. Until the 1990s streams passing through villages were full of water during the dry season (November through May). Today, however, water flow in these streams has reduced by one-third of what it was previously, which is why fifty percent of agricultural plots remain fallow during the dry season. This situation poses a great threat to the livelihoods of the Tanchangya.

Forest conservation and sustainable livelihood issues in Tanchangya communities are closely linked and complex. I argue that key problems include the lack of registration of descendents of Tanchangya communities as forest villagers, as well as a lack of land and tree tenure including certificates of usufruct rights, which creates insecurities concerning land that may be appropriated for plantations. Other significant problems that contribute to poverty are inefficient farming, poor

infrastructure, and a lack of education, which limits livelihood possibilities.

The World Bank (2003) defines poverty as pronounced deprivation of wellbeing related to lack of material income or consumption; low levels of education and health; vulnerability and exposure to risk; lack of representation; and powerlessness. In other words, to be poor is to have few resources from which to secure a livelihood (Shimizu 2006) that contributes to human well being. The FAO (2003) defines poverty reduction as the lessening of deprivation of wellbeing or successful prevention of increase in deprivation. The Tanchangya are largely illiterate and among the poorest communities in Bangladesh in terms of non-farm skills, health, physical assets, and access to power at local, sub-district, and district levels. Therefore, according to the World Bank criterion for poverty, the Tanchangya are extremely poor.

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From an historical perspective this study reveals that the Tanchangya have contributed little to forest degradation because their population is small (less than 4,000 individuals) compared to the total number of people (150,000) living inside TGR. The major players in forest degradation are the government, through its plantation program, the influx of Rohingya refugees, frequent natural calamities, and lack of political support for forest conservation. It must be noted, the Tanchangya are involved in deforestation through conversion of forest land to produce cultivable plots. However, the Tanchangya people carry out this sort of activity because they have not received enough support from the government to build up their capacity to shift towards non-forest activities.

What can be done?

The challenge of reconciling livelihood improvement and forest conservation in developing countries is daunting and remains largely unmet. Levang *et al* (2003) and Wunder (2001) argue that due to a number of peculiarities of forestry activities, the real frontier for achieving these two objectives is inevitably limited. Accordingly, attempts to reconcile poverty alleviation and forest conservation should be carried out deliberately and systematically at local, regional, and national levels.

Populist and people-centered discourses on conservation and development have emphasized the need for empowerment of local people. Chambers (1993) coined the term "empowerment", which is generally understood as a process by which people, especially poor people, are enabled to take more control over their lives and secure a better livelihood with ownership of productive assets as one key element. The concept therefore has political dimensions, in terms of rights to resources, as well as socio-economic dimensions, in terms of sustainable livelihood security. Empowerment is seen as both a means (to conservation and to better development) and as an end itself (Brown and Rosendo 2000).

My study suggests that it is necessary to take a number of steps in order to achieve the twin goals of conservation and livelihood improvement. First, Tanchangya villages should be surveyed and individual plots mapped, and each household should be awarded a non-transferable certificate of usufruct rights for their homestead and

cultivation plots. This will secure user rights and provide a tool for the FD to monitor and prevent land transfers. Second, all descendent families of Tanchangya should be registered as forest villagers. Finally, I suggest administering the Participatory Benefit Sharing Agreement (PBSA) under the FD's 2000 Social Forestry Rules with the Tanchangya appointed as beneficiary members, for which they are very much enthusiastic. Up to this point the FD has done nothing to assist forest villages but rather has used them as a source of cheap labor for FD plantations. Under the NSP the FD has been trying to protect natural forest in TGR by engaging community patrol groups. Though this effort has failed, participatory plantations established by the Forestry Support Project funded by ADB were successful. Because the Tanchangya are dependent on natural forests for their livelihoods and live in close proximity to existing natural forest within the core zone, they are ideal candidates to help protect natural forests. However to make PBSA successful the FD must restore the non-timber forest resource-base because current supplies do not meet the need.

I also examined the impact of education upon behavior change in Tanchangya communities and my results are very encouraging (Table 9); they suggest that up to eight years of schooling has generated considerable improvements in all aspects of life. Most noticeably, educated people appear not to take part in legal offenses towards or the clearing of TGR forests, but rather work with the FD. This indicates that those Tanchangya with education develop different kinds of life skills and training that allow them to work in the TGR forest.

Table 9: Education and Behavior among Tanchangya

INDICATOR	ILLITERATE	LITERATE
Child per mother (person)	6	3
Age at marriage		
• Male (years)	21	26
• Female (years)	16	21
Children enrolled in school (%)	70	100
Access to safe drinking water (%)	10	100
Latrine (%)	10	100
Forest offense (in 2009)	20	0
Clearing forest (in 2009)	25	0

I suggest, therefore, that education is the investment that has the greatest impact on forest-related practices. Individuals who had completed at least eight years of schooling were not involved in opening forests for cultivation or cutting trees for income. Rather, such individuals were involved in intensifying cultivation by introducing new vegetables and rearing cattle. Those with at least eight years of education also went for skill development training and have received jobs in NGOs and the private sector outside their villages. The educated men had sanitary latrines, received ante-natal care, and went to paramedics or registered doctors in case of ailments. Their average age of marriage was higher, they had fewer children, practiced family planning, and washed their hands after defecation.

In these circumstances I suggest establishing a governmental primary school in each Tanchangya village and establishing local high schools or technical schools. The sooner these educational infrastructure projects are undertaken the better. Until the proposed high schools are established, competent students could be sent to nearby high schools on scholarships or the government could provide interest free loans for students. As a short term initiative with high and immediate impact for skill development, my key informants suggested that educated youths could be sent to technical training centers in urban areas followed by job placement. Better roads should be constructed in Tanchangya villages in order to increase social mobility, improve market access and open access to governmental services. Lastly, the Tanchangya should enjoy privileged representation in governance; one Union Parishad member should come from the Tanchangya to look after their interests. This is a key reform as the Union Parishad is the door to all government services and social security provisions.

Conclusion

The role and value of forest resources in supporting the livelihoods of the poor has been widely recognized. Tanchangya people depend upon forests for shelter and land, and forests serve as safety nets during lean periods. The Tanchangya are involved in forest conversion because of a lack of other livelihood alternatives. They have remained on the periphery in terms of government support systems and rural power structures, and this has created a state of perpetual marginality. The attitude and practice of educated people (with at least eight years of schooling) are compatible with forest conservation. The participation of Tanchangya people cannot be ensured merely through the development of awareness. Both long term efforts towards empowerment (i.e., updating forest villagers' certificates, forest village mapping, participatory forestry in core areas, NTFP restoration in core areas, privileged representation in local government) and short term efforts to solve key livelihood issues (i.e., establishment of governmental primary schools, water conservation, agricultural and vocational training, supplying of fertilizer) are required.

References

ADB. 2002. The Conservation Action Plan for Teknaf Games Reserve, Bangladesh Forest Department Bangladesh/ Asian Development, Dhaka, Bangladesh Forest Department. 2010. Teknaf Game Reserve. URL [Accessed May 6, 2010]: http://www.bforest.gov.bd/teknaf.php

BANGLAPEDIA: National Encyclopedia of Bangladesh. 2006. URL [Accessed May 9, 2010]: http://www.banglapedia.org/httpdocs/HT/T_0106.HTM

Brown, K. and Rosendo, S. 2000. Environmentalists, rubber tapers, and empowerment:

The political and economic dimensions of extractive reserves, *Development and Change* 31:201-27.

Brown, K. 2002. Environment, Biodiversity and Sustainable development: international issues. In C. Kirkpatrick, R. Clarke, and C. Polidano (eds), *Companion to development policy management*. Edward Elgar, Cheltonham, ch 22

Byron, N. and M. Arnold. 1999. What Futures for the people of tropical forest? *World Development* 27: 99-121.

Chambers, R. 1993. Challenging the profession: frontiers for rural development, Intermediate Technology Publications, London.

Champion, H.G., S.K. Seth, and G.M. Khattak. 1965. Forest types of Pakistan. Pakistan Forest Institute, Peshawar, 238 pp.

Das, D.K. 1990. Forest types of Bangladesh. Bulletin 6, Plant Taxonomy Series, Bangladesh Forest Research Institute, Chittagong. 9 pp.

FAO. 2003. Forests and Poverty alleviation, by Sunderlin *et al* In State of the World's Forests 2003, Rome Italy.

Bangladesh Forest Department. 2007. Management plan for Teknaf Games Rreserve, IRG/USAID/Forest Department (FD) Bangladesh, Dhaka.

Khan. M.S., M.M. Rahman, A. M. Huq, and M. M. K. Mia. 1994. Assessment of biodiversity of Teknaf Game Reserve in Bangladesh focusing on economically and ecologically important plant species. *Bangladesh Journal of Plant Taxonomy*, 1(1):21-33.

Levang, P., E. Dounias, and S. Sitorus. 2003. Out of the forests, out of poverty? Paper presented at the International conference on rural livelihoods, forests and biodiversity. Bonn, Germany, May 19-23, 2003.

Mollah, A. R., S. Rahman, and M.M. Rahman. 2004. Site-level field appraisal for protected area co-management: Teknaf Game Reserve. Nature Conservation Management (NACOM): Dhaka, Bangladesh.

Rosario, E. A. 1997. The Conservation Management Plan of The Protected Areas other then those in the Sunderban Forests of Bangladesh, Bangladesh Forest Department/ World Bank, Dhaka.

Shimizu, T. and M. Trudel. 2006. Methodology and case studies on linkage between poverty and forestry: Afghanistan, Iran and Kyrgyzstan and Turkey; LSP working paper.

Velum Von Sandal. 1997. Travel History of Francois Buchanan in Noakhali, Chittagong and Chittagong Hill Tracts, UPL, Dhaka.

World Bank. 2003. *World Development Report: 2003* Sustainable Development in Dynamic world: transforming institutions, growth and quality of life. Washington DC. The World Bank, New York Oxford Press.

Wunder, S. 2001. Poverty alleviation and Tropical forests: What Scope for Synergies? *World Development*, 29(11), 1817-1833.

Appendix 1
[Plants used by Tanchangya Baidhya from natural forests]

LOCAL NAME	SCIENTIFIC NAME	FAMILY	USES
Apeng	Achyranthes aspera L.	Amaranthaceae	Jauindice, dog and fox bite
Agnichita	Plumbago indica L.	Plumbaginaceae	Anaemia, menustration irregular, skin disease, leuchorrhoea
Bon holud	Cucuma aromatica	Zingiberaceae	Snake bite, tonic, carminative, Blood purifier
Baggach	Lee macrophylla Roxb.	Leeaceae	Boils, arthrities
Bombaraja	Rauwolfia serpentine Benth.	Apocynaceae	Snakebite, headache
Bon methi	Sida acuta Burm.	Malvaceae	Fever, chronic dysentery, intestinal worm, gonorrhoea
Chita	Plumbago zeylanica L.	Plumbaginaceae	Leucorrhoea, jaundice, menstrual problem
Dadmordon	Cassia alata L	Leguminosae	Skin disease
Gila lata	Derris trifoliate Lour.	Papilionaceae	Stomach disorder,
Harjora	Vitex quadrangularis Wall	Vitaceae	Orthopedic disorder
Kamranga	Averrhoa carambola L	Oxalidaceae	Cough, fever
Kala holud	Kaempferia parviflora Wall ex. Baker	Zingiberaceae	Diarrhoea, vomiting

LOCAL NAME	SCIENTIFIC NAME	FAMILY	USES
Langio	Cynoglossum Lancelatum Forssk.	Boraginaceae	Bowl syndrom
Moragphul	Celosia cristata L.	Amarantaceae	Body swalling(dropsy), allergy
Menmuni	Centella asitica L.	Hydrocotylaveae	Blood dysentry
Mainshak	Gelonium multiflorum	Euphorbiaceae	Boils
Misridana	Scoparia dulcis	Schorphulariaceae	Stomach pain
Penchi	Annona muricata Linn	Annonaceae	Pain relief
Rakta chita	Plumbago rosea L.	Plumbaginaceae	Eye infection, skin diseases, paralysis, abortion, leprosy, indigestion
Sapangeys	Antidesma ghaesembilla Garten	Euphorbiaceae	Madness
Simakrakhi	Helmintostcheys zelynica L.	Ophyglossaceae	Jauindice
Veg	Clerodendrum viscosum L.	Vervenaceae	Round worm , indigestion, vomiting

Livelihoods of Forest-dependent People in Kaptai National Park

Md. Zahidur Rahman Miah[1]

Abstract

Forests provide both a home and livelihood for people living in and around them and serve as vital safety nets for the rural poor. In Bangladesh, forest resources are being depleted at alarming rates due to over exploitation. Local communities practice swidden farming (jhum) in hill districts in Bangladesh and survive lean periods by collecting wild fruits, leaves, and tubers from forest reserves. In response to growing pressures on forests, in 2009 the Bangladesh Forest Department initiated a co-management program with the assistance of the Integrated Protected Area and Co-Management (IPAC) Project. In this paper I examine the livelihood patterns and needs of residents in two villages (Bangchari and Kamillochari) in Kaptai National Park in order to highlight how conservation can be linked to the welfare of local communities. I argue that local residents are fully dependent on the park and are therefore excited to participate in co-management programs.

Introduction

Forests provide both a home and livelihood for people living in and around them, supplying wild foods, fuelwood, medicinal plants, and materials for building and other purposes. Forests serve as vital safety nets that help rural people sustain their livelihoods. In Bangladesh forest resources are being depleted at alarming rates due to over exploitation. Although ten to twelve percent of the total national land in Bangladesh is designated as forest, tree cover accounts for only five to seven percent according to one estimate (Haque 1998). However, it should be noted that there is controversy among organizations over estimates concerning the scale of forest area and rates of deforestation. According to the Forest Policy of 1992 the national target is to achieve a forest cover of 20% by 2015.

In many tropical countries swidden farming (*jhum*) is widely practiced even though it remains controversial among conservationists and others (Delang 2006). Swiddening, often referred to as "slash-and-burn", is an ancient farming practice. In Bangladesh, swidden farming is practiced in the three hill districts of Rangamati, Bandarban, and Khagrachari. Swidden farmers cut down trees, shrubs and herbs in a selected area, burn plant materials after they dry, and then sow seeds after the first rains fall. After cropping a particular area for a time it is left fallow for several years. When first established, the Forest Department (FD) allowed villagers to use swidden techniques in the reserve forests. However, since the creation of the Forest Act of 1927 (amended in 1990) swidden farming in the reserve forests has been prohibited in Bangladesh. However, the livelihood strategies of forest dwellers still revolve

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around this traditional farming system and swiddening continues at low levels in reserve forest areas where the FD unofficially allows some villagers to engage in the practice in exchange for forest protection services.

In addition, many local communities survive during the annual lean period from June to August by collecting wild fruits, leaves, and tubers from core areas of forest reserves. Prior to the management of these areas by the FD, forest villagers collected fuelwood, wild foods and some non-timber forest products (NTFP). However, nowadays many people go to the forests to cut wood illegally. This has caused conflict between forest managers and local people, which has had two negative effects: forest resources have become depleted and forest dwellers have lost access to essential resources.

As a response to population pressures, a shortage of FD staff members, and weak forest management practices, the FD initiated a co-management program in Kaptai National Park in 2009 with the assistance of the Integrated Protected Area and Co-Management (IPAC) Project. The goals of this program are to foster respect for forest peoples, their knowledge of the forest, and their inherent rights to use forest land, and to incorporate these elements into forest resource management. In addition, an experimental participatory agar (*Aquilaria agallocha*) plantation was started in the buffer area of the park in 2008. This project sought to replace traditional swidden practices with legal forest management practices.

In this paper I examine the livelihood patterns and needs of residents in two villages (Bangchari and Kamillochari) in Kaptai National Park in order to offer insights into the livelihood needs of forest people and show how conservation can be linked with people's livelihoods.

Background

Chittagong Hill Tracts (CHT) comprises an area of 13,180 square kilometers in southeastern Bangladesh. CHT is a unique part of the country both in terms of its landscape and people. It is Bangladesh's only hilly terrain and is home to the country's largest concentration of ethnic people, with thirteen distinct groups. About fifty percent of the population belongs to non-Bengali ethnic groups, mostly migrants from Myanmar and Tripura State in India. Kaptai National Park is situated in Rangamati District and is managed under CHT South Forest Division.

Administratively Kaptai National Park is divided into two ranges: Kaptai Range and Karnaphully Range. In the Kaptai Range there are two big hills, Rampahar and Sitapahar. Some natural forest remains in Sitapahar , but the rest of the Kaptai Range is covered with planted forest. Prior to the designation of Kaptai National Park the area was known as Sitapahar Reserve. The park was established by gazette order in 1999. Its area is 5,465 hectares (13,498 acres) and it harbors many plant and animal species. Kaptai National Park is now treated as an important protected area in the country (Figure 1). Historically, Kaptai National Park is famous as the place where the first teak plantation was established in Bangladesh in 1871.

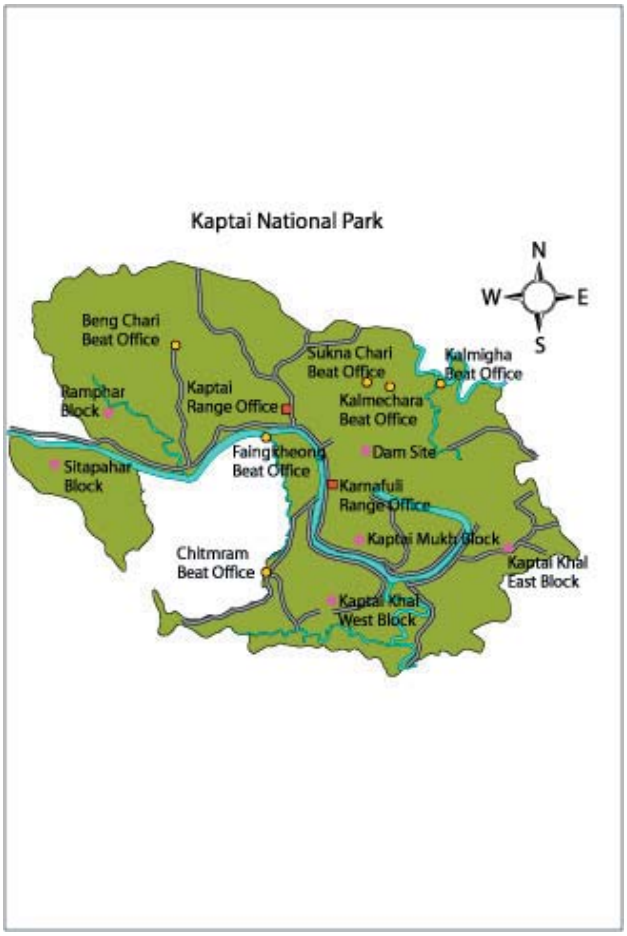

Fig. 1: Map of Kaptai National Park

The topography of Kaptai National Park is undulating, with elevations ranging from 30 to 180 meters. The park is located within a mixed evergreen forest biographic zone and numerous streams also flow through it (Khan and Monirul 2007). Notable animals include the Asian elephant (*Elephus maximus*), barking deer (*Muntiacus muntjak*), hoolock gibbon (*Hylobates hoolock*), wild boar (*Sus scrofa*), and samber (*Cervus unicolor*). Kaptai National Park is home to the second largest population of hoolock gibbons in the country after Lawachara National Park, at present there are forty Hoolock Gibbons in the park (IPAC 2009). Tree species include garjan (*Dipterocarpus sp.*), chapalish (*Artocarpus chaplasha*), banshpata (*Podocarpus nerifolia*), civit (*Swintonia floribunda*), gutgutia (*Fortium serrattum*), and toon (*Cedrella toona*).

The livelihoods of many people in Kaptai National Park area are closely connected to forests. There are about 35 villages in and around the park, with nine in the immediate area next to the park and two inside the park boundary itself. Village

populations are comprised of mixed ethnic groups including Bengalis, Chakma, Marma, and Tanchangya. Villages located outside of the park are mostly inhabited by Bengalis, while residents of the two interior villages are mostly non-Bengali. The two interior villages, Bangchari and Kalabuniapara, have a total population of about five hundred people. These peoples are landless, although some of them practice cultivation on occupied forest lands. In the minds of FD staff members the land-use practices of these communities are undesirable because swidden cultivation and the indiscriminate collection of forest resources reduce biodiversity.

This study focuses on one of the villages inside Kaptai National Park (Bangchari) and one village on the park edge (Kamillachari). In Kamillachari some people maintain their livelihoods by catching fish and cultivating their own farmland. Many people in Kamillachari, however, are landless and therefore practice swiddening in the buffer area of Kaptai National Park.

Communities in the Chittagong Hill Tracts have traditional knowledge of mixed cropping. They can identify medicinal and edible plants and they have knowledge about fishing. Some local people use integrated farming systems that remain successful. In fiscal year 2007-2008 the FD introduced a participatory agar plantation in the buffer area of the park. The plantation was purposely placed in a traditional swidden area as part of an effort to encourage swidden practitioners settle and switch to agroforestry. Approximately one hundred tribal people actively participated in the establishment of the seventy three hectare plantation. Local people were allowed to intersperse agricultural crops along with agar seedlings. By participating in the plantation program and implementing a collaborative forest resources management system these communities are reasserting their inherent rights to use natural resources and are now participating in natural resource conservation activities.

Methods

Bangchari has a total population of 200 people and 84 households. Most inhabitants belong to the Marma tribe, but two households are Tanchangya. Bangchari village is comprised of five scattered hamlets called *paras*. The number of households per hamlet is summarized in Table 1.

Table 1: Number of households in each hamlet of Bangchari Village

Hamlet name	Alternate name	Number of households
Andalachara	Keranighona	11
Kaplachara	Headmanpara	14
Rohahongpara	Puranpara	22
Bogachari	-	10
Kargochara	Notunpara	27

Kamillachari consist of three hamlets inhabited by Chakma and Tanchangya people. There are eighty-one households in the village and the total population is about 250 people of which approximately fifty are Tanchangya.

For this study I used a combination of qualitative and quantitative social science methods. I conducted two informal group interviews (approximately fifteen people per group) with forest resource users in both villages. In Bangchari, I conducted a focus group discussion with people who depend on FD lands for their subsistence and I also conducted a focus group discussion with FD staff members. In Kamillachari, I conducted two focus group discussions, one with fishers and the other with land owners. I conducted key informant interviews with three people in Bangchari and two people in Kamillachari.

The village headmen in both villages helped me to rank all the households in each village according to income. I then used stratified random sampling to select households for interviews. I conducted interviews in twenty five percent of village households (21 in Bangchari and 20 in Kamillachari). Interviews lasted approximately 1 to 1.5 hours and I interviewed either males or females depending on who was available. I observed that some respondents who had profound knowledge of their village and its assets played active roles in the community. In each village I created a community map with the help of villagers and walked a transect to validate the maps and observe different livelihood activities. During the transect I associated groups of households with particular livelihood activities.

Results

Farmers in both Bangchari and Kamillachari have swidden fields, paddy fields, and homestead gardens. Bangchari is located within Kaptai National Park and all its lands are owned by the FD, but villagers have usufruct rights and use land for various purposes. The FD has arrangements for allotting specific forest lands to farmers from Bangchari for swiddening. When the FD identifies areas to be reforested, farmers from Bangchari cut down secondary trees and brush to cultivate crops such as rain-fed rice, maize, pepper, eggplant, pumpkin, turmeric, and ginger. After several years of crop cultivation, villagers assist FD personnel with replanting the land as an FD plantation. The FD calls this land-use system swidden agriculture, but elsewhere it is also known as a form of *taungya* forestry. In Bangchari ninety four percent of households are dependent on this type of agriculture. However, villagers are now facing land scarcity because the FD is planting fewer plantations in the Bangchari area.

In contrast, Kamillachari is located on the edge of Kaptai National Park and farmers from Kamillachari do not have legal access to use park land for swiddening. FD personnel believe that farmers from Kamillachari destroy plantations by illegally clearing them for swiddening. This causes conflict between Kamillachari villagers and park staff. I found that sixty two percent of households in Kamillachari depend on swiddening to support their livelihoods. As in Bangchari, farmers plant upland rice, maize, pepper, eggplant, pumpkin, turmeric, and ginger in their swidden fields.

According to key informants there are 102.4 acres of cultivable paddy fields in Bangchari village. Approximately sixty four percent of households are dependent on paddy farming to provide a six to seven months supply of rice. After harvest most paddy fields are fallowed because there is insufficient water for a second crop. In Kamillachari there are 150.4 acres of cultivable paddy field and approximately forty three percent of households own paddy lands. Appendix 1 is a crop calendar for the two villages.

My study shows that currently as many as eighty percent of households in Bangchari and fifty percent in Kamillachari have gardens near their homes where they grow vegetables such as beans, pumpkins, greens (*puishak*), as well as fruit trees such as lemons, guava, bananas, mangos, and jackfruit. Both swidden fields and home gardens are frequently damaged by wild elephants, boars, monkeys, and hoolock gibbons. Villagers in Kamillachari faced attacks by wild elephants on their homes between August and October 2009. Informants suggested that four percent of households were severely affected, with elephants destroying all assets including homes. Farmers must guard their agricultural crops diligently from wild animals.

I found that approximately thirty one percent of households in Bangchari cultivate coriander as a shade tolerant crop in the forest. They plant coriander leaves in the month of *Bhadra* (mid-August to mid-September) and harvest in the month of *Baishak* (mid-April to mid-May). Coriander is a very profitable crop for villagers. None of the villagers in Kamillachari cultivate coriander leaves on their swidden or other farm land (see appendix 1).

Approximately thirty six percent of households in Bangchari and fifty seven percent of households in Kamillachari have no agricultural land. The landless in both villages collect and sell fuelwood and other NTFPs from neighboring forests. Besides these activities they also earn money from wage labor and rearing cows, pigs and poultry. Approximately seventeen percent of households raise cattle, which are released into forests to graze and sold in markets after they are fattened. Many landless people in Bangchari (but not Kamillachari) also distill and sell alcohol. Bangchari villagers also face the problem of having only one deep tube well; as a consequence many villagers frequently suffer from waterborne diseases for lack of fresh water

People living in forest environments and practicing hunting, collecting, and swidden agriculture draw heavily on forest products not only for subsistence but also for income. Forest related incomes include not only the typical NTFPs but also crops grown in swidden fields and livestock grazed in the forests (Shephard, Arnold and Bass 1999). In Bangchari the main sources of subsistence and income include swiddening, paddy farming, home gardening, and livestock raising. Landless households earn money from collecting and selling NTFPs and day-labor opportunities. Villagers in Kamillachari earn their primary livelihood from swiddening as well as fishing in Kaptai Lake. Other sources of income include wage labor and selling broomsticks (made using *Thysanolaena maxima*) in the winter season. In both villages people spend most of their cash income purchasing food, cloth, health care services, and agriculture-related products. In Kamillachari fishers

also purchase fishing equipment. Table 2 summarizes the various subsistence and income activities people engage in throughout the year. Figure 2 compares the total amount of assets available in each village.

Table 2: Calendar of subsistence and income activities in Bangchari and Kamillachari village

	January	February	March	April	May	June	July	August	September	October	November	December	Number of households (Bangchari)	Number of households (Kamillachari)
Swidden cultivation	▬	▬	▬	▬				▬	▬	▬	▬	▬	79	50
Fishing	▬	▬	▬	▬	▬				▬	▬	▬	▬	--	35
Cow rearing	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	51	7
Pig rearing	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	65	3
Poultry rearing	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	84	81
Small Trade	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	4	15
Farming on own land	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	9	35
Cloth making	▬	▬	▬							▬	▬	▬	--	70
Fuelwood collection	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	81	--
Government job	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	3	--

Major NGOs, including the Indigenous Development Federation (IDF), Bangladesh Rural Advancement Committee (BRAC), the Association of Social Advancement (ASA), and Grameen Bank, operate in Bangchori and Kamillachori villages. According to key informants, ten households in Bangchari and eight in Kamillachari have received credit from ASA. In addition ten households in Kamillachari have received credit from BRAC and fifty five households from UNDP. In addition, fifty five households in Kamillachari have taken credit from the Bangladesh Rural Development Board (BRDB).

In 2008 the FD started an experimental agar plantation in the buffer area of Kaptai National Park to help resolve conflicts over swiddening and to provide economic support for people highly dependent on park resources. Provision was provided by the FD for local people to practice intercropping until the agar canopy became too

thick for field crops to grow. In addition, participating farmers were to receive forty five percent of income earned from the agar trees.

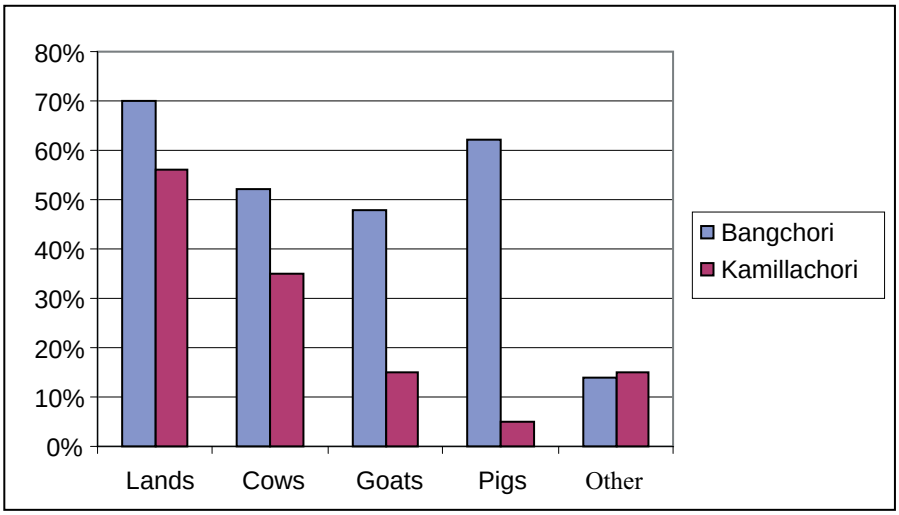

Figure 2: Comparative households assets found in Bangchari and Kamillachari

I found that approximately eleven percent of households in Kamillachari directly benefited from intercropping paddy, ginger, turmeric, maize and other agricultural crops with the agar seedlings. Another fifty seven percent of Kamillachari and twenty four percent of Bangchari households work as wage laborers in the agar plantation (see Table 3).

Table 3: Percent of households receiving benefits from agar plantation in Bangchari and Kamillachari villages

Benefit received	Percent of households, Bangchari	Percent of households, Kamillachari
Intercropping (paddy/maize/vegetables)	-	11
Paddy straw	-	28
Wage labor	24	57

The total contribution of forests to livelihoods is difficult to quantify. The amount of forest products collected by forest dependent households varies according to season, access, and available alternative options (Warner 2000). Forests provide fuelwood and housing materials for all households in both villages irrespective of season. Most households in Bangchari mitigate the lean period (June to August) by collecting wild vegetables and fruits from forest (see appendix-1). In Kamillachari approximately thirty nine percent of farm households are dependent on forests for wild foods during this season. Fishing is also banned in Kaptai Lake during this lean period so

approximately forty three percent of fisher households in Kamillachari also depend on park resources as a source of food during this time. Villagers in Bangchari suggested that food insecurity has increased overtime with the degradation of resources in Kaptai National Park.

Looking comparatively at both villages, only about twenty five percent of the villagers in Kamillachari are not heavily dependent on forest resources. Table 4 shows the percent of households in each village that collect various wild foods in the forest.

Table 4: Percentage of households collecting and types of wild foods collected during the wet season.

Resource	Local name	Scientific name	Extent	households collecting, Bangchari (%)	households collecting, Kamillachari (%)
Leafy vegetables	Chingi shak	*Laasia spinosa*	More available	100%	50%
	Tara shak	*Alpinia nigra*	More available	100%	50%
	Chikon shak	*Homalomena aromatica*	More available	100%	50%
	Dheki shak	*Dicranopteris linearis*	More available	100%	50%
	Thankuni shak	*Clitoria ternatea*	More available	30-40%	20-30%
	Ban kochu (Leaf, stem and corm)	*Colocasia esculenta* (taro)	More available	100%	50-60%
	Kalar mocha and Thor	*Musa ornate* (wild banana)	Less available	30-40%	20%
	Moricha Lata(Chui jhal)	*Piper chaba*	Less available	30-40%	30%
Bamboo Shoots	Bash korol	*Melocanna baccifera*	Moderately available	100%	100%
Jungle Fruits	Jog dumur	*Ficus racemosa*	More available	100%	100%
	Chalta	*Dillenia indica*	Less available	86%	20-30%
	Gutgutia Fruit	*Fortium serrattum*	Less available	30-40%	20-30%
	Khana Fruits	*Oroxylum indicum*	Less available	30-40%	20%

The FD and IPAC have recently introduced co-management programs in Kaptai National Park to solicit the participation of local people in park management. Eight people each from Bangchari and Kamillachari villages are members of the co-

management council (CMC) for the park. The CMC considers appropriate alternative Income Generating Activities (IGA) for these villages. In this study I found that approximately 70 percent of the population of Bangchari wants to culture fish in low-lying lands (*headmanghona*), and 30 percent of the population wants to establish tourist facilities for income generation. People also want to plant fruit trees in their home gardens and establish tree nurseries. In Kamillachari 12 percent of the population wants to culture fishing in streams (*chara*) inside the agar plantation. They also want to collect entry fees from tourists coming to see the agar plantation.

Plate 1: Tourists watching a tribal dance

Plate 2: A *chara* inside

Recommendations

In focus group discussions people in the two villages suggested alternative income generating activities that they are interested in exploring for improving their livelihoods. In Bangchari these included planting a fruit orchard in the FD participatory plantation area or other areas allotted by the FD; creating tree nurseries on areas allotted by the FD; co-operative fish culture in low-lying lands (*headmanghona*); and ecotourism.

Planting fruit yielding trees in the forests is good for both tree cover and people's livelihoods. It will provide a supplementary source of income and a safety net in times of crop failure, unemployment, or other hardships.

Regarding eco-tourism, an ethnic museum could be established in Bangchari reflecting local culture and traditions. An autumn celebration could be held in the forest with tourists encouraged to participate in a "Tourist Tree Planting Center". Opportunities could be provided for people who want to taste traditional tribal foods to dine in the homes of community members. Tourists of course would pay for enjoying these activities. Young people could be trained to be eco-tour guides. Others may want to develop an eco rickshaw business for carrying tourists from Kaptai-Chittagong road (located near the Bangchari Beat office) to the village.

Mushroom cultivation is now popular in the community. Training and assistance could be provided for mushroom cultivation that could become a source of income and food for the community. Building and installing improved stoves (*chullas*) could also become a source of income for some people if they received training on making and installing them. In addition these stoves would reduce the amount of fuelwood used and improve women's health by minimizing the amount of smoke they inhale during cooking.

There are many low-lying paddy fields inside the Bangchari Beat Office. These lands are not used for seven months (December to June) after the paddies are harvested. Multipurpose use of these fields should be developed by providing a source of water during the dry season.

Plate 3: A fallow paddy field inside Bangchari

Plate 4: A traditional swidden hut (*jhum ghar*)

In Kamillachari people expressed a desire to plant a fruit orchard at the participatory agar plantation area; create tree seedling nurseries on their own farming lands; do bamboo crafts; do ecotourism activities; and start co-operative fish cultivation in low-lying streams inside the FD owned participatory agar plantation.

A tourist shop could be established along the New Rangamati Kaptai road. Chakma and Tanchangya women generally weave their own clothes. They could generate income from the weaving and selling of cloth. In addition, many tourists go to their swidden huts (*jhum ghar*) to observe the daily lives of villagers, so this could become a means of earning money from tourists by charging money for these visits. People would pay to eat traditional tribal foods with the community people and to stay at the jhum ghars during the day.

Plate 5: A Tribal woman weaving cloth in Kamillachari

Conclusion

The main conclusion from this study is that the majority of people in Bangchari are still dependent on swidden agriculture. The people of Bangchari are fully dependent on the forests of the Kaptai National Park for shelter, fodder, and fuelwood. As the FD reduces the amount of land it manages under plantations, it also reduces the amount available for swiddening, making the livelihoods of Bangchari villagers less sustainable. This has caused growing conflict between the FD and Banchari villagers. Though some households can meet their rice needs from cultivating their low-lying paddy fields, respondents say they would like to cultivate several crops per year. On the other hand, villagers without access to low-lying paddy fields cannot maintain their livelihoods.

In the past, people from Kamillachori village practiced swiddening in the buffer area of the park that is now part of the experimental agar plantation. A small portion of these people benefited from their participation in FD plantations, but others continued to pursue less sustainable livelihoods. In addition, villagers from Kamillachori also face problems with elephants destroying their homes and fields. For villagers the forests of Kaptai National Park also play important roles in helping them to overcome lean periods.

People in these villages are excited to participate in co-management programs because of opportunities to benefit from alternative income generating activities. As noted above people have begun to identify activities that they think would most benefit them and help provide a more sustainable livelihood.

References

Delang, C.O. 2006. Indigenous Systems of Forest Classification: Understanding Land Use Patterns and the Role of NTFPs in Shifting Cultivators' Subsistence Economics. *Environmental Management 37* (4): 470-486.

Haque, N. 1998. Depletion of Tropical Forests with Particular Reference to Bangladesh. Biomass Resources Potential in Bangladesh. Renewable Energy & Environmental Information Netwrk (REEIN).

IPAC. 2009. Site Level Field Appraisal for Integrated Protected Area Co-Management.Kaptai National Park.Chittagong Hill Tracts Cluster. Integrated Protected Area Co-management Project.Rangamati. Bangladesh.

Khan, M. and H. Monirul. 2007. Participatory Bird Survey to Assess Protected Area Management Impacts: Third Year Report. NSP Bird Survey: Third Year Report.

Shepherd, G., J.E.M. Arnold, and S. Bass.1999. Forests and sustainable livelihoods. Background document, World Bank Forest Policy Implementation Review and Strategy. Internet Document: http://wbln0018. worldbank.org/essd/forestpole.nsf/main view (Under "other relevant stakeholder documents"). [Draft].

Warner, K. 2007. Forestry and sustainable livelihoods. *Unasylva* 226/227(58).

Appendix 1

Crop calendar of Bangchari and Kamillachari village

Baishak (mid-April to mid-May)	Piles slash materials. Plant bananas
Jaishta (mid-May to mid-June)	Sow paddy. Plant turmeric and ginger
Ashar (mid-June to mid-July)	Weed paddy (first time)
Srabon (mid-July to mid-August)	Weeds paddy (second time)
Bhadra (mid-August to mid-September)	Start paddy cutting
Ashwin (mid-September to mid-October)	Continue paddy cutting
Kartik (mid-October to mid-November)	Complete paddy harvesting
Agrohayan (mid-November to mid-December)	Clean fields for planting turmeric and ginger
Poush (mid-December to mid-January)	Clean fields for p lanting turmeric and ginger
Magh (mid-January to mid-February)	Start weeding swidden fields and harvest turmeric and ginger
Falgun (mid-February to mid-March)	Continue weeding
Chaitrow (mid-March to mid-April)	Burn dried materials and plant bananas

Appendix 2
List of the indigenous edible vegetables and fruits collected from Kaptai National Park

Forest Vegetables:

1. Local name: Tara
Tribal name: Tara (Chakma), Chang yangang or Chang a duk (Marma)
Scientific name: *Alpinia nigra* (Gaertn.)
Family: Zingiberaceae
Distribution in the forests: Found in low lying areas, stream banks.
Used part: Inner portion of aerial parts (pith)
Uses: Cooked as vegetables and used in curry for flavoring.
Other uses: Rhizome is considered to be relieves stomach aches, aphrodisiac, tonic, diuretic etc.

2. Local name: Helencha, Malancha
Tribal name: Anlochi or Keckrock shag (Chakma), Tidi dog (Marma)
Scientific name: *Alternanthera philoxeroides* (Mart.)
Family: Amaranthaceae
Distribution in the forests: Found in wet soil, slow moving shallow water
Used parts: Leaves, young twigs
Uses: Cooked as vegetable

3. Local name: Ol kachu
Tribal name: Ol khochu (Chakma), Pring Faing (Marma)
Scientific name: *Amorphophallus paeoniifolius* (Dennst.)
Family: Amaranthaceae
Distribution in the forests: Found in moist places under the shades of trees, forest areas and plantations. It is also commercially cultivated in Chittagong hill tracts.
Used parts: Corm
Uses: As a common tuber cooked as vegetable and sometimes in meat.
Other uses: It is used as an appetizer, relieves stomach aches, and tonic. Aerial Used part(s) in cholera, diarrhea, kala-zar, neuralgia, bites of poisonous insects etc.

4. Local name: Jangli tulsi
Tribal name: Jangli harinchi, Horinshing (Chakma), Lendaza (Marma), Harsanga (Tripura), Tunga dana (Tanchangya)
Scientific name: *Anisomeles indica* (L.) Kuntze
Family: Lamiaceae
Used part: Leaves
Uses: The leaves are used as additive and also as flavoring agent also as vegetable with small fishes.
Other uses: The crushed stem is taken for the treatment of childhood illnesses and leaf extracts are taken thrice daily for treatment of fever in children (Chakma).

5. Local name: Kukur sunga
Tribal name: Ambosh (Chakma), Fawma bopong (Marma)
Scientific name: *Blumea lacera* (Bum.f.)
Family: Asteraceae
Distribution in the forests: Occasional along the roadsides and fellow lands.
Used part: Tender shoots
Uses: Young shoots are boiled to remove the bad scent and then cooked as vegetable.
Other use: It is used in medicinal purposes.

6. Local name: Punarnava
Tribal name: Punorva dalok
Scientific name: *Boerhavia diffusa* L.
Family: Nyctaginaceae
Distribution in the forests: Frequent in marginal land.
Used part(s): Young Leaves and stem
Uses: The plant is cooked by the indigenous people as veget

7. Local name: Shimul, Tula gach.
Tribal name: Seme phul /Semain Gach (Chakma), Lapyang bu-pang(Marma)
Scientific name: *Bombax insigne* Wall.
Family: Bombacaceae
Distribution in the forests: Found in forest and village thickets.
Used part: Flower.
Uses: Removing the corolla rest of the flowers are dried in the sun and stored. These storage flowers are used as additive in vegetable. It is also taken as bharta (paste) after boiling.
Other use: Fruits are the source of cotton. Young roots are used as medicine in sexual impotency.

8. Local Name: Chikan bet, Jali Bet.
Tribal name: Moricha (Chakma), Kejune (Marma)
Scientific name: *Calamus guruba* Buch.
Family: Areceacae
Distribution in the forests: Occasional in hill slopes.
Used parts: Stem pith.
Uses: The spiny skin of young stem of this rattan is peeled off and the inner soft, tender creamy pith is cooked with small shrimp and popular as a delicious menu.
Other use: Use for making furniture, cane-strips for binding edge of bamboo baskets etc.

9. Local name: Thankuni/Thulkuri
Tribal name: Minmini (Chakma), Murong khoya (Marma).
Scientific name: *Centella asiatica* (L.)
Family: Apiaceae.
Distribution in the forests: Occasional in foot hills and wet moist lands.
Used part: Leaves
Uses: Used in salad, Chutney and cooked as leafy vegetable.
Other use: The whole plant is used to treat diarrhea and dysentery.
Family: Chenopodiaceae.

10. Local name: Bathua shak.
Tribal name: Bathwa shak (Chakma), Bra Tho Aa(Marma)
Scientific name: *Chenopodium album* L,
Family: Chenopodiaceae.
Distribution in the forests: Grow in crop fields.
Used parts: Young shoot and leaves.
Uses: Cooked as vegetables with or without small shrimp or available small fishes to make a tasty curry.
Other uses: Leaves are used medicinally in the treatment of hepatic disorders and spleen enlargement, dysentery, piles and also laxative, anathematic.

11. Local name: Tok patha
Tribal name: Mormoijjya amile(Chakma), Pong Kryang shi (Marma)
Scientific name: *Cissus repens* Lamk.
Family: Vitaceae
Used parts: Tender stem, leaves
Used as: Young shoots are used in curries. Sometimes used as additive to bring a sour taste especially in fish items.
Other Use: Leaf extracts are taken for fever.

12. Local name: Cingi shak(Marma)
Scientific name:*Laasia spinosa*
Family: Araceae
Used parts: Pith
Uses: Pith is used as vegetable.

13. Local name: Jungle termaric
Scientific name:*Curcuma zeodorii*
Family: Zingiberaceae
Used parts: Rhizome
Used: Rhizome is used as vegetable.

14. Local name: Dheki shak
Scientific name:*Dicranopteris linearis*
Family: Dicranopteraceae
Used parts: Frond
Uses: Frond is used as vegetable.

15. Local name: Chikon shak
Scientific name: *Homalomena aromatica*
Family: Araceae
Distribution in the Forests: Found in moist places under the shades of trees
Used parts: Petiole
Uses: Petiole is used as vegetable.

16. Local name: Moricha Lata (Chui jhal)
Scientific name: *Piper chaba*
Family: Piparaceae
Distribution in the Forests: Found in moist places near the streams.
Used parts: Stem
Uses: Stem is used in vegetable.

17. Local name: Muli bamboo
Scientific name: *Melocanna baccifera*
Family: Poaceae
Used parts: Bamboo shoots
Uses: Bamboo shoots are used as vegetable.

Forests fruits:

1. Local name: Latkan.
Tribal name: *Kusumgula (Chakma)*
Scientific name: *Baccaurea ramiflora Lour.*
Used part: Fruit
Uses: The sour and sweet tasted fruits are edible.
Other uses: The fruits pulp used in vomiting and very useful in diarrhea and high blood pressure.

2. Local name: Khorkoijja bet, Karak bet.
Tribal name: Karath (Chakma)
Scientific name: *Calamus viminalis Willd.*
Family: Arecaceae
Distribution in the forests: Occasional in hill slopes and in secondary forests.
Used part: Fruits.
Uses: Ripe fruit pulps are edible.
Other uses: Stems used for making arrows, baskets, different household item etc.

3. Local name: Makhna shim
Tribal name: Moma shumi (Chakma), Pay- Thak- Shi (Marma).
Scientific name: *Canavilia gladiata (Jacq.)*
Family: Fabaceae
Used part: Fruit
Uses: Fruits are cooked as vegetables.

4. Local name: Tit Begun
Scientific name: *Solanum torvum*
Family: Solanaceae
Used parts: Fruits
Uses: Fruits are used as vegetable.

5. Local name: Khana
Scientific name: *Oroxylum indicum*
Family: Dicranopteraceae
Used parts: Fruits
Uses: Fruits are used as vegetable.

6. Local name: Chapalish
Scientific name: *Artocarpus chaplasha*
Family: Moraceae
Used parts: Fruits, Seeds
Uses: Fruits, Seeds (By the frying) are used as food.

People's Livelihoods and Involvement in Co-management of Madhupur National Park, Bangladesh

Rokeya Begum[1]

Abstract

Natural forests in Bangladesh have been severely degraded due to over exploitation, encroachment, fire, uncontrolled and wasteful commercial logging, illegal felling, overgrazing, and the collection of fuelwood to support the energy needs of a large population. In 2003 the Forest Department (FD) with assistance from the United States Agency for International Development (USAID) launched the Nishorgo Support Program (NSP) to test a participatory co-management approach to protected area (PA) management. The project lasted until 2007 and was followed in 2008 by the Integrated PA Co-management (IPAC) project with the aim of improving local people's livelihoods through greater access to and control over local forest resources. This paper investigates the livelihoods of local people in two villages and their involvement in management of Madhupur National Park. Based on data collected between September and December 2009 I argue that farmers in the study area are heavily dependant on forestry-related activities to support livelihoods. Residents of both villages have a long history of participation in outside-initiated social forestry programs, and farmers have become suspicious that these programs may not provide the benefits promised, may limit their access to forest resources, and may exacerbate long standing conflicts with the FD. Moreover, despite their history with these programs, many people have little knowledge of co-management. In this paper I conclude that potential exists for various alternative income generating (AIG) activities that could help improve the livelihoods of the local people and the management of Madhupur National Park.

Introduction

A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Carney 1988).

Many of the world's protected areas (PAs) are important not only for their biodiversity, but also for their natural resources that many local people rely on for their livelihoods (Falconer and Arnold 1989, Cavendish 2000). Many people believe that without the active involvement of local people in park management and increased economic incentives for their collaboration in conservation, there is little chance for PAs to be conserved and local resources to be sustainably managed. People also argue that the conservation of biodiversity in PAs will be more

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challenging if local communities are heavily dependent on these areas for energy, nutrition, medicine, and other subsistence needs (Masozera and Alavalapati 2004). Biodiversity conservation planners need to take into consideration the needs of local people, presence or absence of income sources, livelihood issues, and dependence on the forest and forest resources. In the context of Bangladesh, it is very difficult to involve local people in conservation efforts without providing them with some direct and tangible benefits - either benefits in kind or cash for their involvement.

Natural forests in Bangladesh have been severely degraded due to over exploitation, changes in land use, encroachment on forestlands, fire, uncontrolled and wasteful commercial logging, illegal felling, grazing, and the collection of fuelwood to support the energy needs of a large population. The total forest area affected by encroachment in Bangladesh is estimated to be about 36,000 hectares (Haque 2007). It is estimated that approximately 1,000,000 people in Bangladesh live and farm on encroached land (Haque 2007). As a result of these various factors the Sal forests of central and northern Bangladesh have been seriously depleted. Conventional forest management without the participation of local people has not succeeded in curbing deforestation and forest encroachment. I argue that to save Bangladesh's forests and their associated biodiversity, it is imperative that we reduce the dependence of local people on forests and bring them into the mainstream of management. I base my argument on data collected between September and December 2009 in Madhupur National Park.

Bangladesh has a long history of community involvement in forest management. As early as 1871 tribal *jhum* (swidden) farmers in the Chittagong Hill Tracts were engaged in the planting of teak trees (*Tectona grandis*) in abandoned dry land fields under the *taungya* system. In the 1980s, the Forest Department (FD) used funding from the Asian Development Bank (ADB) to initiate the Community Forestry Project in twenty three districts of the northern part of the country as a social forestry project, the first of its kind in Bangladesh. Under this project, marginal fallow lands (road and rail embankments) were converted from bare or cultivated land into forest. Local people were involved and became responsible for the care and maintenance of plantations in return for a share of profits from the mature crops.

This initial program was a great success and marked a milestone in participatory forestry in Bangladesh. Successively, more participatory projects were also implemented. In 1995, the government approved the twenty-year Forestry Sector Master Plan (FSMP) for the protection and development of the country's forest resources. Similarly, the ADB-assisted Forestry Sector Project (FSP), which lasted from 1997-2006, encouraged afforestation activities on marginal lands belonging to various land owning agencies of the government. FSP paid local people for their involvement in the care and maintenance of tree plantations through a share of the tree thinning and pruning materials. The FSP also paid a handsome amount of money from sale proceeds based on a Participatory Benefit Sharing Agreement (PBSA). Under the FSP participants also received money on a daily basis from the FD for labor they contributed to plantation activities. The project covered sixty-four districts including seven PAs (Mukul *et.al* 2008).

Co-management or collaborative management is defined as a "situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources" (Borrini-Feyerabend *et al* 2000). The Bangladeshi government adopted its first co-management program for natural resources, the Management of Aquatic Ecosystems through Community Husbandry (MACH) project, to restore the productivity of three major wetlands between 1998 and 2007.

In 2003, the FD launched the Nishorgo Support Project (NSP) with assistance from the United States Agency for International Development (USAID) to test a participatory co-management approach to PA management. The NSP broadly covered five PAs in Bangladesh (Lawachara National Park, Rema-Kalenga Wildlife Sanctaury, Satchuri National Park, Chunoti Wildlife Sanctaury and Teknaf Game Reserve) and lasted until 2007. NSP officials worked closely with the FD personnel and key conservation stakeholders to develop and implement a co-management strategy to help conserve the country's PAs. The focus of the NSP was on building equitable partnerships between the FD and key local, regional, and national stakeholders to assist in the conservation of Bangladesh's PAs (GOB 2007).

In 2008, the FD and USAID started the Integrated Protected Area Co-management (IPAC) project in 17 PAs and one eco-park in Bangladesh with the aim of improving local people's livelihoods through greater access to and control over local forest resources. IPAC project officials work with personnel in the FD, the Department of Fisheries (DoF), and the Department of Environment (DoE) to: 1) provide support to sustain success in biodiversity conservation and alternative income generating (AIG) activities at NSP and MACH pilot sites; 2) expand and support development of an integrated strategy and coherent national program to support co-management and environmental governance; and 3) mitigate and adapt to climate change (Sharma *et. al.* 2006).

Madhupur National Park is one of the PAs associated with the IPAC project. To achieve the objectives and apply the activities of the IPAC in Madhupur National Park it is necessary to understand the existing livelihood conditions and involvement of local people in the PA. The goal of this paper is to contribute to our understanding of the livelihoods of local people and their involvement in forest management at Madhupur National Park.

Background

Madhupur National Park is located in Tangail District, 125 kilometers north of Dhaka on Tangail-Mymensingh Road. The park is located in the northeastern part of Tangail Forest Division along the boundary with Mymensingh District (it also extends slightly into the district). Madhupur National Park is located in three *upazillas* (sub-districts): Madhupur Upazilla in Tangail District and Muktagacha and Fulbaria Upazillas in Mymensingh District. Major parts of the park are under the administrative jurisdiction of Tangail Forest Division and a small portion is under the

jurisdiction of Mymensingh Forest Division.

Madhupur National Park began as Madhupur Sal Forest, but was finally declared a national park in 1982, although calls for national park status began as early as 1962. Madhupur National Park, which is also known as Madhupur Garh (*garh* meaning 'fort'), comprises an area of 45,565 acres, of which 2,525 acres are reserved forest though gazette notification, and the remaining 43,039 acres are in the process of being declared as reserved forests. A total of 44,533 acres have been surveyed. Madhupur National Park has four ranges, ten beats, and one nursery center (IPAC 2009).

Madhupur National Park is part of the tropical moist broadleaf eco-region of Bangladesh and eastern India. Historically, these tropical moist deciduous forests stretched along the lower reaches of the Ganges and Brahmaputra river plains across the Indian states of Bihar, West Bengal, Assam, Uttar Pradesh and Orissa, and most of Bangladesh. Madhupur National Park forms a slightly elevated tract not exceeding 20 meters in height above the surrounding land. The ridges, locally known as *chala*, are not continuous and are covered with forest formations. Numerous depressions with gentle slopes intercept the ridges. These depressions, commonly known as *baid,* are cultivated for growing rice (CEGIS 2008).

The main forest tree species in Madhupur National Park is sal (*Shorea rubusta*). Formerly the area was very rich in flora and fauna and had populations of elephants and different sub-species of Indian tigers, bears, and birds. Most of these mammals are now locally extinct. Remaining fauna species include monkeys, deer, and languor. Floral species include *haldu, korai, satain, ronia, kadam dewa, neem,* and *shimul*. According to the locals, massive geo-physical changes have occurred over the last twenty years with rapid and almost complete deforestation of the forest (GOB 2006).

Despite its staus as a PA, people continue to depend upon Madhupur National Park's forests for natural resources. Forest stakeholders include *moholder* (auctioneers); illegal tree fellers; collectors of fuelwood, honey, bamboo, cane, sun-grass, fruits, and medicinal plants; hunters and trappers; and farmers who grow pineapples, bananas, papayas, lemons, and other crops in the forest. Many villagers are entirely dependent on the forest for fuelwood and building materials, the collection of which often involves illegal tree felling.

Several mosques, Hindu temples, and churches are also located in the park. About nineteen non-governmental organizations (NGOs) are active in the park, with many providing credit for small businesses such as livestock rearing. NGO micro-credit programs usually focus on supporting activities for women. A government bank also functions in the park making micro-loans for income generating activities such as agriculture and handicrafts to assist in poverty reduction.

Approximately 113 villages surround Madhupur National Park with a combined population of 28,513 households consisting of 124,575 inhabitants,of which 63,678

are male and 60,897 are female (IPAC 2009). Park inhabitants include members of Muslim, Hindu, and Christian religions (Garo, Bormon and Koch) (IPAC 2009). Most natural forests in Bangladesh are home to ethnic minorities who intensively manage forests as PAs in order to retain natural vegetation, forest tree cover, and tribal-forest associations. During the Liberation War, freedom fighters used Madhupur National Park and the surrounding sal forests as a base area. The FD has overall responsibility for the management, conservation and development of Madhupur National Park through planting, patrolling, and guarding forest resources. While the number of FD personnel is inadequate for the management of Madhupur National Park forests, the agency plays a positive role in the protection of the forest range.

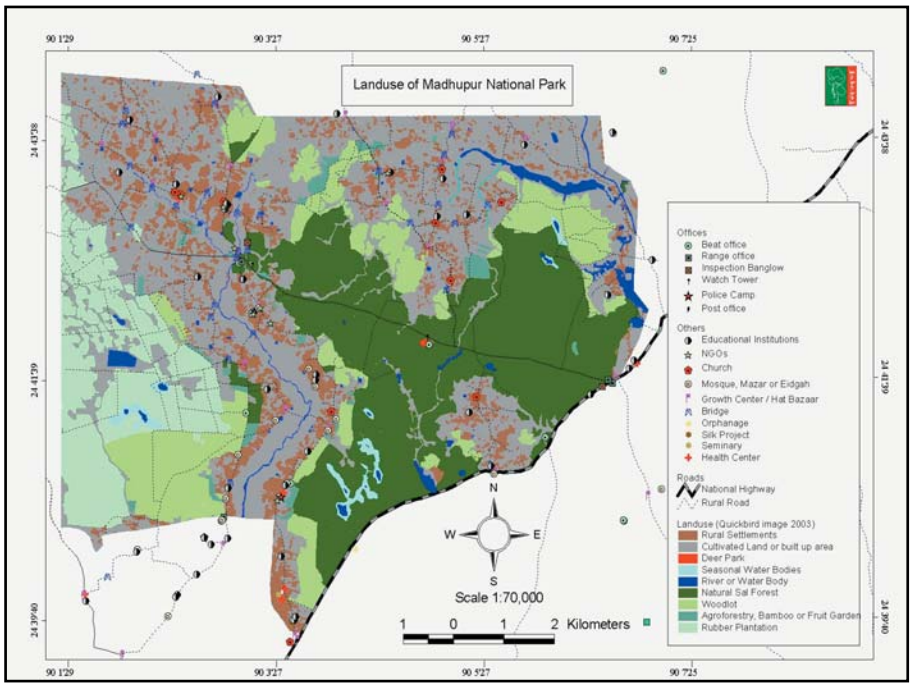

Figure 1: Land-use map of the study area

Research objective and questions

The overall health of Madhupur's sal forest is extremely poor. The forest is greatly disturbed by human activities such as encroachment and illicit tree felling has been tremendously accelerated due to population pressure and privately owned agricultural lands within the reserve forest. There is a serious crisis related to supplies of domestic fuelwood. The local Garo (Mandi) community has been living in the forest area for well over a hundred years, and their livelihoods depend heavily on the forest. The Garo community believes that the forest belongs to them, and that they need access to it to support the needs of their growing population for more

agricultural land. This has caused a serious conflict between the FD and Garo community in Madhupur National Park over land and forest use rights. FD personnel have tried to implement several management practices in the past, but these attempts have faced strong protest from members of the Garo community who fear that these activities will harm their rights to use land and forest resources. In another example of conflict, the FD tried to develop an eco-park in the area and constructed a boundary wall for wildlife habitat. The project failed, however, due to obstruction from local residents, especially the Garo community. The local Garo leader died in this conflict during clashes with law enforcement officers in 2004.

My objective in this paper is to add to our understanding of the livelihoods of the local people and their involvement in management of Madhupur National Park. I also identify ways that local people can be better involved in forest management. The following research questions were designed to address this objective:

- What are the income sources of local people?
- Are local people dependent on forests?
- How are local people involved in forest management?
- What are the local people's perceptions of FSP projects?
- Are local people interested in co-management?

Methods

I collected primary data between September and December 2009 from two villages, the IPAC site office, forestry officials at the Madhupur National Park beat office, and key informants through personal interviews using a semi-structured questionnaire. I chose the two villages (*Pirgacha* and Telki) because of their easy accessibility and the heavy dependence of their residents on forests. In September 2009, I organized four focus group discussions with people at the IPAC site office, officials at the FD beat office, a women's group in *Pirgacha* Village, and a Garo group in Telki Village. In these discussions I sought to learn about local people's livelihoods and social conditions, their participation in FSP, their relations with the FD and their interest in co-management. I conducted two additional group discussions, one in a local tea stall in *Pirgacha* and the other at the local bazaar in Telki. In these discussions I sought to learn about the existing roles of local peoples in forest management and their perceptions of the effects of FSPs on their livelihood activities. Based on these discussions I selected four key informants based on their levels of knowledge and involvement with the community. Later I interviewed these key informants about the historical background of the area and local communities, present forest conditions, local people's dependence on forests, livelihood activities, and local people's perception of FSP affects, and the interest of local people in co-management. Key informants included two members of the local elite, a FD officer, and an IPAC staff member. I collected secondary information from various sources including the internet, journals and books, as well as official reports from the NSP, the FD and the International Resources Group (IRG).

Field research took place in two villages, *Pirgacha* and Telki. Both Bengali people and ethnic minorities (Garo) live in these two villages. Most Garos are Christians who converted from Hinduism after local missionary organizations provided local people with education and sanitation facilities. In addition to these missionary organizations, various NGOs and a government bank work to develop the livelihoods of local people.

In order to select households for interviews I prepared community maps of the two villages through group discussions with community members. I then developed a community profile for each village to investigate household livelihood strategies. I also prepared a household livelihood profile through discussion with community leaders, key informants, and focus groups. In addition, I confirmed information on community maps through two transect walks in the villages, during which I observed resources and livelihood activities.

Pirgacha sits about six to seven kilometers from the Dokhola Range Park Office. The village has three hamlets (*para*): Purba Para, Bormon Para, and Mission Para. The IPAC project is developing a Village Community Forum (VCF) in the village. Almost every household has a tube well and slab latrine, perhaps due to development interventions by Christian missionaries. The village has a total population of 1,042 people (516 males and 526 females). All but three households belong to the Garo ethnic community. Out of a total 279 households, I used a systematic sampling process to select fifty-five households (52 Garo and 3 Bengali) from three paras. Twelve of the households are located in Purba Para, thirty-tree in Bormon Para, and ten in Mission Para. After interviewing the first household in each para I conducted additional interviews in every fifth household. For interviews I used a semi-structured questionnaire and interviewed both male and female heads of household depending on who was at home. If both the male and female head of household were available, I interviewed the male. Proposed checklists of issues were used as a basis for questions. The duration of each household interview was thirty to forty-five minutes.

Telki village lies adjacent to Madhupur National Park. Most people in the village belong to the Garo community, and in general they are poorer than those in Pirgacha village. The majority of households have tube wells for water and sanitation facilities. The total population of the village is 289 people (247 Garo and 42 Bengali). The total male population is 148 (Garo 124 and Bengali 24) and the female population is 141 (123 Garo and 18 Bengali). The total number of households is fifty-five (45 Garo and 10 Bengali). Out of the total fifty-five households, I selected twenty-five (20 Garo and 5 Bengali) for interviews using systematic sampling. As in Purba, I interviewed both male and female respondents using checklists of issues; each household interview lasted thirty to forty-five minutes.

I collected demographic data related to family size, primary and secondary occupations, education, and income sources using a household survey. Survey questions dealt with the respondent's background, household assets, dependence on forests resources, present management system, relationship with the FD, perceptions

of the effects of FSPs, and interest in co-management. All of the respondents were local residents, over 18 years of age, and native to the area. I also collected information on household composition, age, education, medical facilities, land and livestock holdings, toilet conditions, benefits from other organizations (banks, NGOs), sources of family income, alternative sources of fuel wood, and monthly/yearly income.

Results and discussion

Pirgacha has a total of 279 households and a population of 1,042 people (519 males and 526 females, 79 of which are children under the age of 15). I interviewed a sample of fifty-five households in *Pirgacha.* Twenty-six of my interviewees were male and twenty-nine were female. Most of the local people in my research area are Christian and the rest are Muslim and Hindu. Family sizes range from three to ten members. The average age of respondents was forty-four years old. The youngest and the oldest respondents were eighteen and seventy years old. Almost all of the households interviewed (91%) have tube wells and only 9% have dug wells. All of the households use sanitary latrines. Data from this study shows that an average of fifty-five percent of children in *Pirgacha* attend primary school, twenty-four percent attend secondary school, and twenty-one percent go to high school. Most of the respondents (92%) had *katcha* homes (mud walls with a corrugated iron roof), one household (2%) had semi-*pacca* homes (brick walls with a corrugated iron roof) and three households (6%) had tin sheet homes (walls and roof are made of corrugated iron sheets). I found that in my sample, forty-two households were male-headed and thirteen households were female-headed. Approximately 30% of households have cows, 36% have goats, 76% have poultry and 2% have pigs. All the households have access to medical facilities established by Christian missionaries. The primary income generating activities in the community are farming, day labor, forestry-related work, business, government service, and non-governmental work.

Telki Village has a total of fifty-five households and 289 people (148 males and 141 females, out of which 84 are children under the age of 15). In Telki, I interviewed twenty-five households. Fifteen households were male-headed and ten were female-headed. The majority of respondents were Christian and others were Muslim and Hindu. Families ranged in size from three to nine members. Respondents' average age was 39 years old. The youngest and oldest respondents were sixteen and sixty-five years of age. I found that 93% of households used tube well water and 8% of households used water from dug wells. All of the households have sanitary latrines. I also found that 64% of children have attended primary school, 20% secondary school, and 16% go to high school. Housing structures in Telki are katcha (94%) and the remaining are tin sheds (6%). In addition, 24% of households have cows, 48% have goats, 68% have poultry, and 40% have pigs.

Existing Livelihoods of the Study Villages

The livelihood conditions of local people were analyzed in terms of sources of cash income for households in the study areas. The primary source of income was defined as the income that contributed more than half of the household's earnings. Figure 1

shows that in *Pirgacha* the primary occupations are forestry-related (55%). Of the respondents in *Pirgacha*, 16% are farmers (agriculture cultivation), 9% were day laborers, 7% were engaged in business, 7% worked in the non-governmental sector, 1% are in government service, and 5% are engaged in jobs under the category of 'other', which includes van driver, truck driver, blacksmith, grocer, hotel owner, and a variety of other occupations. In Telki Village, forestry-related activities were the most important primary source of cash income. Another twenty-percent of respondents depended on farming and eight-percent were day laborers.

For the household survey (Table 1), I categorized the households into four different income classes based on monthly income: extremely poor (?1,999 BDT (28.70 USD)), poor (2,000-4,999 BDT (28.72-71.77 USD)), medium class (5,000-7,999 BDT (71.79-114.85 USD)) and rich (?8,000 BDT (114.86 USD)). I found that more extremely poor and poor people live in Telki than *Pirgacha* and that the number of medium and rich people in *Pirgacha* is higher than Telki.

Table 1: Monthly incomes of households in *Pirgacha* and Telki

Ranges	*Pirgacha* Respondents	Telki Respondents
1,999 BDT (28.70 USD)	5.5%	16%
2,000-4,999 BDT (28.72-71.77 USD)	78.2%	80%
5,000-7,999 BDT (71.79-114.85 USD)	7.3%	4%
8,000 BDT (114.86 USD)	9.0%	0%

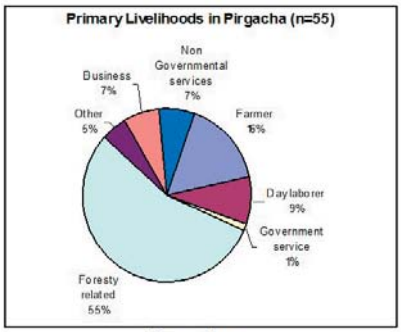

Figure 1a

Figure 1a: Primary occupations among households in *Pirgacha*

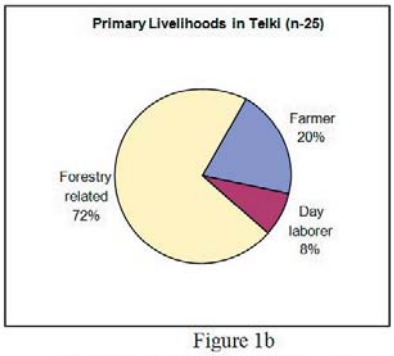

Figure 1b

Figure 1b: Primary occupations among households in Telki .

Figures 1a and 1b indicate that the majority of local people in the study area depend on natural resources for their livelihood activities. Traditionally, local people collected various resources from national park forests. People extract wood, fuelwood, bamboo, and cane from forests both to meet their household's needs and for sale as an additional income to support and supplement their livelihoods. Households in both villages have traditionally been heavily dependent on forests for their livelihoods. However, households in *Pirgacha* appear to be less dependent on forests than those in Telki. Because it is far from the national park and education levels are higher, *Pirgacha*'s population is engaged in skilled occupations such as

business, office jobs, and driving vehicles. In Telki, there are only three significant job options: farming, day labor, and forestry. On the other hand, households in Telki village remain heavily dependent on the forest.

Different NGOs and banks provide micro-credit to local people for small business, livestock rearing, fish cultures, poultry, and other alternative income generating activities. Bank loans are provided in order to support income generating activities for poverty reduction and rural development. For example, banks will encourage income generating activities with seed money for agriculture and handicrafts. Most women in the study area are involved in NGO credit programs. Some of these organizations are also working on issues such as mass education, health and sanitation, and women's development. Although these organizations and activities are providing important support, respondents expressed that these activities were not sufficient to support their livelihoods.

Dependence of Households on Forests

Results from this study reveal that in the village of *Pirgacha* 82% of households engage in forestry activities inside national park forests, while 18% do not engage in such activities. Fuelwood is collected from national park forests by 75% of households for daily consumption and also for sale. The rest of the households interviewed do not collect fuelwood from the park; instead they collect fuelwood from other locations, such as their own homesteads (11%); hilly lands near the national park (7%); or at a market (7%). In addition to fuelwood, I also found 20% of households collect wood and that 18% collect fruits and leaves from forests. Approximately 36% of households own land. In Telki Village, 100% of households collect fuelwood from national park forests for both household consumption and sale. In addition, 84% collect wood and 12% collect fruit and leaves from the forest. In Telki, 32% respondents own land.

In *Pirgacha*, households in both communities depend on fuelwood for cooking due to the unavailability of natural gas and the higher prices of alternate sources of energy. The villagers also sell wood for extra income. In Pirgacha, forest dependence is less than Telki because they have more possible sources of income and their living standard is better than in Telki. This part of my study indicates that the level of dependence of local people on forest resources is high and that forest-related activities are the major income source for most local people. Dependence on the forest is not new; it is custom.

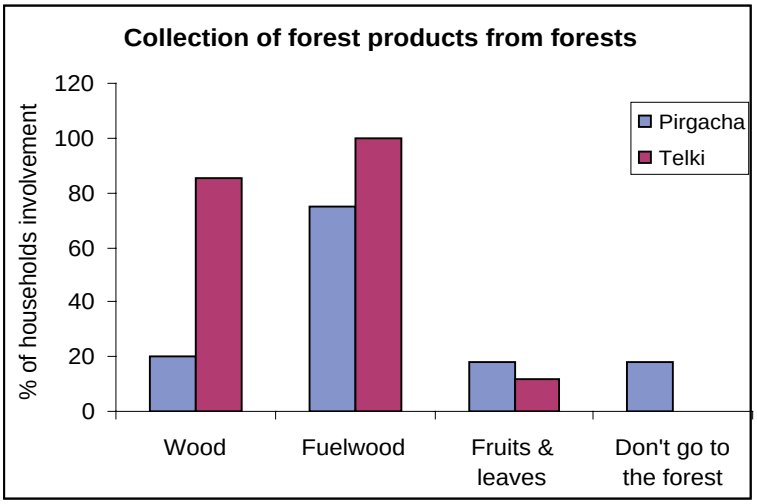

Figure 2: Percentage of households involved in forest product collection activities

Participation of Local People in Forest Management

Madhupur National Park is famous for its Sal forest. However, most of the sal forest within Madhupur National Park has been lost through illicit logging or conversion into rubber plantations. In the park, many forest lands have been encroached upon by Bangalis and ethnic minorities. In 1982, under the Thana Afforestation and Nursery Development project (TANDP) and with the assistance of the Asian Development Bank, the FD started a plantation on the present-day site of Madhupur National Park. After the project's completion in 2002, the FSP took over management responsibilities for the plantations. In order to develop the degraded natural Sal forests, 3,602 hectares of coppiced land has been brought under the authority of the FSP and is now managed with the participation of local communities. Under the Participatory Benefit Sharing Agreement, one hectare of Sal coppice was allocated to each ten participants in a group who were tasked with managing the land by employing a silvicultural system. The coppice crop was designed to be managed on a twenty year rotation cycle over sixty years with a total of three rotations. In addition to sal coppice plots, woodlots (block plantation), agro-forest lands, and buffer zone plantations were also part of the FSP.

As part of the FSP 3,904 hectares of forest (mixes of the types mentioned above) were managed by a total of 3,472 participants (2,826 of which were Bengali and 646 of which were Garo) (Table 2). Through my household survey in *Pirgacha*, I found that fifty-three percent of respondents were involved in the FSP. They are part of a Participatory Benefit Sharing Agreement with the FD, and they get some benefits through selling pruned branches, the trees felled during the first thinning, the fruits of fruit bearing trees, and non timber forest products. Participants also receive cash

benefits for matured crops from FSP (Madhupur National Park Forest Department Office, *personal communication* 2009).

Table 2: FSP plantation types from 2001-2006 in Madhupur National Park

Types of plantation	Area of plantation (hectares)	Participants		
		Bengali	Garo	Total
Woodlot	1965.92	1080	293	1373
Agroforestry	827.82	782	83	865
Bufferzone	368.46	317	68	385
Sal coppices	742	647	202	849
Total area	3904.2	2826	646	3472

Local people, especially in the Garo community, expressed that they were not happy with the FSP's woodlot plantation activities in Madhupur National Park because the plantations limited their use of the forest. In the past, local people used these areas for collecting timber and various other forest products. With the creation of the FSP and the development of plantations, local people realized that their rights to use these lands would be reduced. Although some people benefited from their involvement in plantation management, many residents were not local to the area and there was political pressure from powerful elites influencing who became participants in the FSP. Local people felt that the FSP degraded their land tenure rights, and as a result they are skeptical of all development activities in the national park.

In addition, there was a lack of clarity about the objectives of the FSP and who would benefit. This led to mistrust and suspicion among local people about the FSP and the FD's role and intentions. Locals perceived access to natural forests as being more beneficial to their everyday lives than the plantations and associated activities of the FSP. Natural forests supply them with fuelwood, food, household materials, and so on. The FSP replaced some of the forests they depended on with monoculture plantations, which negatively impacted people's ability to meet their livelihood needs. Although some people earned money from the plantations, they had to wait for these benefits until the end of the plantation rotation. On the other hand, the natural forest had provided those benefits daily. The FSP ended in 2006, at which time all project activities were stopped. In this study, respondents expressed that they want sustainable development activities in Madhupur National Park and that they want to ensure that they have access to the forest to help them meet their daily livelihood needs.

Awareness of co-management practices differed between residents of the two villages in the study area. In *Pirgacha* seventy-four percent of respondents reported interest in co-management practices, while in Telki only fifty-two percent reported being interested. Part of the reason for this may be that at the time the IPAC project developed a Participatory Rural Appraisal (PRA) report for Madhupur National Park a Village Community Forum (VCF) had already been developed in *Pirgacha*.

Therefore, respondents in *Pirgacha* were more aware of co-management than those in Telki.

Conclusion

PAs play an important role in the conservation of forests, the maintenance of biological diversity, and the protection of ecosystem services. However, when local people are dependent on forests that lie within PAs it is important that they are actively involved in forest management. Local communities living near and within national parks often have important and long-standing relationships with these areas. In many places in the world, forest resources are important for people's livelihoods and their cultural survival (Khattak 2002). The primary purpose of this study has been to learn about the livelihoods of local people living in Madhupur National Park and better understand their dependence on the park's forests as well as their past and present involvement in the management of forest resources.

My findings show that in the villages of *Pirgacha* and Telki the primary occupations of villagers are forestry-related activities (55% in Pirgacha and 72% in Telki). The majority of local people in both villages are dependent on forests for their livelihoods to varying degrees. All of the households from both villages use fuelwood for cooking and almost all of the households from both villages collect their fuelwood from the national park. Given their economic status, there are few livelihood choices for residents of *Pirgacha* and Telki. According to the indicators investigated in this study, villagers in *Pirgacha* are poor and villagers in Telki are extremely poor. Therefore, prohibiting them from using forest resources without providing livelihood alternatives will have dire consequences.

Projects meant to improve the living situation in *Pirgacha* and Telki have included the Community Forestry social forestry project (1981-87) and the Thana Afforestation and Nursery Development Project (1989-1996). The principal emphasis of these social forestry projects has been increased participation of local community members in the protection and regeneration of forest resources. The largest of these projects was the Asian Development Bank's assisted Forestry Sector Project. Although some people in *Pirgacha* and Telki received benefits from the FSP, the majority were not involved. The FSP was a successful project in many respects, however it did not provide daily livelihoods activities that could be sustained through time, and after the project ended so did the benefits.

Recently, Madhupur National Park was included as a new IPAC project area. The main objective of the IPAC project is the development of co-management arrangements that promote biodiversity conservation in protected areas. However, in Madhupur National Park, most of the local people do not have knowledge of co-management activities. In this paper I've shown that in a majority of residents in the study area lack interest in co-management practices. Respondents of both villages have some skepticism because of their previous experiences with the Forestry Sector Project.

In light of past and current struggles with co-management, I argue that the following issues must be considered by Madhupur National Park managers, FD officials, and future project leaders in Madhupur National Park:

1) Alternative income generating activities, such as cultivation of bamboo and cane, handicraft making, medicinal plant nurseries, poultry, bee cultures, and cattle rearing can help improve the livelihoods of local people.
2) In Madhupur National Park there is a serious fuelwood crisis. Fuelwood efficient stoves should be promoted to reduce dependence on forest.
3) Homestead plantation activities should be promoted to reduce dependence on national park forests.
4) A habitat restoration and forest rehabilitation program employing local people should be implemented to restore degraded areas in the park.
5) Ecotourism should be introduced by developing publicity activities (colorful posters, booklets, and postcards), eco-cottages and other tourist facilities, guide vehicles, and certified eco-guides. In this way eco-tourism could potentially become another income-generating activity for local people. However, much care must be taken with eco-tourism to ensure that local people and ethnic minorities, rather than more wealthy and connected outsiders, are the beneficiaries.

This paper provides an account of a small study of only two villages in Madhupur National Park. In order to improve park management and enable co-management, a greater understanding of local livelihoods is needed. This will require a larger livelihoods study of villages within the park. Such a study will ideally be done before another project begins, so that the next project better addresses the interests of local people. The newest project in Madhupur National Park is the IPAC project, which recently began activities geared towards improving the management of the national park. Hopefully those associated with the IPAC project can learn from the lessons of previous projects in Madhupur National Park and design a program based on the needs of local people.

Acknowledgements

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References

Borrini-Feyerabend G., T.M. Farvar, J. C. Nguinguiri, and V. A. Ndangang 2000. *Co-management of Natural Resources*. IUCN: Gland, Switzerland and Cambridge, UK.

CEGIS (Center for Environmental and Geographic Information Services). 2008. Landuse/ Landcover and GIS database of Madhupur National Park. Dhaka, Bangladesh.

Carney. D. 1988. Implementing the Sustainable Rural Livelihoods Approach. *In Sustainable Rural Livelihoods: What contribution can we make?* Paper presented at the Department of International Developments Natural Resources Adviser's Conference, edited by D. Carney. London: DFID.

Cavendish, W. 2000. Empirical irregularities in the poverty-environment relationship of rural households: evidence from Zimbabwe. *World Development* 28: 1979-2000.

Falconer, J., and J. E. M. Arnold 1989. Household Food Security and Forestry: An Analysis of Socio-economic Issues. Rome: FAO.

GOB (Government of Bangladesh). 2007. Lessons Learned from Co-Management under Nishorgo and Guidelines for Adapting Co-Management to other Protected Forest Areas. Forestry Department. Dhaka. Bangladesh.

GOB (Government of Bangladesh). 2006. Participatory Sal coppice Management: Bulletin No. 6. Forestry Sector Project. FD. Dhaka. Bangladesh.

Haque. N. 2007. Depletion of Tropical Forests with Particular References of Bangladesh. URL (Accessed August 9, 2007): http://www.eb 2000.org/short_note_10.htm.

IPAC (Integrated Protected Area Co-management project) 2009. Site-Level Field Appraisal for Forest Co-management: IPAC Madhupur Site. Bangladesh: International Resource Group (IRG).

Mesozera and Janaki R.R. Alavalapati. 2004. Forest Dependency and its implications for Protected Areas Management: A case study from the Nyangwe Forest Reserve, Rwanda. *Scandinavian Journal of Forest Research*, 19 (suppl.4).

Khattak, A.K. 2002. Guidelines for the Preparation of Joint Forest Management Plans for Upland ForestsNWFP: Forest Management Centre. Peshwar. Pakistan.

Mukul, S. A., M. B. Uddin, M. S. Uddin, M. A. S. A. Khan, and B. Marzan 2008. Protected areas of Bangladesh: current status and efficacy for biodiversity conservation. *Proceedings of the Pakistan Academy of Sciences* 45(2): 59-68.

Personal Communication. 2009. Madhupur National Park Forestry Department Office.

Sharma, R., P. Decosse, M. Roy, M. Khan, and A. Mazumder 2006. Co-management of protected areas in South Asia with special reference to Bangladesh. Dhaka: Partner Report, Nishorgo Support Project (with FD, USAID and IRG).

Impacts of Co-management Activities on Livelihoods in Satchari National Park

Mahmudah Roksena Sultana[1]

Abstract

Under the Wildlife Preservation Amendment Act (1974), Bangladesh has declared nineteen protected areas including national parks, wildlife sanctuaries, and game reserves. To reduce the dependence of local people on protected areas the Forest Department initiated the Nishorgo Support Project (NSP) in 2004. NSP identified local stakeholders and formed forest users groups (FUGs), community patrolling groups, and community management committees to provide local people with alternative income generating activities consistent with conservation. This paper seeks to assess the effect of collaborative management activities on rural livelihoods in four villages outside Satchari National Park by comparing the livelihood status of FUG members to non-members; and to assess any change in the forest dependence of the four communities or in the condition of the forest following NSP activities. Drawing on data gathered through household surveys, focus group discussions, and key informants interviews, as well as secondary data, I show that FUG members received support to invest in alternative income generating activities such as plant nurseries, livestock rearing, and fish culture. These activities had a positive impact on the livelihoods of participants while reducing forest resource extraction. However, only 508 out of 17,836 households living in and around the park were FUG members, and among these only 189 households received support for alternative income generating activities. These results raise the question of whether alternative income generating activities can ever be sufficient to have a significant impact on forest conditions.

Introduction

One quarter of the world's poor depend directly or indirectly on forests for their livelihoods (World Bank 2000a cited by Uprety, 2004). Although still a low percentage overall, an increasing amount of forests worldwide are defined as protected areas (PAs). The International Union for Conservation of Nature defines a PA as, "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (IUCN 2008). In Bangladesh and other developing countries PAs are often established on state lands and have historically been poorly managed. Most of the PAs in Bangladesh were declared by gazette notification; however, without effective management, these PAs essentially became 'paper parks'. Local people, especially those who live in and around PAs, depend on the resources of these areas for their livelihoods and cultural survival. In

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Bangladesh, as in other countries, there has been a tendency not to allow, or even consider, local people as participants in PA management. However, conservation managers worldwide increasingly recognize that local people, local knowledge, and local participation are key factors in realizing sustainable PA management (Svartad *et al* 2006), and have tried to develop new approaches for PA management. One such approach, first introduced in the 1980s, is 'collaborative management' or 'co-management'. This is a participatory approach to environmental conservation that seeks to enhance both natural resource conservation and local livelihoods.

Under the nation's Wildlife Preservation Amendment Act (1974), Bangladesh had designated nineteen protected areas including national parks, wildlife sanctuaries, and game reserves. These PAs cover only 1.67 percent of the country's territory. The simple declaration of various categories of PAs has not been sufficient to stop the steady loss of biodiversity in Bangladesh because people are dependent on PAs for their livelihoods through their use of timber, fuelwood, wildlife, and other forest products. Without the active involvement of local people, increased economic incentives for their collaboration in conservation, and more sustainable patterns of resource use, there is little chance for success of PA initiatives (Fox *et al* 2008). Conversely, the socio-economic condition of local people depends on the state of PAs. In 2004 the Forest Department (FD) initiated the Nishorgo Support Project (NSP) in five PA pilot sites to test methods for improving the livelihoods of local people who are directly and indirectly dependent on forest resources while promoting the conservation of biodiversity within the PAs.

As part of the NSP local stakeholders were identified and came together to form forest user groups (FUGs), community patrolling groups (CPGs) and community management committees (CMCs) to provide local people with alternative income generating activities consistent with the goals of conservation. Economic benefits from these activities are anticipated to reduce local people's dependence on protected area resources and therefore diminish their negative impacts on PAs (Svartad *et.al.* 2006). The main aim of this research is to reveal whether co-management practices were effective in reducing forest dependence, improving livelihoods of FUG members, as well as promoting the forest condition in *Satchari* National Park (SNP).

The specific objectives of this study are:

1) To assess the effect of collaborative management activities undertaken as part of the NSP on rural livelihoods in four villages outside *Satchari* National Park through a comparison of livelihood status between FUG and non-FUG members.
2) To assess forest conditions and whether there has been any change in forest dependence among the four local communities following the NSP activities.

Background

Satchari National Park was established in 2005 to preserve the remaining natural hill forest patch of Raghunandan Hill Reserve Forest, an area of 243 hectares. However, the total area of *Satchari* Wildlife Range is about 1,760 hectares (IPAC 2009). The

park is situated in the Paikpara Union of Chunarughat Upazila in the district of Habigonj. The reserve forest is under the jurisdiction of *Satchari* Wildlife Range, which is part of the Wildlife Management and Nature Conservation Division of the Forest Department. The park is divided into two administrative sectors known as forest beats, namely *Satchari* Forest Beat and Telmachara Forest Beat. *Satchari* National Park stands on the old Dhaka-Sylhet Highway and is about 130-140 kilometers northeast of Dhaka, between *Teliapara* and Srimongal. The forest area is undulating with scattered slopes and hillocks (tilla) ranging from ten to fifteen meters in height. The forest is drained by a number of small streams with sandy beds.

Satchari National Park is surrounded by a number of tea estates, villages, towns, and cultivated fields. Nine tea estates are located close to the park. A total of seventy-three villages with various degrees of connection or involvement in the park have been identified. The village of Tiprapara, a tribal community of about twenty-four households, is located inside park forest and its residents have a major interest in park management. The rest of the villages are located six to nine kilometers away from park forest. Residents of these villages have various levels of stakeholder status in terms of park management ranging from major to minor. The majority of forest resource users are fuelwood collectors and illegal loggers (IPAC 2009). Forest villagers, local poor people, tea estate laborers, and *Moholders* (auctioneers) are especially dependent on *Satchari* National Park's forests for their livelihoods. Local poor people, including Tripura community members, are involved in illegally extracting major resources from the forest. *Moholders* are rich and locally influential people, who are involved with legal tree felling but who also destroy forest biodiversity through harmful clear felling operations. Forest villagers are men, women, and adolescent boys who collect forest products such as fuelwood, bamboo, and fodder.

The overall livelihood situation of people living in and near *Satchari* National Park is not good. In *Satchari* National Park, the majority of people are poor (55-60%), followed by middle class (22-25%), and extremely poor (17-20%). Only about four to five percent of community members are classified as rich. In Tripura communities, approximately 65 percent of households are poor, 12 percent extremely poor, and the rest belong to the categories of rich (1%) and middle class (2%) (IPAC 2009). In terms of education, about eighty percent of people are illiterate; although the educational level of children is currently increasing. Approximately thirty to forty percent of children go to primary school, ten percent go to high school, and only one percent study in college (IPAC 2009).

Major occupation groups include farmers (65-70%), day laborers (20-25%), fuelwood collectors and timber poachers (3-5%), small businessmen (2-3%), service providers (3%), and overseas employment (2%). Secondary occupations include fuelwood and bamboo collectors (5-8%), and day laborers (5-10%). The occupation patters of local people of *Satchari* National Park have been changing over time. Presently, the number of day laborers has increased with a trend of decreased involvement in agriculture. Illegal logging has greatly increased over the past 15 years as a local occupation. The occupations of some households have changed from

farming to day labor, fuelwood collection, timber poaching, and small businesses. Local people have also adopted other wood-based occupations like timber trading, furniture shops, and carpentry (IPAC 2009).

Training and credit support opportunities play a vital role in income generation for some local people, lessening their dependence on the forest in the *Satchari* National Park area. After completion of the NSP's training program, forest user groups received grants for different types of alternative income generation (AIG) activities. Existing AIG activities practiced in the area include fish cultivation, livestock rearing, ecotourist rickshaw operating, ecotourist shop operating, weaving, plant nursery operating, bamboo product development, and home gardening.

The purpose of this study is to assess the impacts of AIG activities associated with co-management in *Satchari* National Park. My assessment looks at the effects of AIGs on rural livelihoods and forest dependence. The assessment compares the livelihoods and forest dependence patterns of FUG members to non-FUG members (people within the communities who are not members of a forest user group). I also examine the perceptions of FUG members and non-FUG members about changes in forest conditions in the four villages located outside *Satchari* National Park that are involved in the NSP.

Methods

AIG activities were undertaken with the support of the NSP with the goals of reducing the forest dependence of local people, improving their livelihoods, and changing their attitudes towards resource management. The NSP was implemented from July 2004 to June 2009 to advance co-management through various methods, including alternative income generating activities. The NSP involved local people through the formation of FUG. One of the first steps in developing FUGs was to identify the degree and nature of forest dependence and poverty among local people. This information was gathered through a participatory rural appraisal (PRA) (Kumar 2002). Based on the information gathered through the PRA, the NSP field organizer and/or the co-management committee members had discussions with stakeholder groups within communities, and eventually the co-management council gave permission for the communities to form a FUG. Forty-one forest user groups have been formed as part of the NSP (23 of which are female groups and 18 of which are male groups) across seventy-three villages in and around the *Satchari* National Park site.

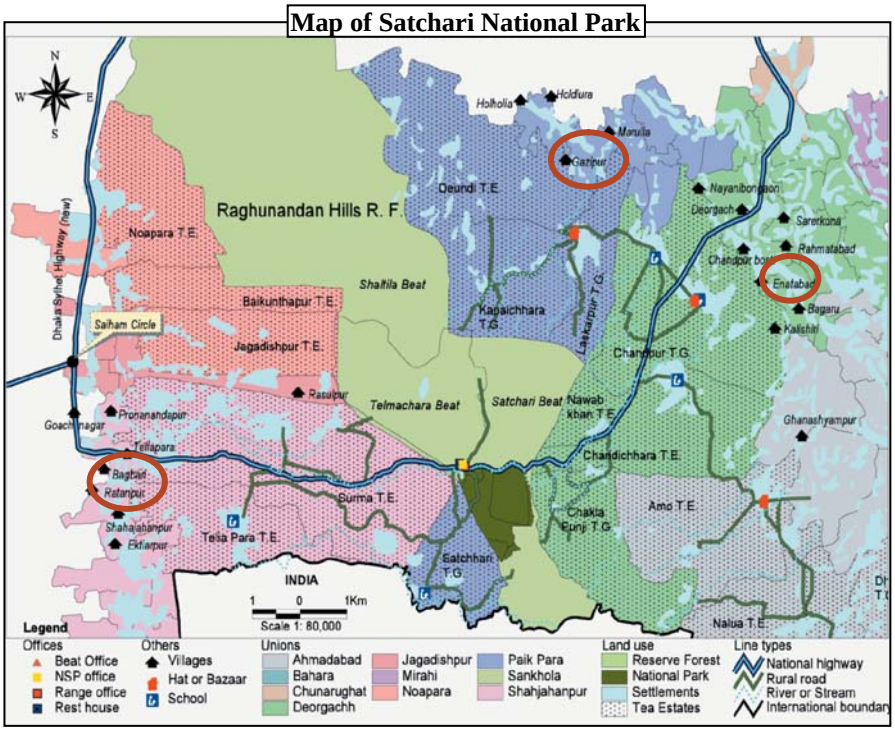

Figure 1: Map of *Satchari* National Park and Surroundings (Source: NSP, 2006).

After reviewing PRA reports and consulting with Forest Department (FD) officials and Integrated Protected Area Co-management (IPAC) project staff I chose four villages-Ratanpur, Bagbari, Gazipur, and Enatabad-as research sites. Ratanpur and Bagbari are situated in Sajhanpur Union, Gazipur in Paikpara Union, and Enatabad in Deworgach Union. Nine of the forty-one FUGs formed under the NSP are based in the study area (four in Ratanpur, three in Bagbari, one in Gazipur, and one in Enatabad).

This paper draws on both primary and secondary data. I gathered primary data through household surveys, focus group discussions, and key informants interviews. Secondary data consists of relevant published and unpublished documents, participatory rural appraisal reports (IPAC 2009), the Management Plan for *Satchari* National Park (Sharma, 2006), NSP site information documents (NSP 2006), and other sources from the internet.

For household surveys I selected twenty households in each village (ten households with members belonging to forest user groups and ten households that are not part of forest user groups) and interviewed them using semi-structured questionnaires. In Bagbari and Ratanpur all FUG respondents were male while those in Gazipur and Enatabad were all female. Households were chosen using a random sampling method and I selected one adult (either male or female) from each household as a respondent.

In total, I interviewed 80 respondents, with each interview lasting thirty to sixty minutes.

Table 1: Sample size for household survey

Number of respondents

Village Name	Forest User Group Member, Male	Forest User Group Member, Female	Non-member, Male	Non-member, Female
Bagbari	10	0	8	2
Ratanpur	10	0	9	1
Gazipur	0	10	8	2
Enatabad	0	10	8	2

As part of the study I also conducted seven focus group discussions. These discussions consisted of one group discussion with co-management committees (CMCs), four group discussions with forest user groups who live in the research area, and two discussions with FD officials and IPAC staff. Using a checklist of topics, I asked discussants about the situation of *Satchari* National Park prior to implementing the NSP. I also asked if co-management practices under NSP brought fruitful results in the context of environmental conservation and the protection of *Satchari* National Park. With regard to AIG activities, I asked what types of AIG activities local people have engaged in and whether or not it they are sufficient enough to improve local livelihoods.

I also interviewed one person from each village as a key informant. Key informants were chose for their broad and in-depth knowledge about their area as well as the livelihoods of villagers. In Ratanpur and Enatabad the key informants were also FUG members; in Bagbari and Gazipur the key informants were not FUG members. Discussions with key informants focused on past conditions in *Satchari* National Park, village people, and their livelihoods. Key informants also spoke about forest dependence and collaborative activities under the NSP.

Results and discussion

In this section I address three main questions: 1) Do co-management practices reduce the forest dependence of FUG members; 2) Do co-management practices improve the livelihoods of FUG members through AIG activities; and 3) Do co-management practices affect forest conditions.

The majority of people in the study area are permanent residents, and almost all are Muslim. Among these villagers, approximately ninety percent live in mud (*katcha*) houses. Water supply facilities of local people are not sufficient but their sanitation facilities are adequate. About fifty percent of households consist of three to five members, twenty-five percent have one to three members, and the rest consist of five or more members. Sixty-nine percent of people in the study area are illiterate, twenty-four percent have a primary education, and the rest have a secondary school education. Although many residents are illiterate, they have a positive attitude concerning their children's education, but educational facilities vary from one village to another. Nearly all residents own homestead land, with an average size of .004 to

.08 hectares. However, few people have both homestead and agricultural land. People in the study area depend on forest resources for their livelihoods.

Do Co-management Practices Reduce Forest Dependence among FUG Members?

The NSP began initiating AIG projects at *Satchari* National Park after the formation of FUGs in 2005. In focus group discussions, I learned that FUG members became concerned about conservation issues and the protection of the national park through different types of awareness programs, trainings, and meetings. Their changing attitudes influenced their choice of professions. Based on individual interviews, I found that the main income sources of FUG members are livestock rearing (43%), farming (22%), day labor (15%), forest resource extraction (5%), bussiness (8%) and other forms of work (7%) (Figure 2). The number of people rearing livestock is higher than other professions because half the respondents in FUGs were female and livestock-related activities are one of only a few sources of income for housewives.

Among residents who are not members of FUGs, main sources of livelihood continue to be forestry-related activities (50%), followed by farming (20%), livestock rearing(3%), business (5%), day labor (17%) and other forms of work (5%). In other words, my findings show that non-members were still actively involved in forestry related activities. The co-management practices introduced through the NSP were effective in involving local FUG members, who were more motivated to shift their profession from forestry related activities to other professions like day labor, farming, and business entrepreneurship.

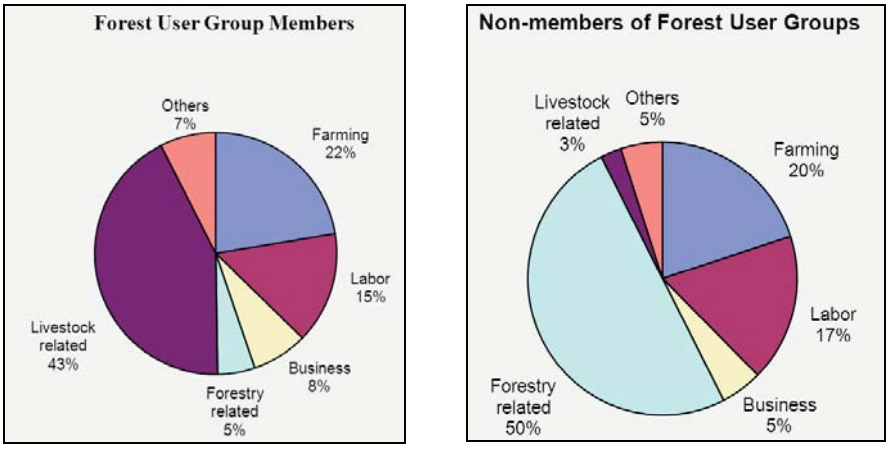

Figure 2: Major occupations among FUG members and non-members

Forests have historically played important roles both as a resource base and as a source of income for communities in *Satchari* National Park. Local people collect different types of forest resources to meet their daily subsistence needs and earn cash income. Among interview respondents, I observed that FUG members collect fuelwood (20%), bamboo (13%), and fruits (3%). Also FUG members do not appear

to be involved in illegal felling of timber. On the other hand, non-members of FUGs collect timber (20%), fuelwood (70%), bamboo (25%), rattan (3%), and fruits (18%) from the forest.

Figure 3 compares the responses of FUG members and non-members concerning involvement in the collection of forest resources in *Satchari* National Park. As the figure shows, fuelwood is the most commonly harvested forest product, followed by bamboo and then timber. All respondents, regardless of FUG membership status, collect fuelwood, bamboo, rattan and fruits for their own consumption as well as for sale. Both members and non-members also use traditional materials they collect from the forest and their homesteads. FUG members placed importance on gathering fuelwood from their homesteads rather than the forest. Indeed, my data indicate that forest fuelwood collection by FUG members is less than that of non-members due to awareness raised through training programs regarding the importance of forest protection and conservation.

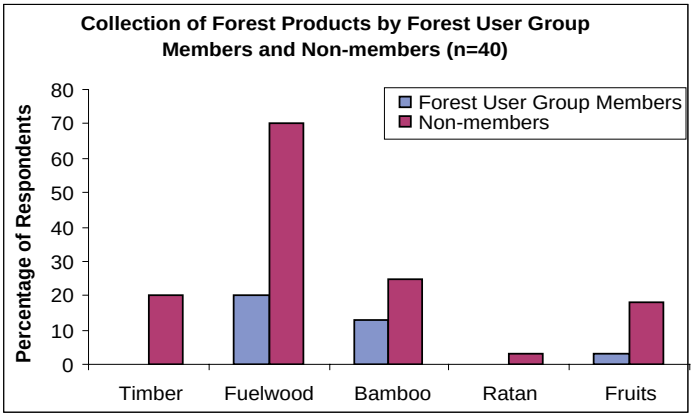

Figure 3: Percentage of forest products collected from *Satchari* National Park by forest user group members and non-members.

Do AIG Activities Improve the Livelihoods of FUG Members?

I analyzed improvements in livelihoods in terms of the monthly cash income of respondent households. Figure 4 shows that only three percent of FUG members earned monthly cash incomes in the highest range (>15,000 BDT) (>215.83 USD). Regardless of FUG membership status, the income of three percent of respondents was between 12,000-15,000 BDT (172.66-215.83 USD). However, higher percentages of FUG members earned incomes in the ranges of 3,000-5,000 BDT (43.17-71.94 USD), 6,000-8,000 BDT (86.33-115.11 USD), and 9,000-11,000 BDT (129.50-158.27 USD). The reverse was found in terms of lowest income range (<3,000 BDT) (<43.17 USD), in which nearly 30% the income of non-members falls, whereas only that of 13% of FUG members does.

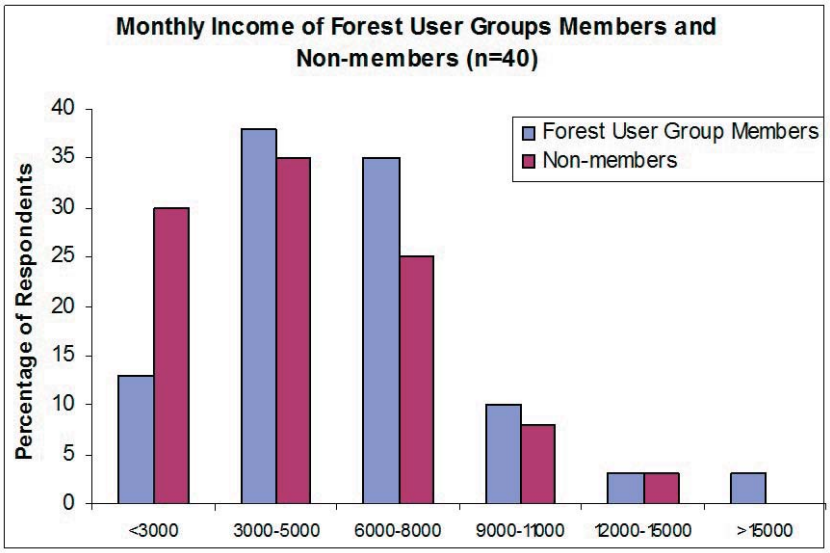

Figure 4: Percentage of monthly income of forest user group members and non-members

This differential income structure reveals that the financial status of FUG members is better than non-members, which suggests that the NSP has been successful in creating alternative income generating activities for FUG members. Under the NSP members receive various types of training and earn extra money from AIG activities, which in turn helps them to improve their livelihoods. One of the six components of the NSP is to create AIG opportunities for local people who are dependent on forest resources. By bettering socio-economic conditions and improving people's ability to practice sustainable forest management AIG opportunities facilitate the protection and conservation of forests. Based on this data, it is apparent that NSP activities have been gradually improving the livelihoods of FUG members.

In 2005, the NSP began initiating AIG activities with participants at *Satchari* National Park. Thirty-four out of forty FUG member respondents have received support for AIG activities during the project period. Plant nurseries are one of the most successful AIG activities at *Satchari* National Park. In the study area, three respondents were involved in plant nursery activities with an initial allocation of 4,000 BDT (57.55 USD). These farmers have developed and improved their nurseries and have earned a good income from nursery activities. Among these three respondents, one FUG member (also a community management committee member) earned 150,000 BDT (2,158.27 USD) over the last three years and another two FUG members earned 15,000 BDT (215.83 USD) and 11,000 BDT (158.27 USD) respectively last year from selling tree seedlings they had grown in their nurseries (Figure 5).

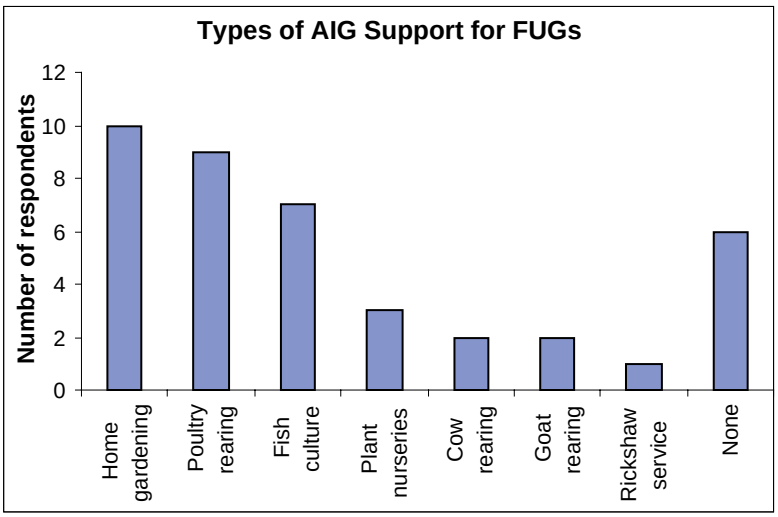

Figure 5: FUG member respondents who received benefits from alternative income generating activities.

Eco-rickshaws have been the most successful AIG activities in the study area, although only seven people are currently involved. I observed that the program to introduce eco-rickshaws as AIG activities in Ratanpur was well received and that one participant earned nearly 60,000 BDT (USD 863.31) in a year.

Many of the respondents (25%) are involved in home gardening as an AIG activity. Under the NSP members are given an allocation of 2,000 BDT (28.78 USD) for gardening. However, the results of this activity have not been as successful. FUG members are provided with seeds for homestead gardening; however respondents suggested that the seeds they received were inferior and not suitable for planting. Among the ten respondents involved in homestead gardening, one FUG members from Bagbari earned 10,000 BDT (143.89 USD) last year from selling vegetables. Another respondent from Gazipur earned 4,000 BDT (57.55 USD), but the rest of the respondents lost their principal investment money. Better quality seeds are required to improve this AIG activity.

Poultry rearing is another AIG activity promoted under the NSP. During the study period this program produced both successful and unsuccessful results. Hatchery chickens were provided to FUG members through the NSP. However, during this period bird flu was widespread in Bangladesh and the variety of chickens provided was prone to attacks by bird flu (avian influenza); as a result most of the birds died. Thus, participants from Bagbari could not earn money from this AIG activity. On the other hand, FUG members in Ratanpur had greater success because they took precautions to save their chickens from bird flu. Precautionary measures against bird flu are necessary in order to gain more benefits from poultry rearing as an AIG activity.

Fish cultivation has also been ineffective as an AIG activity. Most of the seven supported individuals have not earned significant returns from the activity. For this reason, FUG members in Bagbari, Gazipur, and Enatabad have abandoned their fish cultivation activities. Failures have occurred for several reasons; among them: fish fingerlings were not distributed at the proper time; people's ponds were not adequate for fish cultivation; and technical support was inadequate. Cultivating fish is time-sensitive work and program recipients must be careful about the timing of the activity. At the Ratanpur site, one NSP fish cultivator is doing quite well and has received some return from selling his fish products. This is because he had previous experience with fish rearing and knew how to properly manage his pond. The success of this activity depends on the time consciousness of the participants, their previous experience with fish rearing, and proper technical support.

Cow rearing has been successful as an AIG activity, but goat rearing has been unsuccessful. I found that cow rearing AIG activities have been going well at Bagbari Village. The participants earn a good income from the activity, but it is a slow process. In the case of goat rearing, the participants have not earned money due to the inferiority of the goats provided. Better quality goats are needed for this program to succeed.

A total of 17,836 households are situated in and around *Satchari* National Park. Among them, 508 families are involved in NSP activities as members of FUGs, community patrolling groups, and/or community management committees. However, the number of AIG activity projects is limited. From 2005 to 2007, only 189 families received support for AIG activities. At the time of this study, most residents who were not FUG members were dependent on forest resources. Considering that the goal is to reduce dependence on forest resources and improve livelihoods, the amount of AIG activity support provided to accomplish this goal is negligible. Having said that, AIG activities have definitely had a positive impact on local livelihoods and have reduce dependence on forest resources. Based on these findings, I suggest that more local people should become involved in FUGs so that they can benefit from AIG activities as part of the IPAC project.

Do People perceive that Co-management Practices affect Forest Conditions?

Figure 6 indicates that people's perceptions regarding forest conditions in *Satchari* National Park vary. During individual interviews, I encountered different opinions from local people about fuelwood and bamboo collection, illegal felling, entrance of outsiders, number of wild animals, and tree coverage. The majority of respondents expressed opinions that forest conditions have improved somewhat in regard to stopping illegal felling (approximately 68% of respondents), resisting entrance by outsiders (64%), increasing the number of wild animals (83%), and improving tree cover (86%). In regard to reducing wood collection, respondents expressed the opinion that conditions have slightly improved in terms of fuelwood (73%) and bamboo (90%); whereas some respondents expressed the opinion that there has been no improvement (26% for fuelwood and 5% for bamboo). Many unemployed people

are particularly dependent on forest resources in the park area. In light of this reality, it is arguable that co-management activities generate opportunities for local people to meet their basic needs without degrading protected areas.

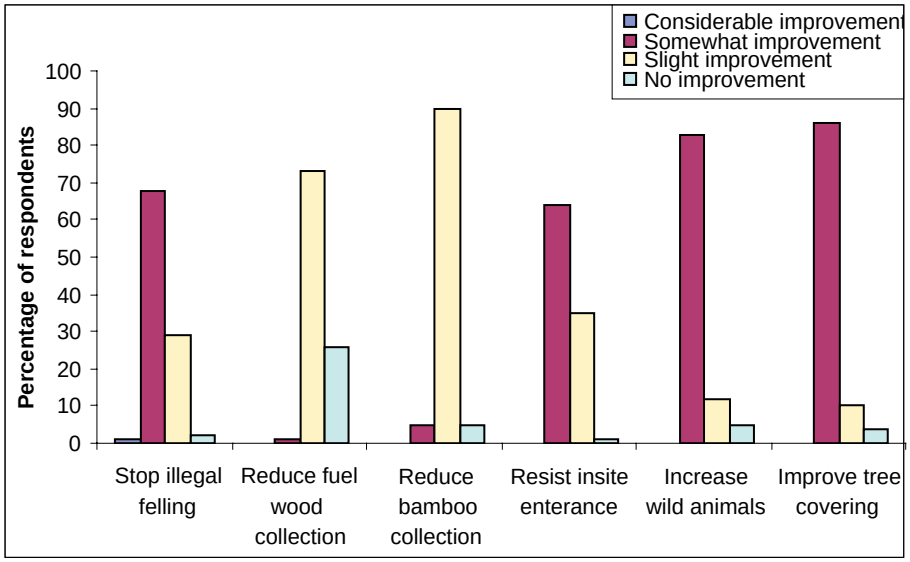

Figure 6: Local perceptions concerning forest management outcomes (n=80)

If people's perceptions are accurate, these results indicate a slight reduction in the collection of fuelwood and bamboo and an improvement in halting illegal felling. The park's CMC supported initiatives to stop fuelwood and bamboo collection. The entrance of outsiders into the park and local communities also appears to be decreasing.

In group discussions respondents suggested that support for AIG activities and the awareness of local people are the main factors that contribute to reducing forest dependence and improve forest conditions. However, other steps are important as well. Coordination should be considerably enhanced among Forest Department personnel, International Resources Group staff, and members of local management committees. Patrolling should be strengthened with the help of forest villagers and Forest Department staff. Honorarium funds are needed as a salary for villager patrolling groups. Ecotourism facilities and other sources of income are important for local people. In *Satchari* National Park ecotourism facilities have already developed. The income generated by ecotourism needs to be properly managed, and a portion of the proceeds should be used for the wellbeing of local people. Overall, the results of this research suggest that co-management activities are playing an effective role in reducing forest dependence, improving the livelihoods of local people, and improving forest conditions.

Conclusion

In this paper I looked at the effects of AIG activities on the livelihoods of rural residents and forest dependence, and also compared the livelihoods and forest dependence patterns of FUG members to non-members. I also examined perceptions of FUG members and non-members about forest conditions in *Satchari* National Park under the NSP. I also examined if the creation of alternative income generating opportunities can reduce the forest dependence of local people.

Study results suggest that only five percent of FUG members are involved in forest resource extraction whereas fifty percent of non-members are engaged in forestry related activities. There is a noticeable difference in the forest dependent income of FUG members and non-members. Alternative income generating opportunities have changed the attitude of FUG members, redirected their occupations away from forestry-related activities to other professions, and also reduced their forest dependence. Dependence on forests has also been reduced as a result of alternative sources of income and livelihood (Gunatilake 1998).

In the region of *Satchari* National Park, the forest has historically played an important role as a source of income and a basis for the livelihoods of local communities. Local people collect different types of forest resources to meet their daily subsistence needs and earn cash income. Local people collect forest products from park forests, as well as their own homesteads, for consumption as well as for sale. The results of this study show that FUG members are less dependent upon forests than non-members. This is most likely due to the creation of awareness about forest issues and AIGs through the NSP. After joining co-management activities, FUG members were made aware of forest protection and conservation through different training programs.

AIG programs have definitely had a positive impact on the livelihoods of local people. The NSP started introducing AIG activities to participants in and around *Satchari* National Park in 2005. FUG member respondents have received support for plant nurseries, livestock rearing, fish culture, and other AIG activities; however, this support has been limited and inconsistent. Only a small percentage of local people are involved in AIG activities. To be sustainable, co-management activities need the involvement of more local people (non-members of FUGs) in FUG initiatives and needs to provide these people with consistent AIG support. The monthly income structure of residents shows that the financial status of FUG members is better than non-members because the NSP has created more AIG activities for FUG members. Members receive various types of training and get extra money from AIG activities. This extra money helps to improve their livelihoods. AIG activities can influence socio-economic conditions and improve people's ability to practice sustainable forest management.

Local people's perceptions of the condition of the forest vary. They perceive slight reductions in the collection of fuelwood and bamboo and considerable improvement in the reduction of illegal felling. The entrance of outsiders into the national park and

local communities also appears to be decreasing, while the number of wild animals is increasing and tree quantity and quality are also improving. The perceptions of local people indicate a changing situation at *Satchari* National Park.

Co-management approaches to natural resource management are recognized in many areans of the world (Ostrom 1990, Bromley 1992, Connor *et al* 1996, UNDP 1999, Borrini-Feyerabend *et al* 2000, Keen and Lal 2002). However, in Bangladesh the co-management approach was introduced as recently as 2005. During this short period different types of research have been completed on co-management activities. The overall results of this research suggest that co-management activities have a positive impact in reducing forest dependency and improving the livelihoods of local people in *Satchari* National Park.

Recommendations

Based on my research findings, I suggest the following recommendations for reducing forest dependence, improving local livelihoods, and promoting positive forest conditions in *Satchari* National Park.

1. Only a small percentage of households are involved in FUGs; there needs to be more involvement in FUG initiatives.
2. The financial benefits of AIG activities for FUG members were limited and insufficient. AIG activity projects should be increased.
3. The distribution of funds for AIG activities should be changed to a micro-credit program so that a revolving fund can be created to sustain the program.
4. Capacity building training is needed for all local people including non-members. Forest managers also need training in sustainable management of forest resources and biodiversity conservation.
5. Due to inadequate staffing to patrol *Satchari* National Park, there needs to be increased staff recruitment.
6. Patrolling should be strengthened with the help of forest villagers and Forest Department staff. Honorarium funds are needed to pay villager patrolling groups.

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References

Borrini-Feyerabend,G., Farvar, M.T.,Nguinguiri, J.C. and Ndangang, V.A.2000. Co-management of Natural Resources: Organizing, Negotiating and Learning-by-Doing. The World Conservation Union (IUCN): Gland, Switzerland.

Bromley, D.(ed). 1992. The Commons, Property and Common Property Regims.in Making the Commons Work: Theory, Practice and Policy. Institute of Contemporary Studies, San Francisco.

Connor, R., Houlbrook, R. and Tarihao, F.1996. Local Conservation Area Ownership Traditional Management, in Wallace, H. (ed), Developing Alternatives: Community Development Strategies and Environmental Issues in the Pacific, Victoria University, Melbourne.

Fox, J., B. R. Bushley, W. B. Miles, and S. A. Quazi, eds. 2008. Connecting Communities and Conservation: Collaborative Management of Protected Areas in Bangladesh. Honolulu: East-West Center.

GOB (Government of Bangladesh). 1974. Bangladesh Wildlife (Preservation) (Amendment) Act.1974. Forest Directorate, Government of Bangladesh.

Gunatilake, H. M. 1998. The role of rural development in protecting tropical rainforests: evidence from Sri Lanka. *Journal of Environmental Management* 53(3): 273-292.

IPAC (Integrated Protected Area Co-Management) North-East Cluster Team. 2009. Site-Level Field Appraisal for Integrated Protected Area Co-Management: *Satchari* National Park.

IUCN (International Union for Conservation of Nature). 2008. Overview. URL [Accessed July 16, 2010]: http://www.iucn.org/about/union/commissions/wcpa/wcpa_overview/

Kumar, S., 2002, Does Participation in Common Pool Resource Management Help the Poor? A Social Cost-Benefit Analysis of Joint Forest Management in Jharkhand, India. *World Development*, 30, pp. 763-782.

Keen,M. and Lal, P. 2002. Creating Supporative Frameworks for Community Based Resource Management. *Development Bulletin* 58: 46-51.

Nishrgo Support Project 2006. Site information Brochure; *Satchari* National Park. Dhaka,Bangladesh.

Ostrom, E. 1990. Governing the Commons: *The Evolution of institutions of Collective Action*. Cambridge University Press: Cambridge.

Sharma, R.2006. Management Plan for Satchari National Park. Nishrgo Support Project, Forest Department, Government of the People's Republic of Bangladesh.

Svartad. H.K Daugstad. Ol Vistad. and I. Gulvik.2006.New protected areas in Norway: Local participation without gender equality. *Mountain Research and Development* 26(1): 48-54.

UNDP.1999. Pacific Human Development Report 1999: Creating Opportunities United Nations Development Programme: Suva.

Uprety, Dharam.2004. Role of Community Forestry in Sustainable Rural Livelihoods: A case study of some Community Forest Users' Groups in Nepal. Vienna, Austria: PhD thesis, University of Natural Resources and Applied Life Sciences (BOKU).

Perceptions of Climate Change in Kaptai National Park

Suriya Ferdous[1]

Abstract

Bangladesh has always been vulnerable to climate variability due to its geographical features and location. This vulnerability is exacerbated by high population density, high levels of poverty, and people's reliance on climate-sensitive sectors, particularly rural agriculture. In this paper I describe the perceptions and observations of local tribal people living in Kaptai National Park, Bangladesh concerning climate change and its impacts on their livelihoods. My main purpose is not only to understand tribal people's perceptions about climate change and its effects on their livelihood, but also to look at how they are adapting to perceived changes. I argue that the recording of tribal knowledge and perceptions of climate change in Kaptai National Park is important for both understanding local livelihoods and developing climate change policies. Such understanding is of great value because it helps us to better understand the present and potential future impacts of climate change on people living in Kaptai National Park, while offering clues into adaptive measures that should be taken.

Introduction

Bangladesh is internationally renowned as a "mega delta" and is home to the world's largest mangrove forest. The nation is also categorized as one of the world's least developed countries. In recent years, Bangladesh has been increasingly featured in international news because it is considered to be one of the first places where the impacts of climate change and sea level rise will be evident. This susceptibility to climate change is due to the country's low elevation and its location at the convergence of three major rivers (the Ganges, Brahmaputra, and Meghna) and the Bay of Bengal.

According to the predictions of global circulation models, global climate change will result in an average temperature increase in Bangladesh of 1ºC by 2030 and 1.4ºC by 2050. In addition, by 2050 monsoon precipitation is likely to increase by 6.8% (Selvaraju *et al* 2006). Bangladesh has always been vulnerable to climate variability due to its geographical features and location. The country is highly influenced by monsoons and regional precipitation patterns, which result in floods during the monsoon season and droughts in the dry season. The impact of this weather variability on the Bangladeshi people is exacerbated by high population density, high levels of poverty, and people's reliance on climate-sensitive sectors, particularly agriculture (Climate Change Cell 2006).

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The impacts of climate change in Bangladesh are likely to be most severe in the southern coastal belt along the Bay of Bengal. People living in this area are also especially vulnerable to disasters related to climate change because they live on marginal lands and their livelihoods are highly dependent on natural resources. According to the Intergovernmental Panel on Climate Change (IPCC)'s Fourth Assessment Report, people such as these are among the most vulnerable to climate change (IPCC 2007a). Therefore, it is important that consideration of these coastal communities is always integrated into estimations of the impact of future climate change-related disasters.

In this paper I describe the perceptions and observations of local ethnic minority people in Kaptai National Park concerning climate change and its impacts on their livelihoods. I also demonstrate how people in the park have been adapting to climatic variations up to this point. The main purpose of the study is not only to understand tribal people's perceptions about climate change and its effects on their livelihood, but also to look at how they are adapting to perceived changes.

Importance of the study

Bangladesh is a disaster prone country, and the majority of the most damaging events have occurred in the southern part of the country. According to the IPCC, communities that reside in marginal lands and whose livelihoods are dependent on natural resources and forests belong to a "high risk" group in the context of climate change (IPCC 2007b). Thus, tribal communities in southern Bangladesh could be in an even more vulnerable situation in the future due to climate change.

In attempting to comprehend the livelihoods of tribal people, the knowledge of the people themselves contains a wealth of significant information. According to Byg and Salick (2009).

> Documenting local perceptions of climate change is also important from a policy point of view, since local perceptions reflect local concerns and focus on the actual impacts of climate change on people's lives, which are dependent on local factors and cannot be estimated through models. In addition, local knowledge and perceptions influence people's decisions both in deciding whether to act or not and what adaptive measures are taken over both short- and long-terms. Therefore, local observations and perceptions should be taken into account in efforts to understand climate change, its impacts, adaptation to it, and mitigation of it.

In this paper I argue that the recording of tribal knowledge and perceptions of climate change in Kaptai National Park is important both for understanding impacts on livelihoods and developing climate change policies. This research will help us to better understand the present and future effects that climate change may have on tribal people living in Kaptai National Park, while offering clues into adaptive measures that should be taken.

For this study I selected Kaptai National Park for the following reasons:

- The park is located in a part of Bangladesh that is susceptible to sea-level rise and that is heavily impacted by seasonal weather variability and flooding;
- The park is co-managed;
- Limited research has been done on the impacts of climate change in the area.

Background

The global climate is changing and it is likely to change further over coming decades due to increasing concentrations of "greenhouse gases" in the earth's atmosphere caused largely by human activities (Climate Change Cell 2006). Like the rest of the world, Bangladesh is also experiencing significant climatic changes. Changes in rainfall patterns, droughts during rainy seasons, late monsoons, recurring floods, and warm winters may be signs of these changes. It is well recognized that these weather variations have had significant impacts in southern Bangladesh, particularly in southwestern Bangladesh. For example, since catastrophic landslides struck Chittagong in June 2007, it has been recognized that the Chittagong Hill Tracts are likely to be significantly affected by climate change-induced disasters. While flash floods and landslides in the Chittagong Hill Tracts are related mostly to human-caused soil erosion and deforestation, it is probable that the frequency and severity of such disasters will increase sharply due to climate change-induced increases in precipitation and storm surges (Gunter *et al* 2008). In addition, Bangladesh is particularly susceptible to sea level rise due to its geographical position.

Bangladesh is located between 20° and 26° north latitude and 88° and 92° east longitude. The country is bordered by India to the west, north, and east; by Myanmar to the southeast; and by the Bay of Bengal to the south. Eighty percent of the country occupies floodplains and mean elevations range from one to six meters (IPAC 2009). Bangladesh is a densely populated country, with over 156,050,900 people living in an area of only 143,998 square kilometers. This is significant in that higher population densities increase vulnerability to climate change because more people are exposed to risks while opportunities for migration are limited. Straddling the Tropic of Cancer, Bangladesh has a typically humid and warm tropical climate. The country is susceptible to natural calamities such as floods, tropical cyclones, tornadoes, and tidal bores. Such phenomena occur almost yearly. In Bangladesh there are four prominent seasons: winter, pre-monsoon, monsoon and post-monsoon (Agarwala *et al* 2003). The general characteristics of the seasons of Bangladesh are shown in Table 1.

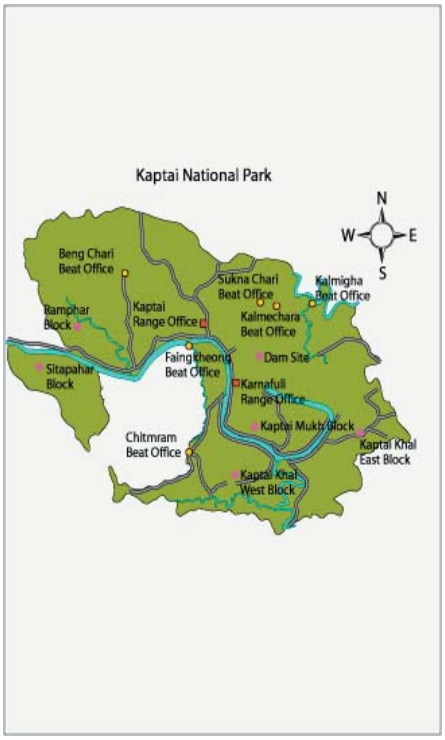
Table 1: General characteristics of seasons in Bangladesh (Agarwala *et al* 2003)

Season	Description
Winter	Period: December to February Type: relatively cooler and drier Temperature: 7.2 to 31.1°C
Pre-monsoon	Period: March to May Type: hot with high rate of evaporation and occasional rainfall Temperature: maximum of 36.7°C
Monsoon	Period: June to early-October Type: hot and humid with torrential rainfall Temperature: 22 to 40°C
Post-monsoon	Period: late October to November Type: reduced rainfall and lower night-time minimum temperature Temperature: 20 to 33°C

Kaptai is a hilly district situated in the southeastern part of Bangladesh. The area was declared a national park in 1999 by the Forest Department. The park is located in the Karnaphuly and Kaptai Ranges, part of the Rangamati Hill District, which is under the jurisdiction of the Chittagong Hill Tracts South Forest Division. Kaptai National Park covers 5,464 hectares and is about 57 kilometers east of Chittagong city (Table-2). The park, which is composed of evergreen deciduous and semi-deciduous tropical forest, is unique for its monumental teak plantations established in 1873, 1878, and 1879. These are the oldest plantations in Bangladesh and were the starting point of modern forest management in the Indian sub-continent. This type of natural forest[2] is found only in deep valleys where wet conditions exist. The canopy is irregular and the forest is multi-storied and unevenly aged.

[2]. Tree species include: gorjon (*Dipterocarpus sp.*), chompaful (*Michelia champaca.*), boilum (*Anisoptera scaphula*), gutguria (*Fortium serratum*), bohera (*Terminalia belerica*), civit (*Swintonia floribunda*), chakua (*Albizia chinensis*), narikeli (*Pterygota alata*), chapalis (*Artocarphus chapalus*), pitraj (*Aphanamixis polystachya*), nageshor (*Mesua nagessarium*), dharmara (*Stereospermum personatum*), bashpata (*Podocarpus neriifolia*), chulta (*Dillenia indica*), udal (*Sterculia villosa*), konok (*Schima wallichii*), and chikrashi (*Chickrassia tubulasis*).

Table 2: Characteristics and map of Kaptai National Park (Reza 2007, Khan 2007)

Area: 5464 hectares (13,498 acres)	
Geography: Hills covered in mixed - evergreen forests	
Coordinates: 22°30´ N latitude, 92°20´ E longitude	
Compartments: 50 (25 each in Kaptai & Karnaphully)	
Villages: 40	
Households: 1400 (approximately)	
Population: 9000 (approximately)	
Main Occupation: Jhum Cultivation	
Amphibian species: 11 Reptile species: 78	
Ethnic minorities: Chakma, Marma, Tanchainga	
Climate: Sub-tropical	
Temperature: 34°C - 12°C	
Rainfall: 2,200 to 3,600 mm	
Humidity: 35 -45% (November through March), 80% or higher (rainy season)	
Evaporation: average annual of about 500 mm	
Wind velocity: Maximum recorded is 96.54 km/h	

The first teak plantation was established at the site of present-day Kaptai National Park after teak seeds were imported from neighboring Myanmar in 1871. The growing of teak on a massive scale in the Sitapahar area began in 1873. The Sitapahar forest area was declared a forest reserve in 1945 and gazetted in 1946. In 1999, the Government of Bangladesh, with power authorized under section 23(3) of the Bangladesh Wildlife (Preservation) (Amendment) Act of 1974 (act number 17), declared the reserve forest "Kaptai National Park" and determined its boundary (IPAC 2009).

In addition to a wealth of wildlife[3], Kaptai National Park also supports a large number of tribal communities (e.g., Chakma, Marma, and Tanchangya) whose livelihoods mostly depend on *jhum*[4] cultivation and forest resources. Peoples from these three communities have continued to live in and near Kaptai National Park since its designation as a protected area. Two villages are located inside the park: Bangchori in the Kaptai Range and Kolabunia in the Karnaphuli Range. Marma, Chakma and Tanchangya peoples live in Bangchori, while only those of the Marma ethnicity live in Kolabunia.

Study area

Bangchori

Bangchori is located in the Kaptai Range forest administrative area. The village has eighty-four households located in five hamlets. The largest tribal group in Bangchori is the Marma, but the village is also home to Chakma and Tanchangya people. The main occupation in Bangchori is jhum cultivation, but people also engage in other occupations such as agriculture, retailing, day labor, fuelwood collection, business, teaching, logging, and government jobs. Typically males are the primary money-earners in the households and many females are housewives. Buddhism is the predominant religion of the villagers and their level of education is quite low. Bangchori has no primary school and only one preschool run by the NGO, Bangladesh Rural Advancement Committee (BRAC). I interviewed fifteen people in Bangchori, of which nine were males and six were females from different occupations.

Plate 1: Jhum Cultivation in Bangchori

According to the seasonal calendar of Bangchori (Table 3), jhum cultivation starts in the winter season (October to February) (Plate 1). A variety of crops are reaped during the time of jhum cultivation. Bangchori villagers grow and harvest rice, corn, long bean, bean, turmeric, banana, ginger, okra, sweet pumpkin, and spinach. The annual income of the villagers earned from jhum cultivation is approximately 25,000 to 30,000 BDT (362 to 434 USD). In the summer (June to October), locals engage in rice cultivation and tree logging. However, only a small portion of the villagers have their own land for rice cultivation, so a large portion of villagers engage in tree logging and other seasonal occupations during this time.

[3]. Wildlife includes: hati (*Elephus maximus*), maya horin (*Muntiacus muntjak*), para horin (*Cervus porcinus*), barsinga (*Cervus duvauceli*), Khorgous (*Lepus nigricolis*), honumun (*Presbytis entellus*), ulluk (*Hylobates hoolock*), Bon birul (*Felis chaus*), bonno sukor (*Sus scrofa*), sojaru (*Hystrix indica*), udh birul (*Lutra lutra*), bon chagol (*Capricornis sumatracnsis*), sumbur (*Cervus unicolor*), bunor (*Macaca sp.*), beji (*Herpestes sp.*) as well as many unknown birds, amphibians and reptiles.

[4]. A type of swidden agriculture

Table 3: The Seasonal Calendar of Bangchori

Seasons → / Occupations ↓	Summer					Winter				Pre-Summer		
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Jhum cultivation												
Rice cultivation												
Retailing												
Day labor												
Fuelwood collection												
Tree logging												
Business												
Teaching												

Kolabunia

Kolabunia is in the Karnaphuli Range forest administrative area. The village has eighteen households and is home to a population of approximately one hundred people belonging to the Marma tribal group. Like in Bangchori, the main occupation in Kolabunia is jhum cultivation. People also engage in other occupations, including fishing, day labor, boat operating, teaching, shop-keeping, and government jobs. In Kolabunia many of the women work in their own homes as housewives. The village has a low level of education. For this study, I interviewed ten people from the village, of which eight were males and two were females from different occupations.

According to the seasonal calendar of Kolabunia (Table 4), jhum cultivation starts in the winter season (December to February). A variety of crops are cultivated during this time, including rice, watermelon, bean, long bean, turmeric, banana, ginger, papaya and sweet pumpkin. The annual income earned by villagers from jhum cultivation is about 20,000 to 25,000 BDT (289 to 362 USD). In Kolabunia, the summer season lasts from June to October, during which time the villagers are engaged in day labor and fishing. The average monthly income of villagers engaged in fishing and day labor is about 4,000 to 5,000 BDT (58 to 72 USD) and 6,000 to 7,000 BDT (87 to 101 USD) respectively. In the past, during summer a large portion of the villagers provided day labor to the forest department for which they received fuelwood and wages.

Table 4: The Seasonal Calendar of Kolabunia

Seasons → / Occupations ↓	Summer			Pre-Winter		Winter				Pre-Summer	Summer	
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Jhum cultivation												
Fishing												
Boatman												
Day labor												
Shop keeping												
Business												
Teaching												

One problem expressed by study participants in both villages was wildlife pestilence. Villagers in both communities have suffered badly from repeated intrusions of animals like elephants and monkeys into their jhum fields over the past several years. These animals uproot crops and damage fields. Increasingly animals do not get enough food from inside the forests because of severe degradation, and so they enter human settlements searching for food.

Methods

In order to identify perceptions of tribal people concerning the effects of climate change on their livelihoods in Kaptai National Park, I utilized both primary and secondary data. However, because I was particularly interested in people's perceptions, I relied mainly on primary data collected through interviews and focus group discussions. In particular, I focused on issues related to climate change such as environmental changes, variations in rainfall patterns, changes in agricultural practices, vector-borne diseases, biodiversity, culture change, natural disasters, and adaptation measures.

This research project spanned a six-month period from August 2009 to January 2010. I conducted field research from October to November 2009, and again in January 2010. In addition, I carried out informal discussions with NGO staff and government agency officials in Dhaka from September to December 2009. In total, I spent approximately thirty days collecting data in the villages and additional time reviewing relevant literature and analyzing findings.

I used an open-ended questionnaire for the semi-structured interviews with households. The questionnaire was designed to 1) gather information on livelihoods; and 2) to document opinions on and observations of impacts of climate change. The data from the questionnaire were used to draw conclusions about the socio-environmental condition of the villages.

I interviewed a total of twenty-five households in two villages. For the household survey, I did an ad hoc sampling of households in Bangchori and random sampling of households in Kolabunia. In Bangchori, I interviewed sixteen of eighty-one households in five hamlets. The breakdown of households in the hamlets of Bangchori is as follows: Old (22); Headman (14); Andalachara (11); Bogachori (10), and New (27). I interviewed five households each from New and Old hamlets, and two households from each of the other hamlets. In Kolabunia, I interviewed ten households out of eighteen.

For the household survey I interviewed either male or female respondents. I purposefully selected individuals 30 years of age or older as household respondents. Through preliminary discussions with villagers (both in Bangchori and Kolabunia), I found that female respondents did not have sufficient education, or were not conscious enough of the issues to respond appropriately. Most females were not interested in topics like environment, agriculture, rainfall, weather, food patterns, markets, or even, surprisingly, culture. Many female respondents simple answered, "I don't know anything." Therefore, the numbers of male respondents are comparatively higher than female.

Focus group discussions with villagers centered on perceived climate change impacts. They included questions about temperature fluctuation, rainfall changes, agricultural changes, biodiversity, vector borne diseases, and natural disasters. I conducted a total of two focus group discussions (one for each village). There were five respondents in each focus group discussion. The groups were composed of both males and females above thirty years of age and from various occupations.

For the key informant interviews I used an open-ended, in-depth questionnaire to ask questions about tribal people's experiences with the effects of climate change. My key informants were the two focal village's headmen.

With the help of villagers I prepared seasonal calendars for the two villages (Tables 3 and 4) in order to understand their agricultural practices with respect to the seasons of the year. These calendars contain time frames for crop production during different seasons, from which a considerable amount of information about villagers' livelihoods can be gleaned.

Results

This study sought to determine whether tribal people in two villages in Kaptai National Park perceive of climate change as affecting their environment and livelihoods; and if so, in what ways. Many respondents perceive that their environment is changing and that these changes are not the result of normal climatic variations or natural phenomena. They perceive enhanced anomalous changes in the climate, although most of them are not familiar with the term "climate change". In Bangchori village 40 percent of the participants (6 people) were familiar with the

term climate change and felt that the environmental changes they were experiencing in their own lives may be due to this. Of the six people who perceived changes, four were men and two were women. In Kolabunia village, none of the participants were aware of the term climate change but they perceived changes in rainfall, temperature, and other climate variables.

Table 5 summarizes the changes perceived by respondents in the two villages. Approximately 47% and 40% of respondents in Bangchori and Kolabunia respectively perceived that temperatures were increasing while the same percentage of respondents observed no changes in temperatures. In Bangchori 6% of respondents felt that winters were colder while in Kolabunia 20% perceived winter temperatures to be cooler. Most respondents in both villages felt that summers were getting longer and considerably hotter.

Approximately 47% and 70% of participants in Bangchori and Kolabunia respectively perceived rainfall to be decreasing at alarming rates, while 34% and 30% of participants perceived no changes in rainfall. In Bangchori, approximately 19% of participants perceive rainfall to be more irregular. Villagers could not recall the period and duration of rainfall patterns for the past four or five years but most of them perceived the changes in rainfall were affecting the cultivation and production of food crops.

Approximately 20% of participants in Bangchori and 60% in Kolabunia perceived that food production had decreased, while 47% and 20% perceived no change. Villagers were also aware of changes in the production of rice. An alternative rice variety had been introduced in both villages to improve yields. Rice varieties, such as "rice-10/11/panza" that had been grown in the past cannot be cultivated now. In Bangchori, 27% of respondents perceived that water availability was reduced. Villagers traditionally depended on spring water from nearby hills for irrigation and daily needs throughout the year, but for the last five or six years the springs have dried up in the winter and only begin to flow again in mid-summer. As water has become less available, farmers have started to use pumps to draw ground water for irrigation. Villagers also observed that the number of insect pests had increased and that consequently the application of pesticides had also increased. In addition, 20% of participants in Kolabunia felt that fewer fish were available in Kaptai Lake.

Table 5: Summary of perceived environmental changes in the two villages

Perceived effects	Bangchori % and number of respondents (n=15)	Kolabunia % and number of respondents (n=10)
Temperature changes		
Temperatures warmer	47% (7)	40% (4)
Winter much colder	6% (1)	20% (2)
No changes	47% (7)	40% (4)
Rainfall changes		
Rainfall has decreased alarmingly	--	70% (7)
Rainfall has decreased	47% (7)	--
Rainfall more irregular	19% (3)	--
No changes	34% (5)	30% (3)
Agricultural changes		
Agricultural production increased	--	60% (6)
Availability of fish more irregular	--	20% (2)
Availability of water to be reduced	27% (4)	--
Agricultural production decreased and alte rnative rice varieties introduced	20% (3)	--
Perceive pesticide use to have increased	6% (1)	--
Perceive no changes	47% (7)	20% (2)
Changes in vectors		
Increase in mosquito -borne infections	40% (6)	50% (5)
Increase in number of insects	20% (3)	30% (3)
No changes	40% (6)	20% (2)
Biodiversity changes		
Massive changes in biodiversity	74% (11)	50% (5)
No changes	26% (4)	50% (5)
Cultural changes		
No changes	100% (15)	100% (10)
Natural disaster		
Increase in irregularity of large storms	37% (6)	20% (2)
No changes	63% (9)	80% (8)
Adaptation measures		
Adaptation is occurring	20% (3)	20% (2)
No changes	80% (12)	80% (8)

In Bangchori and Kolabunia respectively, approximately 40% and 50% of participants perceive that vector borne diseases, especially diseases borne by mosquitoes, have increased. Approximately 20% and 30% of participants in the respective villages perceive that the number of insects has increased, while 40% and 20% of participants do not perceive any changes. Villagers identified a black mosquito as the main source of diseases such as malaria and believe that these mosquitoes are becoming more poisonous due to excessive use of pesticides. They hypothesize that mosquitoes exposed to the chemicals used in pesticides become more potent and consequently cause more severe disease in humans.

Villagers in both communities perceive massive changes in biodiversity (74% and 50% in Bangchori and Kolabunia respectively), while 26% and 50% of participants in the two villages did not perceive any changes in biodiversity. Twenty years ago a large variety of flora and fauna adorned Bangchori, but today people experience a village devoid of much of its biodiversity. In Kolabunia participants identified a loss of fish diversity and attributed it to deficient water transparency in Kaptai Lake. They suggested that big fish and shrimp face extinction while small fish are less available and are becoming seasonal (Plate 2). Migratory birds to Kaptai Lake were also more abundant in the past.

Plate 2: Shrimp from Kaptai Lake; half the size of a regular shrimp

Some respondents, approximately 37% in Bangchari and 20% in Kolabunia, perceived that tropical storms, cyclones, and floods were becoming more irregular, while a larger percentage, 63% and 80%, perceived no changes in natural disasters. Villagers expressed that they had less confidence in their ability to read the weather and said they could not forecast natural disasters. As they were not able to estimate when a disaster would strike they could not prepare themselves.

Approximately 20% of participants in each village perceived that they were taking measures to adapt to climatic and other changes, while 80% did not perceive any adaptation. Some of the ways in which people perceived that they were adapting were the increased use of pesticides to control insect pests, the use of water pumps to adjust to water shortages, and the protection of forests to safeguard water supplies.

Discussion

Few studies in Bangladesh have attempted to document people's perceptions of climate change or its affects on daily livelihoods; even less work has been done in the southeastern portion of the country. I could not find any studies in Bangladesh on the perceptions of tribal people living in protected areas concerning climate change and its effects. Selvaraju (2006) documented people's perceptions of climate change in drought prone areas of Bangladesh. He concluded that "People in the study area perceive that today's climate is different from the past - the seasonal cycle and rainfall pattern have changed, droughts have become more frequent, and pest and disease incidences have increased" (Selvaraju et al 2006:iv). In another paper, Gunter (2008) argues that both tribal and non-tribal populations in Chittagong Hill Tracts are highly vulnerable to climate change-induced increases in droughts, floods, landslides and cyclones (Gunter *et al* 2008).

A few recent research papers from other South Asian countries also report that people perceive climate change as affecting their daily lives. The author of a study of local perspectives on climate change in eastern Tibet interviewed people in villages that had never heard of the phenomenon of global climate change and asked them about their perceptions of the changes in air temperatures, snow cover, and glacial coverage. The findings showed that respondents had noticed declines in snowfall and rainfall, identified glacial retreat and decreased avalanches, perceived warming temperatures, begun early planting and harvesting, and experienced lower crop yields, increased crop diseases, and insect attacks. Interestingly, when villagers' perceptions of change were compared with scientific evidence, the climate records and models for the area supported their conclusions (Salick and Byg 2007).

In another recent study on local views of climate change in British Columbia, Canada-a region known for its cool, thick temperate rainforests-the author states that the impacts of climate change include shifts in species composition, anomalies in weather patterns, and declines in the health of forests and grasslands. British Columbia's local indigenous people rely heavily on the anticipated seasonal abundance of particular resources and depend on predictable rainfall, snowpack, and montane glaciers. Along the coast, people travel by boat and rely on generations-old knowledge of weather patterns, ocean currents, and tides to keep them safe on the water. Now, these features are changing and becoming less predictable and people feel more vulnerable and at greater risk despite modern weather prediction methods, improved communication, and enhanced technologies. Turner and Clifton (2009) stress the importance of appropriately recognizing and valuing the knowledge of local and indigenous peoples, and incorporating this knowledge into strategies for adapting to and reversing climate change (Turner and Clifton 2009).

This study found that tribal people residing in Kaptai National Park are aware of many differences in their environment, such as changes in temperature, rainfall, agricultural practices, vector-borne diseases, biodiversity, and the occurrence of natural disasters. While most respondents do not consider most of these differences

to be the result of normal variation, not all understand that these differences may be due to climatic variations and other environmental changes that are closely related to climate variables caused by anthropogenic sources.

Respondents recognize that some environmental modifications may be due to climate change but that other changes may have other causes. Changes they perceive as perhaps being caused by climate include variations in temperature and rainfall. Such changes affect agriculture (less water is available) as well as the abundance of insects, mosquitoes, and other pests that affect both agriculture and human health. In terms of agriculture, the communities experience a lack of water for irrigation due to lower flow from hill streams in the dry season and less rainfall (Plate 3). Respondents perceive an alarming decrease of rainfall and they feel rainfall patterns have not been normal for the past four or five years. The lack of water has placed pressure on the food production systems of these communities. Numbers of insects, mosquitoes, and other pests are also perceived to be at an all time high. People are suffering from black mosquitoes, which are said to be more poisonous and have boosted the number of malaria patients in the area.

Plate 3: Hilly streams became narrower in Bangchori

On the contrary, changes in biodiversity and fish abundance are not perceived by participants to be results of climate change. For example, fishers in Kolabunia have noticed changes in fishing patterns. Fish species they used to catch daily twelve to fifteen years ago can no longer be seen. Residents in both villages recognize extensive changes in biodiversity, which they attribute to excessive illegal tree felling and a shortage of agricultural lands (Plate 4). Alternatively, the loss of fish abundance and diversity in Kaptai Lake is considered to be a consequence of the establishment of the Kaptai Hydroelectric Project. This project is perceived to have caused the loss of many migratory birds and fishes.

Plate 4: Illegal logs collected by the Forest Department, Kaptai

Indigenous, traditional, and tribal peoples often depend immensely on their own knowledge, observations, and interpretations, which help them to improve their livelihoods and develop adaptive measures to variations in weather, seasons, natural disasters, agriculture, society, and other factors. Because of this great dependency, it is essential for local residents to understand climatic variation. Respondents in this study expressed that they had less confidence in their ability to read the weather than previously, and that they could not forecast natural disasters like tropical cyclones, storm surges, landslides, or floods that occur randomly in these areas. The IUCN (2008) has suggested that local observations and weather forecasting systems may in the future become less meaningful or even misleading for decision-making, due to more rapid and complex global climate change (IUCN 2008). As this study suggests, people in Kaptai National Park may become more vulnerable to future climatic deviations due to an inability to read with assuredness atypical climatic changes.

As elsewhere in the world, people in Bangladesh are adjusting to alterations in their environment caused by climate change without knowledge about how and why these changes are occurring. They are not helpless victims in the face of climate and other environmental changes, but rather active actors constantly looking for new ways to adapt and adjust to the changing environments they live in. Although most villagers are not familiar with the term "climate change", many of them are aware that they are living and working within a constantly changing environment that can affect their livelihoods for better or worse. Villagers are adopting all sorts of adaptive measures with respect to their changing environment without being completely aware of the causes of that change.

Various organizations have offered projections of climate change impacts that will affect Bangladesh. I compare some of these projected impacts with changes perceived by respondents in order to better triangulate the potential risks of climate change for local tribal people in Kaptai National Park (Table 6).

As can be seen from these comparisons, if projected changes become reality, Bangladesh will be exposed to higher temperatures, decreased precipitation leading

to crop failures, irregular natural disasters, and higher risk of lethal vector borne diseases. It is also important to note that people in the study area have long utilized local biodiversity and natural resources to adapt to alterations and protect themselves from climatic variations. It is tribal people that will experience environmental changes first hand, and it is their perceptions that can best inform the public about how climate change is happening and what its impacts are.

Table 6: Comparison of projected impacts and perceptions of change related to climate change.

Variable	Respondent perceptions	Projections
Temperature	Warmer	Bangladesh's temperature is projected to increase an average of 1ºC by 2030 and 1.4ºC by 2050 (Selvaraju, *et al* 2006)
Vector/borne diseases (malaria, dengue)	Increased	Assuming a global temperature increase of 2 - 3ºC, the number of people at risk of malaria in climatic terms is expected to rise by about 3 -5%, or several hundred million (WHO 2003).
Rainfall	Decreased	In Asia, the changing precipitation patterns are predicted to increase and are projected to affect local production negatively, possibly leading to crop failure, especially in subsistence sectors at low latitudes (IPCC 2007b)
Crop production	Decreased	
Natural disasters (tropical cyclones, floods, storm surges)	Irregular	Bangladesh is particularly vulnerable to tropical cyclones and storm surges. It is estimated that a 1.5 meter rise would affect 17 million people (about 15% of the population) and 22,000 km ^{2} of land.
Biodiversity	Massive exploitation and loss	Biodiversity is a primary tool of adaptation for indigenous peoples, w ho use diverse flora and fauna as a buffer against variation, change, and catastrophe. Throughout human history, climate change, societal change and biodiversity have been closely linked (Salick and Byg 2007)

Conclusion

The Intergovernmental Panel on Climate Change has confirmed that global climate change is already happening. The IPCC's 2007 report states that the determining factors of social and biophysical vulnerability of indigenous and traditional peoples are not well understood and require further investigations globally (IPCC 2007a). Bangladesh has been particularly impacted in the South by climate and weather phenomenon that has devastated the country's coastal livelihoods.

In this paper I examined perceptions of environmental variations possibly due to climate change among the Marma, Chakma, and Tanchainga peoples living in the village of Bangchori and the Marma of Kolabunia. I conclude that approximately half of the participants in Bangchori and Kolabunia perceive that temperatures are warmer than in the past and that the number of mosquitoes and mosquito borne diseases has increased. The World Health Organization (2003) suggests that vector borne diseases such as malaria are sensitive to long-term climate change and will likely increase. Malaria, today, is mostly confined to tropical and subtropical regions. However, assuming a global temperature increase of 2-3ºC, the number of people at risk of malaria in climatic terms is expected to rise by about 3-5%, or several hundred million (WHO 2003). Bangladesh's temperature is projected to increase an average of 1ºC by 2030 and 1.4ºC by 2050. If the projections of these variables become a reality, Bangladesh will be exposed to higher temperatures and the risk of lethal vector borne diseases will greatly increase. It is tribal people that will experience these changes first hand, and it is their perceptions that can best inform the public about how climate change is happening and what its impacts are.

Approximately half of the respondents in Bangchori and more than half in Kolabunia perceived that rainfall, and therefore food production, had decreased. Though changes in precipitation are more difficult to model, it has been projected that there will be less rain in areas adjacent to the tropics, while in the Asian monsoon region and other tropical areas more intense flooding is expected. There is evidence that future tropical cyclones may become more severe, with greater wind speeds and more intense precipitation. Changing precipitation patterns are predicted to increase the frequency of hazards such as droughts and floods and are projected to affect local production negatively, possibly leading to crop failure, especially in subsistence sectors at low latitudes (IPCC 2007b). So, the perceptions of the respondents in this study on rainfall and food production patterns associated with climate change may be true.

Approximately three-fourths of the participants in Bangchori and half of the participants in Kolabunia perceive that massive changes in biodiversity have taken place. Though respondents did not consider changes in biodiversity to be the consequence of a changing climate, and though there are many variables affecting the local ecosystem, adverse impacts on biodiversity as a result of climate change are predicted and the effects of this on local and ethnic minority people must be considered. Biodiversity is a primary tool for adaptation by indigenous peoples universally, who use diverse flora and fauna as a buffer against variation, change, and catastrophe. Tribal people are fighting the loss of biodiversity and adapting to climate change through migration, irrigation, water conservation techniques, land reclamation, changing where and at what elevation plants are cultivated, livelihood adaptation, and a myriad of other techniques. Throughout human history, climate change, societal change, and biodiversity have been closely linked (Salick and Byg 2007). So, it can be assumed that tribal people in the study area have long utilized their local biodiversity and natural resources to adapt to change and protect themselves from climatic variations.

A large portion of participants in Bangchori and in Kolabunia did not think that there had been an increase in the number or severity of natural hazards like tropical cyclones, storm surges, and floods. In this context, some projections for Bangladesh in terms of climate change, especially in the coastal zone, should be considered. Approximately twenty percent of the world's human population lives within thirty kilometers of the sea, and nearly double that number lives within one hundred kilometers of the coast. The main climate change impacts on Asian coastal zones will consist of sea-level rise and more frequent and severe storm events. Bangladesh is particularly vulnerable to tropical cyclones and storm surges. In the case of sea level rise, Bangladesh is expected to be one of the most heavily impacted as it is a flat deltaic land vulnerable to inundation. It is estimated that a 1.5 meter rise would affect seventeen million people (about 15% of the population) and 22,000 square kilometers of land (about 16% of total land surface).

When respondents discussed environmental changes such as changes in temperature, rainfall, agricultural practices and vector-borne diseases, they did not consider these differences to be merely the consequence of normal variations. They perceived these environmental changes as possibly being the result of climatic variations without any knowledge of the term climate change or its predicted effects. Moreover, they have already started to adopt some new adaptation techniques in response to the changing conditions. Regardless of whether or not people understand the term climate change and its causes and impacts, if the predictions of the climate change consortiums are correct, people will need to be able to adapt to survive. It is interesting that tribal people living in Kaptai National Park perceive the environmental alterations as possibly resulting from a changing climate and that they are actively adapting to these differences without having prior knowledge about what climate change is or recommendations on how to adjust to it.

Intensive research is needed to better understand tribal people's perceptions of climate change and to introduce applicable adaptation measures in these areas. It will be important to include the knowledge and perceptions of tribal peoples at the decision-making level, so that their experience and successful adaptative strategies can help shape new forms of governance and strengthen livelihoods to meet the challenges of climate change. In the words of Byg and Salick, "Mutual respect is indispensable to gain a better understanding of climate change and to tackle its many-facetted impacts" (Byg and Salick 2009:166).

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References

Agrawala, S., T. Ota, A. U. Ahmed, J. Smith, and M. V. Aalst 2003. Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans. Organisation for Economic Co-operation and Development: Paris, France.

Byg, A. and Salick, J. 2009. Local perspectives on a global phenomenon-climate change in Eastern Tibetan villages. *Global Environmental Change* 19 (2): 156-166.

Climate Change Cell. 2006. Key Facts: Climate Variability and Change in Bangladesh: Impacts, Vulnerability and Risks. Climate Change Cell, Comprehensive Disaster Management Program, Department of the Environment: Falls Church VA, USA.

Gunter, B. G., A. Rahman, and A. F. M. A. Rahman. 2008. How Vulnerable are Bangladesh's Indigenous People to Climate Change? Bangladesh Development Research Center: Dhaka, Bangladesh.

IPAC (Integrated Protected Area Co-Management). 2009. Site Level Field Appraisal for Integrated Protected Area Co-Management: Kaptai National Park, Chittagong Hill Tract. Integrated Protected Area Co-Management: Rangamati, Bangladesh.

IPCC (Intergovernmental Panel on Climate Change). 2007a. Climate Change 2007: Synthesis Report. Intergovernmental Panel on Climate Change: Valencia, Spain.

IPCC (Intergovernmental Panel on Climate Change). 2007b. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Summary for Policymakers. Intergovernmental Panel on Climate Change: Brussels, Belgium.

IUCN (International Union for Conservation of Nature and Natural Resources). 2008. Indigenous and Traditional Peoples and Climate Change: Issues Paper. International Union for Conservation of Nature and Natural Resources: Gland, Switzerland.

Selvaraju R., Subbiah A.R., Baas S., Juergens I. 2006. Livelihood adaptation to climate variability and change in drought-prone areas of Bangladesh. Food and Agriculture Organization of the United Nations: Rome, Italy.

Salick, J. and Byg, A., eds. 2007. *Indigenous Peoples and Climate Change*. Tyndall Centre: Oxford, United Kingdom.

Turner, N. J. and Clifton, H. 2009. "It's so different today": Climate change and indigenous lifeways in British Columbia, Canada. *Global Environmental Change* 19(1):180-190.

WHO (World Health Organization). 2003. Climate Change and Human Health - Risks and Responses: Summary. World Health Organization: Geneva, Switzerland.

One of the poorest and most densely populated nations in the world, Bangladesh is also arguably the most vulnerable to the negative impacts of climate change. Increased salinity of soils in coastal regions as well as increased incidence and severity of cyclones and other natural disasters lend credence to the argument that the impacts of climate change are already here. Thus, Bangladesh must struggle in its efforts toward poverty alleviation and food security, and build a foundation of resilience to ensure gains made today can be sustained into the future. Increasingly, Bangladesh government officials and civil society recognize the importance of a healthy and integrated protected area system as a fundamental building block in its foundation of resilience. An integrated protected area system ensures that forests and wetlands are managed to conserve and sustain key environmental services. Based on the principles of co-management, government and communities are working together to ensure conservation of existing protected areas (PAs), to demonstrate the development benefits of conservation of protected areas, and to expand this network in size and complexity through the Nishorgo Network – 'Recognizing the need to save/conserve the most productive ecosystems of the country, the Government of Bangladesh materialized its concern by establishing the Nishorgo Network comprising of forest and wetland Protected Areas', http://www.nishorgo.org.

This book is a contribution to strengthening co-management of Bangladesh's PA system. Papers in this volume are based on research funded as part of the Nishorgo Network's IPAC program. Research funds were allotted to government officers from various departments, as well as to one post-graduate student, to support site-specific research pertaining to issues of community-based conservation. It is expected that the research findings reported in this book will illuminate new directions for policy and implementation strategies for creating arrangements that meet the goals conservation while not hindering the livelihoods of local community members. Spending time to investigate the realities of local resource users in both wetland and forest environments will help in tailoring conservation programs to the site-specific variables of socio-natural environments.

The Integrated Protected Area Co-Management (IPAC) project is a five-year USAID contract working with the Government and people of Bangladesh to establish a robust national protected area system based on the principle of co-management. IPAC is implemented by the Ministry of Environment and Forests (MoEF), and Ministry of Fisheries and Livestock (MoFL) involving directly the three line government agencies i.e., Forest Department (FD), Department of Fisheries (DoF) and the Department of Environment (DoE) , through a consortium of partners led by International Resources Group (IRG) and including the international organizations East-West Center, WorldFish Center and WWF-US as well as leading Bangladesh NGOs BELA, CODEC and CNRS. Components of the program have been designed to meet the needs of co-management arrangements at national, regional, and local levels. These include policy development, institutional capacity building, and support for site-specific implementation.

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