Deepor Beel IEMS from the Forestry and Sanctuary Department

Module 1.) There is the need in this area to preserve the forest, wetlands, beel, fauna, and biota contained within the area the Deepor Beel area. The area has been declared a Ramsar Wetland. In being so the wetland has still been exploited after it had joined the Ramsar Convention in 2002.

Module 2.) It appears that the current policies of the area are quite lax. Aerial photo's taken in 2005 suggest there is still a large amount of soil cutting going on in the region as evidenced by fresh elongated pits. I think a stronger course of action is going to be needed to maintain the Ramsar Convention guidelines.

"One action could be no one is allowed into the area any more and if they do so they will be charged with trespassing and sentenced to a jail term. All roads, houses and rail roads will need to be torn down immediately to comply."

Since this is not a viable option we must continue with a means to reduce the impacts of the region. Some of these solutions will be presented in module 4.

Module 3.) Here is a list of some of the interest groups of the area and their impacts on the area.

1.) There are around 200-250 families that are fisherman and they depend on the area for their monetary source from fish catches. The fish they are harvesting are important food for the waterfowl and wildlife of the region. Diminishing amounts of fish can be detrimental to the vitality of the region.
2.)There is also a local tribal population of about 100 farms that has been settled in the area for many years? They farm the wetland for deepwater paddies and giant water lilly seeds. These plants are harbor, protect, and feed the fish populations. There harvesting could cause a decrease in vitality of the area also.
3.) The railroads represent one of the major issues of the site. They had formed a new rail line through the southern area of the beel creating dams and a dangerous crossing for wild life. There have been cases of elephants being killed on the rail lines.
4,) The Forest Department is in charge of the entire Deepor Beel Sanctuary and nearby forests. This group has the hardest responsibility in trying to stay within the Ramsar convention but also sustaining the local populations need to use the wetland. A lot of what happens in the Beel is under the watch of this group and in the end they could ultimately be to blame for the problems that could arise.
5.) The Fish Department enforces the laws of the wetland.
6.) The City of Guwahati Municipal Authority is in charge of sewer systems and solid waste. They are planning on using part of the beel for a waste disposal area. This can create pollution of the groundwater and surface water making the area inhospitable to local wildlife and foul. Just one of the many problems the area is faced with.
7.) The land developers are also a major threat to the well being of the area. This includes the illegal land development and encroachment into the wetland. Aerial photos suggest

that they still continue to clear the land, fill in the wetlands, cut down the forests, and disrupt the natural flow of water through the area.
8.) The industrialists are using the area for producing bricks. Aerial photos show area that have been dug out and left unreturned to pre-excavation times. These may be areas of soil cutting or areas where the clay has been dug out for brick making. It is possible that they are going to use the area for a dump or other reason. They may even possibly be gravel pits. None the less they are located on the sanctuary and should not be tolerated.
9.)The area is one that many naturalist people would like to come to visit because of the diverse and populous water foul collection.

Module 4.)

1.) As an alternative to over fishing the area by commercial fisherman one option could be to limit the size or gender of the fish caught. Another option could be retraining them for a different profession if the powers that be make it totally illegal to fish the area.
2.) Similar restrictions on the farming of wetland flora could be borrowed from the above solution.
3.) I would like to see the railroads totally removed and rerouted but the cost benefit from this may exceed any financial ability of the region. Instead I would propose to remove any areas with dams and put a bridge through those regions to allow water to flow to the wetland and construct more bridges along the tracks to make it possible for animals to cross without having to cross the dangerous tracks. Fences or something similar would need to be added along the tracks also to keep the animals from crossing onto the tracks. It may just be cheaper to reroute the tracks to a more northern route close to the already established highway that is evident in aerial photos. I wonder why they did not do this in the first place.
4.) The Forest Department is going to have to be tougher on the locals in reducing the impacts of the area. Obviously just being part of the Ramsar treaty is not going to solve problems on its own.
5.) The Fish Department is also going to have to abide by the same tougher stance as the Forest Department.
6.) It is totally unacceptable to use the wetlands as a municipal waste dump.
7.) Land developers must be stopped. Any homes that are already there can stay but any further development of the area can not be done. If the encroachment is allowed to continue through out the region then much of the animal population will disappear. Some animals can live side by side with humans but others cannot. This is true the world over. For instance the plains and hills of North America used to harbor the Grizzly Bear, Bison, Elk, Moose, Mountain Lion, and many other animals but these animals have since been pushed to the mountains and highland forests.
8.) If the industrialists are going to continue to soil cut the land around Deepor Beel then the manner in which they cut the soil should be done in a more natural way producing a more natural curvy wetland instead of producing large elongated rectangular pits which are simply scars of an industrialized society. One positive

of their actions are that they are creating more wetlands and storm catchments but the way it is done is simply unpleasing to the eyes and mind.

9.) If the above actions are left unchecked then tourism would probably fall as more and more of the beel becomes filled in.

Module 5.) Measuring success can be achieved by comparing simply aerial photos, rail road incident reports with wild life, tracking the fish and fowl populations, and last I guess the over all happiness of local residents and stakeholders of the region. At the same time of finding solutions they must somewhat conform to local opinion and needs.

Module 6.) All residents and industries should setup boards to over see there parts of whom there leaders will be in direct contact with Ramsar officials of compliance.

Module 7.) If they do not have an annual summary document of the state of the wetland then this will have to be done and also used in modules 5 and 6.

Deepor Beel Wetland Study

Stakeholder: Fishing Community (livelihood derived from fishing)

Stakeholder Requirements

1. Adequate stocks of marketable fish species
    - Restocking plan
    - Community managed plans to reduce overfishing of marketable fish and control of banned fishing methods (dynamiting and the use of monofilaments or multifilaments for example)
2. Access to wetland areas containing marketable fish species
    - Well defined fishing zones
    - Fees, permits and boat registration and inspection managed by local fishing councils
    - Agreements for small-scale fishing access and schedules
3. Adequate water quality for optimum fish harvests
    - Providing adequate and healthy food supply for marketable fish
    - Regulation and monitoring for reduced levels of pollution
    - Waste treatment and wetlands management plans to assure adequate dissolved oxygen (DO), minimal turbidity and other factors affecting fishing stocks
    - Compensation, subsidies and loans accordingly for any required improvements to boats, motors, fishing equipment, nets, and transportation needed to meet changes in wetlands regulations
4. Improved access to markets
5. Legislative provisions for creation and authority of fishing councils so that they have force of law
    - To manage fishing regulations, permits, etc.
    - To represent fishing community in negotiations with other government agencies and interested parties involved with wetland management of Deepor Beel

Tourism Development at Deepor Beel

Module 3

Why is tourism important?

Tourism is an important part of the economy and so is the environment. The development of a tourist industry in wetland areas does not necessarily mean that the health and value of the area would be compromised. Wetlands such as Deepor Beel are very important contributors in diversifying the tourism industry. The tourism industry can also be of benefit to the conservation of wetland areas. Tourism introduces nature-based activities such as bird watching, wildlife parks and nature trails that motivate community involvement and builds nature awareness. Conservationists such as Henry David Thoreau recognizes that one can reflect, relax and gain spiritual upliftment when surrounded by nature.

How do other environmental aspects affect tourism?

Tourism is not non-existent in protected areas. In fact, eco-tourism is a sustainable form of tourism that emphasizes conservation and the importance of the environment. A wetland that is allowed to be degraded and turned into a wasteland is not attractive to tourists and hence would not be a good area to promote for tourism. Tourism appeals to a "healthy environment" in which the condition of the area is still in its natural state. This is why conservation and tourism work hand in hand in order to be successful. According to P.R. Bacon in The Use of Wetlands for Tourism in the Insular Caribbean, recreational use of wetlands does not need to conflict with conservation strategies. In order to prevent conflict the protection of the wetland must be considered before the planning of recreational activities.

Objectives of the tourist industry

One important function that tourism plays is that of spreading educational awareness. Deepor Beel is home to a diverse range of plant and animal species. The tourist attractions at Deepor will focus on promoting the ecological diversity of the wetland. This will also aid in promoting environmental awareness. Deepor Beel is habitat to migratory waterfowl, residential waterfowl and other terrestrial birds. Most of these birds are endemic, endangered, or threatened. The area also supports a diverse freshwater fish population.

The tourism ministry intends to build a floating restaurant with an attached Wetlands Resource Center. The center will be in charge of leading and organizing bird watching hikes along trails and longer nature hikes. The center would also provide a wetlands educational program. Visitors can tour the wetland area by boat or on foot. The floating restaurant will offer fish from local fishermen and other locally grown food. The tourism ministry also intends to build a camp site around Deepor Beel so that visitors can spend more time visiting the area and engaging in recreational activities. The camp site will have designated areas to camp with tents and other camping gear, a restroom area and an area with several picnic tables. The tourism industry intends to achieve 100% of these objectives. However, we are willing to work on making these plans more eco-friendly so that we can conserve this wetland habitat. In many instances tourism can be

an asset to conservation. For example, National Parks in the United States were established to conserve the areas so that present and future generations can be able to enjoy them. Park managers have promoted the importance of protecting the environment and conserving wildlife habitats by educating the tourist. It can be deduced that the tourist plays an important role in conservation.

Module 4

The tourism industry plans to best serve our objectives by making the protection of this wetland a priority in order to reduce environmental impacts. Each objective has been considered and it has been determined that the impacts to the environment would be minimal. Considerations will take into account conservation strategies so as to not cause conflict. The tourism industry intends to put 60% of its profits into conservation projects because it has been realized that conservation of this area is important for the success of the tourism industry.

The funds for the building of the facilities for the floating restaurant and Wetlands Resource Center will be provided by Beharry Shipping Ltd. Funds from a fundraising effort by the tourism ministry will be used to construct the camp site area and maintain the hiking trails. Laparkan Industries has donated several canoes for use by the Wetlands Resource Center. Tourists can purchase tickets for boat tours, bird watching and wetland tours. These funds will be used for the maintenance and upkeep of the area. A percentage of funds from the floating restaurant would be donated to conservation programs at Deepor Beel.

Tourism can be a success in Deepor Beel like it has been in the Boondall Wetland Reserve which is a conservation habitat located north-east of Brisbane, Queensland in Australia.[1] This reserve has focused on sustainable tourism management applications in order to make its tourism industry a success. The Boondall Wetland Reserve offers nature-based recreation, tourism and eco-tourism opportunities similar to what the tourism ministry would like to offer at the Deepor Beel Wetland Resource Center. These opportunities help to promote environmental awareness locally and regionally. The Boondall Wetlands Reserve also provides education and informational resources about wetland systems and also illustrates how wetlands can diversify the tourism industry and help make tourists more eco-conscious.

[1] Lim, Christine and McAleer, Michael, Use of Wetlands for Sustainable Tourism Management Western Australia: Griffith University p 490-495

Integrated Environment Management Plan for Deepor Beel: Modules 3 and 4
Stakeholder: Northeast Frontier Railways

Module 3: Identification of Significant Environmental Aspects and Setting Objectives

Environmental Aspects
Aspects refers to the potential for environmental impact, where a significant aspect would have the potential for large impact, either because impact is likely to occur under current operating conditions, or because there is potential for serious impact (USEPA, 2000). The Deepor Beel Wetland harbors a variety of species and fauna, while providing both subsidence for locals and flood control for the city of Guwahati. Recognizing these benefits, the Northeast Frontier Railways has identified those environmental aspects with respect to its railway line through the southern fringe of Deepor Beel:

1. Rerouting of Flow (Runoff)
2. Wildlife Collisions
3. Noise Pollution

The rerouting of flow in the Deepor Beel Wetland is attributed to the embankment of soil on which the Northeast Frontier Railways track lie. The embankment of soil has prevented the natural runoff course into Deepor Beel, from neighboring areas such as the Rani Reserved Forest and the up-gradient drainage, where 18 km to the east lays the city of Guwahati.

Wildlife collisions occur when the train collides with the wildlife that are harboring on or very near the railway line. Prominent collisions occur with Asiatic wild elephants, which still visit Deepor Beel, crossing the stretch of railway line that run along the Rani and Garbhanga Reserve Forests (The Sentinel, 2004).

Noise pollution refers to noise that produces undesired physiological or psychological effect in an individual (or wildlife) and that may interfere with the social ends of an individual or group, which again can be applied to wildlife (Davis and Matsen, 2004). Two forms of noise are encountered, which are the massive train engines and the frictional noise encountered between the train cars and the railway tracks.

Objectives
Having identified the environmental aspects associated with Northeast Frontier Railways along the southern fringe of Deepor Beel, the organization still believes it can run an environmentally safe operation. Therefore, Northeast Frontier Railways wants its current operations within Deepor Beel to remain, which parallels the Ramsar Wetlands recommendation that the halting of trains should be avoided within the boundary of Deepor Beel (Ramsar Wetlands, 2002). The organizations objectives to ensure this environmental safety:

1. Provide proper sedimentation measures of flow

2. Reduce the number of wildlife collisions
3. Reduce noise level

Module 4: Alternatives

The purpose of the evaluation of alternatives is to work toward the objectives discussed in Module 3, concerning the environmental aspects associated with Northeast Frontier Railways railway line along the southern edge of Deepor Beel. A list for the alternatives is first developed and the scope of the evaluation is set, where information about health, safety, environmental effects, performance, cost, effects on resource use, and regulatory concerns are developed, and finally are individually evaluated (USEPA, 2000). The final evaluation of Deepor Beel yielded the alternative options to implement Module 3's objectives:

1. Examination of culverts and/or bridges at various locations beneath Northeast Frontier Railways embankment (railway line) within Deepor Beel to ensure effective routing of flow into Deepor Beel.
2. Reduce Northeast Frontier Railways train speed through Deepor Beel to a) help reduce the number of wildlife collisions, and b) reduce the noise level encountered by the train's engine and railway friction

Examination of culverts and/or bridges, whether they be new, modified, replaced or even removed, will help ensure that desired flow of runoff will be routed into Deepor Beel. This alternative has two sides *before flow enters* Deepor Beel, where a wanted increase in sedimentation is desired, and a natural sedimentation course is desired.

The case for a desired increase of sedimentation involves the effectiveness of Deepor Beel as a storm water detention basin for the city of Guwahati, which needs to be preserved (Ramsar Wetlands, 2002). Here the railway embankment acts as a buffer region to the contaminants of the city runoff, which can pose a serious threat to Deepor Beel's ecosystem. The water that contains contaminated soils will have a greater retention time, caused by the embankment, which allows for sedimentation before entering Deepor Beel. Another case for desired sedimentation is the increased erosion caused by illegal tree felling around Deepor Beel (Ramsar Wetlands, 2002). Again the embankment will again allow for greater retention time, preventing the adverse effects of the erosion accumulation in Deepor Beel.

A natural sedimentation course is desired when the flow which carry nutrients from nearby forest reserves have the opportunity to follow their natural path and into Deepor Beel, thereby enhancing the ecosystem. Here, additional culverts and/or bridges may be necessary, or improvements to existing structures may be needed.

The train speed reduction through Deepor Beel meets the objectives to reduce both wildlife collisions and noise level. This reduction in speed will provide train engineers more time to respond when wildlife are on or very nearby the railway line. In addition, the reduction in train speed will reduce the amount of work the train engine performs

(thereby reducing noise), and also reduce the frictional noise caused by the train cars and the railway tracks.

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Ramsar Wetlands. Information Sheet on Ramsar Wetlands: Deepor Beel. August 19, 2002.

The Sentinel, Guwahati. Train mows down 3 elephants near city. June 21, 2004.

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INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN FOR DEEPOR BEEL WETLAND IN THE NORTH-EASTERN INDIAN STATE OF ASSAM

Module 3: Identification of Significant Environmental Aspects and Setting Objectives

Land Development Stakeholders' Perspective:

Deepor Beel consists of 41 sq km within the city limits of Guwahati. As discussed in Module 1, much of the land within Deepor Beel has already been developed. Our objective is to insure that additional development is allowed to continue in Deepor Beel and that any future development proceeds in an environmentally friendly manner that considers the interests of other stakeholders.

Guwahati is the largest city in Assam and is the commercial, industrial, and educational center for the region. Being located adjacent to the Brahamaputra River and at the foothills of the Shillong Plateau, land available for expansion of this city of more than one million people is at a premium. Further development of land within Deepor Beel presents an attractive opportunity for land development. However, we acknowledge that the continued development of lands within Deepor Beel has the potential to significantly impact the wetland's ability to perform many ecosystem services important to other stakeholders, including the city of Guwahati which relies on Deepor Beel as its only major storm water storage basin. Thus, we propose that further development within the remaining areas of Deepor Beel be allowed to proceed, but only with significant environmental protections in place. The goal of these protections should be to insure that

future development does not cause any further degradation of the Deepor Beel ecosystem or in its ability to provide goods and services important to other stakeholders. To meet this goal, we propose that detailed Environmental Impact Assessments be performed for all future development projects within Deepor Beel before projects are implemented. These assessments will identify potential environmental impacts of projects and include proposed actions that will negate or minimize identified impacts. If negative impacts are unavoidable, we propose that the development still be allowed to proceed, but only if impacts can be mitigated for within other areas of Deepor Beel. As an example, if development of a project will impact an area where giant water lily (*Euryale ferox*) seeds are harvested, giant water lily stands must be restored in another area of the wetland as mitigation. There are many areas within Deepor Beel (e.g., old brick fields, soil cutting areas, etc.) that present numerous mitigation opportunities. We acknowledge that wetland mitigation efforts often do not adequately restore all functions lost due to development. Thus in our preferred alternative, we suggest replacing lands lost to development at a ratio of two to one (i.e., two ha of wetland will be restored for every one ha of development.

To insure that development continues in an environmental friendly manner, we propose that the State Government take immediate actions to evict illegal encroachers from Deepor Beel (especially from protected and environmentally sensitive areas). The actions of these illegal encroachers proceed in a completely unregulated manner and can cause considerably damage to the wetland ecosystem. However, once evicted, these encroachers will need someplace to go. The State Government should make significant efforts to insure that they are relocated to an area that meets their basic subsistence-level

needs. Patta-holders whose lands are determined to be within environmentally important areas within Deepor Beel, should also be relocated when possible and adequately compensated for their losses. Only well regulated development in which Environmental Impact Analyses are used to identify potential negative impacts and actions are taken to minimize these impacts should be allowed to continue within Deepor Beel.

Land-development projects within Deepor Beel can have significant positive benefits to other stakeholders. The development of an interpretive center for educating local and international tourists about the Deepor Beel ecosystem and its unique plant, wildlife, and human inhabitants would likely be extremely beneficial to the tourism prospects of Deepor Beel. In addition, development of tourist lodging and other facilities within Deepor Beel would also greatly benefit the tourism industry and the surrounding communities as well. But once again, proper planning is needed to insure that further environmental degradation of Deepor Beel is avoided. While land development is often viewed as incompatible with the preservation of properly functioning wetland ecosystems, it is our view that carefully planned development in which environmental impacts are minimized can actually have a positive benefit for the ecosystem as a whole if the monetary resources that often accompany such development projects are directed towards significant mitigation efforts within environmentally important areas. Additionally, development projects that benefit tourism stakeholders may also have indirect benefits to the wetland ecosystem through the habitat protection efforts and monetary resources that often accompany such tourism promotion efforts.

Module 4: Alternatives

Land Development Stakeholders' Perspective:

Alternative #1 (No Action) – Land development will be allowed to proceed within Deepor Beel with very little if any regard for impacts to the environment and to the ability of the wetland to provide goods and services important to other stakeholders.

Alternative #2 – Land development within Deepor Beel will be allowed to proceed. However, detailed Environmental Impact Assessments must be completed for all land-development projects and alternatives that minimize environmental damage and impacts to other stakeholders' interests must be fully considered.

Alternative #3 – Land development within Deepor Beel will allowed to proceed, but with significant environmental safe-guards in place. Detailed Environmental Impact Assessments must be completed for all land-development projects. Alternatives that minimize environmental damage and impacts to other stakeholders' interests must be fully considered, and unavoidable impacts must be mitigated for within the Deepor Beel ecosystem at a ratio of one to one. Illegal encroachers will be evicted from Deepor Beel.

Alternative #4 (Preferred Alternative) – Land development within Deepor Beel is allowed to proceed. Detailed Environmental Impact Assessments must be completed for all land-development projects. Alternatives that minimize environmental damage and

impacts to other stakeholders' interests must be fully considered, and unavoidable impacts must be mitigated for at a 2 to 1 ratio. Illegal encroachers will be evicted from Deepor Beel and efforts will be made to relocate patta-holders from areas of significant environmental concern.

Alternative #5 – Land development within Deepor Beel is allowed to proceed only in areas that have already been significantly damaged by past development and land-use practices. Detailed Environmental Impact Assessments must be completed for all land-development projects, alternatives that minimize environmental damage and impacts to other stakeholders' interests must be fully considered, and unavoidable impacts must be mitigated for at a 4 to 1 ratio. Illegal encroachers will be evicted from Deepor Beel and efforts will be made to relocate all patta-holders.

Alternative #6 – All land development within Deepor Beel will be prohibited. All encroachers (both illegal and patta-holders) will be evicted.

IEMS – Deepor Beel

Stakeholder: Brick industrialist

MDULE 3/4: Determining significant environmental aspects and setting alternatives.

As part of the development of the EMS, a comprehensive assessment of environmental aspects has been carried out. The aspects are then assessed, using a set of criteria, to determine if they are 'significant'. Alternatives are also applied when it is necessary.

Our objectives have been established considering the legal requirements, significant environmental aspects, technological options, financial, operational, business requirements and views of interested parties. Our objectives are principally met by setting targets, which are managed through the Environmental Program.

Description of all the significant direct and indirect aspects/impacts of the brick industry at Deepor Beel wetland area.

The Deepor Beel brick industry site determines its aspects, using a set of criteria, which look at its main activities, products and services and determines whether one or more of the aspects has the potential to cause an impact. Then determines whether these aspects are 'significant'. All significant aspects are treated the same and are controlled Environmental Operating Procedures.

i) Emissions to Atmosphere

The impacts of emissions to atmosphere are, in general, the reduction in air quality. The principle aspects in relation to our process are CO2 and dust. Combustion of woods and coal (or other fire materials) generate carbon dioxide which contributes to climate

change. The impact of the CO2 is reduced by monitoring of the exhausts from the chimneys and replacing the filters regularly. Dust has been determined as a significant aspect and can cause a visual impact and residue build up on neighboring properties if not carefully controlled. In the quarry and stocking areas, dust is controlled by the application from a water bowsers.

ii) Solid Waste

Examples of solid wastes are 'green' and 'fired' waste. 'Green waste' is unfired clay that can be reused in the majority of cases. 'Fired waste' is brick that cannot be sold as best or concession although it can be used as aggregate. Other waste is the ash from the burnt firewood and this can be used as fertilizers in agriculture.

iii) Use of Natural Resources/ Raw Material

We consume clay that has been extracted from the quarry adjoining the factories, thus depleting natural resources. These are measured by topographic survey at the end of a clay extraction period and can be allocate for construction sites.

iv) Energy Use

To limit the use of coal, which is a non-renewable natural source, we use fire wood, coconut husks, and dry dung as our energy sources. To minimize the amount of deforestation, reforestation program will be conducted in accordance with the amount of woods used. Discharge of thermal energy is minimized through the internal recirculation of excess heat from the kiln to the dryers and minimized the use of fire material.

v) Transport Issues – Goods, Service and Employee Vehicles

We acknowledge that goods and service vehicles have indirect and direct impacts such as use of fuels, visual impacts, noise, vibration and resource

depletion. We have procedures to control the significant aspects and impacts of the delivery of goods and services to the country. We rely on contractors to deliver our products to our customers. This offers the opportunity for more effective use of fuel resources by relying on the contractors' expertise to maximize return loads.

vi) Employees Transport Issues

Our employees live within walking distance of the site. This means that the impact on the environment is reduced because the amount of fuel used and miles traveled is less than if our employees lived further away.

Farmer in Deepor Beel

Talk about the agriculture in Deepor Beel wetland

Module3

The important in Economical aspect

In the surroundings of Deepor Beel wetland, people cultivated paddy. No data available to show whether agriculture is the main income source of local residents. But I assume that agriculture dominant the economical conditions of the local people and guarantee the safety food supply for city Guwahati.

Negative aspect of Agriculture in Deepor Beel wetland (similar to wetland agriculture activities)

1. water pollution, fertilizer, pesticide,
2. change the biota in Deepor Beel wetland,
3. reduce the biodiversity of wetland,
4. soil nutrient
5. encroach the wetland area
6.

Positive aspect of Agriculture in wetland

1. economical
    a. major income
    b. main food resource
2. social
    a. stabilize the community
3. culture
    a. the traditional value in agriculture activities

Module4

Alternatives

1. ecological agriculture (traditional agriculture with BMPs)
2. soil-less agriculture (cultivating in Bangladesh),
3. give up agriculture cultivation (unfeasible)

Ecological agriculture entails farmers making decisions and applying practices with the aim of sustaining or enhancing natural regenerative processes and stabilizing interactions within local agro-ecosystems. In practice, this includes:

- the management of insect pests by taking account of population dynamics, natural enemies, and plant compensation ;
- the management of soil fertility by taking account of soil structure and composition, nutrient cycling and the action of microorganisms;
- the management of crop varieties by taking account of genetic diversity, the dynamics of resistance, and local adaptation;

- the overall management of a cropping pattern by taking account of local landscape, the flow of inputs and outputs on the farm, and the multifunctional nature of agricultural production.

Negative aspect of Ecological Agriculture in wetland

1. still pollution water
2. change the biota in Deepor Beel wetland,
3. soil nutrient

Positive aspect of Ecological Agriculture in wetland

1. reduce the pollution,
2. high productivity

In my viewpoint, ecological agriculture refers to the traditional agriculture plus BMPs.

Soil-less agriculture is a new cultivating method applied in Bangladesh.

Floating bed with bottle gourd.

Indigenous population's perspective
on
Deepor Beel's Environmental Degradation

Indigenous Population's Perspective

Identification of Significant Environmental Aspects and Setting Objectives

Identification of Significant Environmental Aspects

- To our knowledge the Deepor Beel has existed since a long time ago. With an area of about 4000 hectares, water depth in the wetland ranges from about 1 m in the lowest times to about 4 m in the wet season. The Beel has now been reduced to a shadow of its former self, due to uncontrolled encroachments and environmental degradation.
- We have co-existed with the Beel for a long time. A total of 14 villages are spread in the Deepor Beel fringe, with 1134 households. No specific study on the local tribal people's demographics has been done. Generally, most of the local tribal people live by the southern edge of the wetland. Out of about 13 communities living near the fringe area, about 3, namely Karbi, Boro, and Rabha communities are mostly tribal in nature. The income level in the area is very low; a cross section of the villagers are living below the poverty line (< Rs. 22,000.00 per year).
- We, the indigenous people, especially the people living near the southern boundary to the Beel, have been relying on the Beel for transport to the city by country boats.
- We have been traditionally utilizing the Beel to collect fodder for domestic cattle, natural food (vegetables, flowers, aquatic seeds, fish, mollusks) and other essential requirements. We do the fishing in the water body and also do hunting of animals in the forest area for our protein source. One-fifth of the households living on the fringe of the wetland are completely dependent on the bio-resources of the wetland for livelihood. More than half of the households depend on the wetland for fodder. Therefore, converting the wetland into a full fledged Wildlife Sanctuary will devastate these households. The question of the diversified livelihood of the fringe villagers must be addressed properly prior to any intervention is carried out.
- The wetland ecosystem is part of our life. We have co-existed with it in natural harmony since time immemorial. Yet, whenever any intervention is done on it, we are left out of the process. We are strongly opposed to such callousness on the part of the decision-makers.
- Few agencies like *Aaranyak* came to talk to us for what they called as 'Awareness Camp' to make us aware of our role in the conservation of Deepor Beel wetland. We admit that we are also responsible in some degree in the Beel's deterioration and welcome such initiatives to improve our understanding. Many others tried to involve the local youths and interested citizens through various media like bird watching camps, nature trails, popular talks and seminars. Sometimes, they show

some involvement such as free health and veterinary camps for the fringe villagers by various NGOs working in the field of conservation. But what we need more is that we be considered as a major stakeholder in the Beel's management and any short of decision making.

- The State Forest Department, on 12th July, 1989, declared an area of the Deepor Beel spanning 4.14 sq. km. of the wetland, as Wildlife Sanctuary by a preliminary notification under Wildlife protection Act, 1972. It was said to be as an effort to provide protection to the wetland ecosystem. We agree that the Beel needs protection from degeneration such as the unregulated brick kiln factories, pollution from other nearby industry, siltation due to unplanned hill cuttings surrounding the lake, over fishing, invasive weeds within the lake, and the like. But without solving the problem of the indigenous people who are dependent on the wetland, and thereby finding suitable alternatives for their proper settlement, the whole management efforts of the wetland will be tantamount to the complete destruction of the local indigenous people as well as the wetland.
- As the Beel is so close to the urban centers, just 10 km west of Guwahati city towards the Lokopriya Gopinath Bordoloi International Airport, it has become the target of many profit oriented agencies who are exploiting our natural resources and invading the peace that we had been granted by the nature. One can see all sorts of advertisements from the private companies in the internet offering a 10-day nature trail and 'bird watching' for over 1,000$ for a group of four persons. Such flurries of 'curious' people who come to get away from their chaotic life in the cities in turn make our own serene lives chaotic. One can find 'floating restaurants' inside the Beel which are dumping all their wastes in the waters of the wetland, which is deteriorating the wetland water.
- Land developers are increasingly occupying the Beel area for land development and settling. Since our area is so close to the city, it has a distinctive advantage for overflowing population in the city, who can not afford the rising price of housing in the city, to buy such settlement at cheap price and commute from here to the work. The government is not doing adequately to regulate such activities. Some agencies have even gone to the extent of filling up the fringe of the wetland and use the land as the 'site' for schools, as if there were not any land around the Beel.
- We have traditionally co-existed with the wild animals of the forest area near the Beel. But the construction of the railway track through the forest has caused the animal corridors, especially the elephant corridors to be affected, and as a result, too many elephants have been killed being hit by the trains. Also, with their habitat compromised due to this new railway track, the elephants have begun to create havoc in the human settlements in the nearby villages.
- The Fisheries Department has done more harm than good for the Beel. Firstly, it introduced commercial fish farming which led the private profit-oriented agencies to introduce non-native fishes in the wetland waters which has caused an imbalance in the local fish species populations on which we were living upon. With this commercialized fish farming, our fishing area has been encroached; we can not even go on fishing like before or cross the water body for transport.

- The Guwahati Metropolitan Corporation (GMC), when its dumping site at Sasal was stopped due to the Court order, chose to dump the city's municipal waste at Boragaoun, which is an integral part of the Deepor Beel. Once again, our lack of political power has been exploited, threatening the ecosystem of the wetland.
- Therefore, we are of the strong view that unless our voice is heard well, unless we are fully involved in the planning, decision-making and management processes of the Deepor Beel, the sustainable management of the Beel, and thereby the real long-term benefits from it will not be achieved.

Setting Objectives

With the above background on the Beel's plight, we propose to set the following objectives, from our side, for the integrated environmental management plan for Deepor Beel, to be incorporated along with additional objectives proposed by other stakeholders:

1) To address the needs of the indigenous people ensuring that their livelihoods are protected.
2) To devise and effectively implement a sound water-quality and biota restoration plan for the wetland.
3) To address the dumping site issue on the Deepor Beel.
4) To develop a sustainable eco-tourism based on the carrying capacity of the wetland.
5) To address the man-animal conflict generated by the railway route more effectively.

Alternatives Proposed

1) To address the needs of the indigenous people ensuring that their livelihoods are protected.

We have been trying our best in guarding the Beel since we settled in this area from our forefathers' generations. We are willing to work further to safeguard the habitat for the flora and fauna in the wetland. However, we are of strong view that since a large numbers of households in the fringe villages are dependent solely on the wetland for their livelihood, this fact must be given due recognition and suitable alternatives arranged before any intervention is carried out in the wetland, barring us from our livelihoods.

There is a need to locate areas for the purpose of grazing of our cattle, collect firewood, and fishing. A better option would be to develop animal husbandry in the area to cater to the needs of the local people. This way, uncontrolled grazing can be put to check. The concept of wise use of wetlands must be understood and accepted by all. A fine example of the wise use of a wetland is the Sundarbans, a mangrove forest shared by India and Bangladesh. Many thousands of local people exploit the natural productivity of this wetland, harvesting mangrove trees, palm leaves, fish and other natural resources, yet

the Sundarbans remains one of the richest wildlife areas in the world. Funding for such effective programs, with a active participation from the local people, can be sought from several international donors.

There is an urgent need to construct a surface transportation especially for people of the southern edge of the Beel who have been commuting to the city on the country boats over the Beel. This will help develop the Beel to become a more pristine place for the birds to come and breed, with the disturbances reduced. Most of the roads going through the fringe villages are in a very pathetic condition, which are in urgent need of repair. During the rainy season, villages become cut off because of the excessive mud over the road. The State Government should earmark the funding for the road improvement project or, it can be developed as part of the wetland restoration funding which can be requested to international donors such as World Bank or IUCN.

There is acute lack of potable water in some of the villages; people have to use pool water, pond water or they have to travel a long distance for collecting drinking water. Recently, on the active pursuit from our side and the Aaranyak staff, 5 wells have been dug in the fringe area. Much more wells are needed to ensure that people get potable water.

2) To devise and effectively implement a sound water-quality and biota restoration plan for the wetland

The number of industries in and around the Beel producing point source pollution needs to be limited. Population growth in the nearby cities has put pressure on the limited natural resources such as water, land and forests in our area too. This has far-reaching consequences in terms of resources spent on the future reforestation and all efforts aimed at restoring the lost value of the environment. Demand for lot of bricks from the city has resulted in the Beel area being impacted, as brick industries are scraping the top soils and dumping the sediments onto the water. Such commercial gains are practiced by people to make ends meet regardless of environmental degradation. As an example, we can take the case of wetlands degradation in Rwanda which is closely linked to development in urban centers countrywide. Many construction activities being carried out in the city has caused huge demand for the inputs from wetlands such as bricks and sand, a factor that has led to over exploitation of the resource. Similar situation in the Deepor Beel has caused it to shrink from its former expanse.

Industries must be required to carry out adequate treatment of their wastes before discharging into the Beel. Environmental agencies, local NGOs and other must act like watch dogs. Also, one must be wary about the prospect of future settlement of the industries around the Beel area since it is so near to the city. As an example, most garages within Kigali City in Rwanda are operating near wetlands and this has a negative impact delivered from hazardous oils and other unwanted metals that find their way in the wetlands. The activity has been found mainly around Nyabarongo wetland. Deepor Beel is not yet at that crossroads today, but if unchecked, it is highly likely that it will take the same route of degradation. Discharge of very toxic chemical in wetlands will pose a big threat to the biodiversity that are vital to the environment. Hence, the licensing of the new industries must be made in accordance to the carrying capacity of the wetland water.

3) To address the dumping site issue on the Deepor Beel.

The decision of the GMC, in choosing to dump the city's municipal waste at Boragaoun, which is an integral part of the Deepor Beel, is most unfortunate. We strongly suggest that a new location, outside the Deepor Beel be found. In the event that the decision can not be changed, we are of the view that proper compensation arrangement with the local population be done and projects be implemented to process the waste into fertilizer and be sold back to the city. Such effort, for example, has been carried out in the Kigali city in Rwanda. Various women associations in the wetland in the Kigali are now dealing with garbage collection and they have established a dumpsite which processes garbage into fertilizers and household cooking materials. To them garbage is now a profit making activity.

4) To develop a sustainable eco-tourism business.

We have been living in harmony with the nature around the Deepor Beel for centuries. We have deep knowledge about the flora and fauna found in the wetland. Therefore, we can be effective tour guides if we are given some training (translators may be necessary for foreign tourists). This way, both the local people and the tourism business operating from the city can live in a fruitful symbiotic relationship, which will result in the better care of the fragile wetland. Tourism Authority of the State of Assam, along with the active participation from the private sector tourism business should come forward to provide the funding for such programs.

Apart from 'bird watching' potential of the wetland, which is what is being exploited at the moment, local culture of the indigenous people can be presented as cultural tourism and marketed to the outside world, and in return, the indigenous people can be provided with incentives for being part of the tourism business. Such examples can be found in other places, such as in Thailand where the Karen indigenous people with their distinctive ornamentation around their neck (rings around their neck) have been very successfully marketed. They have become the most popular attraction for hill-tribe trekking tourists in Thailand.

We are of the view that not all the wetland area be opened to tourism. To protect the areas which are in bad shape requiring proper restorations, and other highly sensitive area to the wild life, such areas must be demarcated from opening to the touristic purposes so that they can get some respite and re-grow to their former self.

5) To address the man-animal conflict generated by the railway route more effectively.

In order to make the animals move across freely through the forest and wetland, a proper wildlife corridor must be provided. In the Deepor Beel's case, the railway track has interrupted the traditional corridors used by the animals, especially the elephants in the southern side of the Beel where the railway line has been constructed. Several

needless deaths of elephants have already occurred due to the railway coming in the way of the elephant corridor. Being disturbed in this unnatural way, the elephants have started to create havoc to the human settlements in the southern side of the Beel. The alternative to solve the problem, we suggest, is to close the railway system for good and instead work on more manageable roadway network systems, which can accommodate bigger corridor areas to the elephants. If this can not be done, then a detailed study should be done to alter the railway route to better suite the elephants' need. Examples from other wetland areas which have successfully launched such activities should be studied.

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Deepor Environmental Policy

Fisheries

Module 3: Identification of Significant Environmental Aspects and Setting Objectives

The world's oceans have long been an **important** source of food and resources for mankind from ancient times. While only 5% of the protein consumed by world populations comes from the sea,(http://oceanworld.tamu.edu/students/fisheries /fisheries1.htm), it is still an important contribution to the diet of millions of the world's inhabitants. In 1996, Americans ate an average of 15 pounds of seafood per person (http://oceanworld.tamu.edu/students /fisheries/fisheries1.html).

Commercial fishing provides large amounts of food to all places around the world. Commercial fishermen harvest almost all aquatic species for example,tuna, cod, salmon shrimp, krill, lobster, clams, squid and crab(http://dictionary.laborlawtalk.com/Fishing).

Uses of fisheries:

a. source of food
b. aesthetic purposes
c. medicinal purposes (cod liver oil from sharks)

Environmental Aspect and Impacts (Adverse Effects)

Overfishing as well as other destructive fishing practices are threatening millions of jobs, global food, security and helath of the marine environment (http://oceanworld.tamu.edu/students/fisheries/fisheries1.htm). At least 60% of the world's 200 most valuable fish species are overfished or fished to the limit. Eleven of the world's 15 most important fishing areas are in decline (http://oceanworld.tamu.edu/students/fisheries/fisheries1.htm).

Over one-third of all fish stocks for which we have scientific population information are over-utilized, and nearly half are below optimal population levels (http://www.nurp.noaa.gov/Docs/2004SCIGUID.html). Fish are selective about where they live. http://www.nurp.noaa.gov /Docs/2004SCIGUID .html). With the advent of new fishing technologies, for example inexpensive satellite positioning, commercial and recreational fishermen have gotten better at finding and targeting fish habitats. Destructive fishing practices degrade these habitats, e.g., anchored gill nets are destroying fragile coral reefs. Trawls customized for "rock-hopping," plow through rocky substrate, topple boulders, and bury the encrusting species that attract fish. Many commercial and recreational fishing activities relocate to deeper depths as shallow resources are depleted, and even less about the ecology and habitat of deep water species. http://www.nurp.noaa.gov /Docs/2004SCIGUID.html

Deepor Beel, located in Guwahati City in Assam, has sections of its wetland being leased out for commercial fishing both by the Fisheries Department and private land holders. The commercial fishery performed by using nets smaller than the regulatory net/screen sizes, in order to catch small fish populations.

The commercial fishing area is usually cordoned off using the net support system made of bamboo.

Commercially attractive fish types include: Kurhi (*Labeo gonius*), Rau (*Labeo rohita*), Shol (*Channa striatus*), Sal (*Channa orientalis*), Kandhuli (*Notopterus chitala*), Magur (*Clarias batrachus*), Pabhoh (*Ompok pabo*), Barali (*Wallago attu*), Puthi (*Puntius conchonius, Puntius gelius, Puntius phutonio, Puntius sophore, Puntius sarana sarana*), Bhakua/Bahu (*Catla catla*), Mirika (*Cirrhinus mrigala*), Mali (*Labeo boga*), Goroi (*Channa punctatus*).

With the introduction of commercial fishery within the Ramsar Site, it creates stress on the habitat, food chain and food web. Removal of targeted fish species within the water body could cause the population to skew in one direction; for example, predators or prey. Some fish are herbivores and play a significant role in scavenging and if these (prey) are removed, it could cause detrimental effects such as massive algae growths and covers. If a top predator is removed, it also would cause detrimental effects within a food web and a food chain. Certain fish populations that this top predator would eat, could have increased explosive numbers thus disrupting the food chain. Introduction of new invasive species could also wipe out native species, **(Nile Perch).**

Commercial fishing done in Deepor can have positive outcomes as well. For example, introduction of new fishery into the area will provide an increase in fishery stock for the commercial fishermen, tribal community and the subsistence farmers. The commercial fishing will also only be done in certain areas of the wetland which have water present throughout the entire year.

Eliminating commercial fishing might bring back healthy fish stocks, but let's face reality-the commercial fishing industry literally feeds us. They are a valuable and are a needed part of today's society and there is an increasing demand by us humans for the fisheries. For example:

Because humans rely on the sea as an important source of food and resources, they tend to overexploit its precious commodities. Many species of animals and plants are endangered due to the destructive nature of methods used for harvesting. Three major issues threatening marine species include over-fishing (catching more fish than can be

reproduced), habitat destruction (destroying of the marine enviornment through human use), and by-catch (unwanted species of marine life that is caught).

National Marine Fishery Service Landings Query Results

Year: 2003-2004 Species: Herring, Atlantic State: Maine

http://www.st.nmfs.gov/pls/webpls/MF_ANNUAL_LANDINGS.RESULTS

Year	Species	Metric Tons	Pounds	$
2003	HERRING, ATLANTIC	43,854.0	96,680,581	7,296,176
2004	HERRING, ATLANTIC	41,095.1	90,598,287	8,019,289
GRAND TOTALS:	**-**	**84,949.1**	**187,278,868**	**15,315,465**

NMFS Landings Query Results

Year: 2000-2004 Species: Herring, Atlantic State: Florida

Year	Species	Metric Tons	Pounds	$
2000	HERRING, ATLANTIC THREAD	1,251.0	2,757,858	349,891
2001	HERRING, ATLANTIC THREAD	1,018.0	2,244,200	293,411
2002	HERRING, ATLANTIC THREAD	1,335.3	2,943,748	311,209
2003	HERRING, ATLANTIC THREAD	924.6	2,038,454	284,514
2004	HERRING, ATLANTIC THREAD	1,448.9	3,194,195	356,600
GRANDTOTALS:	**-**	**5,977.7**	**13,178,455**	**1,595,625**

http://www.st.nmfs.gov/pls/webpls/MF_ANNUAL_LANDINGS.RESULTS

In regards to Deepor Beel Ramsar Site and their fishing techniques, nets are not always selective: some scoop up everything in their paths--the target catch, as well as many non-target species (the by-catch) (http://seawifs.gsfc.nasa.gov/OCEAN PLANET/HTML/peril_bycatch.html). Significant losses to wildlife populations can occur through the incidental capture of marine birds (Barnes, Ryan & Boix-Hinzen 1997, Belda & Sanchez 2001, Darby & Dawson 2000, Gales, Brothers & Reid 1998, Norman 2000, Tasker et al 2000, Weimerskirch et al 1999), cetaceans (dolphins, porpoises, whales) (see Dâagrosa, Lennert-Cody, & Vidal 2000, Dans et al 2001, Pichler, Slooten & Dawson 2001, Read &

Wade 2000, Silvani, Gazo & Aguilar 1998, Whitehead, Reeves, & Tyack 2000), and pinnipeds (seals, sea lions, walrus) (see Shaughnessy et al 2001, Wickens 1995, Wilkinson, Burgess & Cawthorn 2001) which are commonly taken in net and hook fishing operations. Other marine organisms can also be detrimentally affected for example sharks (Colman 1997, Marin et al 1998), crustaceans (Livingston & Tjelmeland 2000) and sea snakes (Ward 2000) as well as entire ecological communities such as seamounts and ocean trenches (Probert 1999). Commercial fishing can severely impact on species classified as endangered or vulnerable (Bergin 1997, Dâagrosa, Lennert-Cody, & Vidal 2000; Hall 1995, Pichler, Slooten & Dawson 2001). It also causes economic losses to fisheries in reduced catch of target species and damage to fishing equipment (Hall 1995, Wickens 1995).

Module 4

The majority of the world's fisheries are in a state of collapse (http://www.api4animals.org/facts?p=456&more=1). Too many boats are chasing too few fish. Many of the fish species currently in decline serve as important food sources for sea animals who, unlike humans, have no other food choices. In the Bering Sea, the effects of overfishing on marine animals are obvious. Fur-seal populations have not increased despite a long-standing ban on commercial hunting. The number of Steller's sea lions, which feed mostly on pollack (the number one ingredient in frozen fish sticks and served by fast food chains), has plunged 80% since the 1970s, and seabirds such as the red-legged kittiwake are also in trouble.Modern fishing techniques have enabled humans to catch more fish than ever before, and the once seemingly abundant ocean is now being stripped of life(http://www.api4animals.org/facts?p=456&more=1).

Fisheries Policies mean catch levels are set for the main commercial species, it is important that these quotas are set at appropriate levels. This policy is often criticized.

The commercial fishing industry has substantial and often extremely deleterious impacts on the marine environment.. It is clear that better management is required to conserve marine resources and mitigate against the negative anthropogenic effects of fishing operations.

Alternatives

Commercial fishing is a business and, like other businesses, it requires good management of finances, sales and marketing, human resources, and ongoing training, to be successful.

Fisheries Management Plans are the key to preserving fish stocks. With the development of a plan, it is best to look at the relative numbers and fish recruitment. It is important to monitor the standing biomass-the minimum that is required to maintain a balance within the fish community. It is also important to focus on the population structure, for example, with the removal of adult or juvenile fish from an area, it is best to monitor the effects remaining fish populations whether juvenile or adult in order to retain biomass.

Monitoring of population status-landings (amount of fishes caught). There will never be an accurate number for fishing mortality and most models are only within 10% accuracy thus it is important that the Total Mortality be constantly monitored.

(Total Mortality is the relation between natural and/or fishing mortality) where there is ultimate effect on the population biomass.

Controlling Effort: this involves monitoring the amount of time, people and gear when dealing with commercial fishing. For example, when the catch per unit effort declines, a fish stock or resource is in trouble. In order to prevent this from happening, several measures need to take place:

a. Limit the number of people allowed to fish-(in a democratic country, this is extremely impossible to do since key people in charge will find alternatives or ways to defeat the system in order to win votes)
b. Licensing limits the amount of people going in; so it is good to set the licensing rates to levels where certain companies cannot afford.
c. Limit the amount of time people spend in an area-limited areas for fishing
d. Creation of fishing seasons to allow fish stocks to increase- from this concept, protected areas arise.
e. Create protected areas-for example, no use, no take zones. RAMSAR site can have exclusive no take zones such as spawning sites, feeding grounds, nursing areas. In Belize-Gladden Spit, Hol Chan Marine Reserve, Laughing Bird Caye.

Eliminate or decrease fish from your diet.

Support legislation that sets strict standards for commercial fishing.

Urge National Parks, National Marine Sanctuaries, and National Wildlife Refuges to prohibit commercial and recreational fishing within their boundaries.

Improve stock assessments of mammals, fishes, and invertebrates by developing and employing advanced underwater technology, providing comparative data on populations, and improving and developing population and community models.

Identify and map essential fish habitat to determine habitat requirements for healthy populations, assess damage from mobile fishing gear, and provide research results that increase a manager's ability to identify, protect, and restore essential fish habitat.

Conduct studies to assess the effectiveness of Marine Protected Areas (MPAs) and marine zoning for conserving fish stocks, essential fish habitat (including conservation of biological diversity), and for contributing new productivity to adjacent unprotected areas.

Identify and quantify damage to fisheries resources and their habitat resulting from fishing gear impacts and contaminant input and spills, and determine rates of impact recovery.

Determine the effectiveness of stock enhancement efforts, including replenishment of wild populations with hatchery-reared juveniles.

Assess the effectiveness of habitat enhancements designed to improve the success of stock enhancement efforts.

Bringing in the catch is only the beginning. Commercial fishing also involves storage, processing and transportation to market. It is often necessary to build on-shore installations to accommodate these activities (http://www.dfo-mpo.gc.ca/communic/marshall/related/video/index_e.htm)

Since 1999, DFO has provided funding to train fishers and train other members of their communities in fisheries-related activities. This has been through traditional classroom instruction with some on-the-job training. Results have been very positive. More than 2,000 Aboriginal people have received training (http://www.dfo-mpo.gc.ca/communic/marshall/related/video/index_e.htm).

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