Floodplains: Augmenting community based fisheries

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There are many floodplains throughout Bangladesh which may be utilised like the 'communities' in Daudkandi. NGOs, having experience of organising the people at the grassroots level and working for ensuring participation and empowerment of people, may opt for initiating this type of fish farming projects for diversifying their operations. Floodplains in many places are controlled by the vested interest groups without making any improvement of fish farming and without allowing access to the poor people dependent on these floodplains.

OPEN water bodies are the important fish production units in Bangladesh. About 44 per cent of the total fish catches in the country are from these water bodies. Of the open water bodies, the area covered by the floodplains are the highest -- 2.83 million ha; but the rate of production in the floodplains is very low -- 0.15 metric ton/ha, whereas, this can be raised to more than two per ha, if proper planning, adoption of modern methods and appropriate technologies and participation and access of people are followed in fish production. Most of the cultivable plots in the floodplains are brought under Boro cultivation during December to March/April. In the rainy season these go under water and remain unused from April to November. But these floodplains, stretching over couple of villages, can be made potential resources for fish cultivation through control of water in the rainy season, with some improvement in physical infrastructures. The cultivable plots in the floodplains are owned by many farmers and individual use of the land during flood season is impossible. This calls for agreement and unity and joint effort of all living in the villages around. Community based fish farming is possible in the floodplains, if it can be made clear to the people of all the villages living around which include land owners and the landless depending directly or indirectly on the land, about how they are to be united, why to be united and benefits to be derived out of the united effort. This also calls for identifying enterprising people from among the villagers and development of organisation of all.

Fish farming in the floodplains has already begun in a few places in the country. Initiators are either the village communities around the floodplains or individual initiators or NGOs. Participation of the people has been ensured in some of the projects particularly those organised by the communities and NGOs. Access and participation of people is almost absent in the projects that have been initiated individually by leasing in the land of others. Some projects are well organised and a few become disorganised after some time due to poor organisation and management. Modern method of fish farming is practiced in some and others follow just common sense. Experience says that the organisations which ensured participation of people, maintained transparency, formulated own capital through an affordable contribution of all and followed modern methods in every stage of fish farming, have become successful, sustainable and could provide benefits to the participants. Participants not only received economic returns from their collective investment in this newly developed fish farming approach but also could initiate a community based social change process. Due to the processes of participation the members of the community could develop their awareness, empowerment, commitment and skill in fish farming.

The Pankowri fish farming project implemented by SHISUK (the acronym for Shikhya, Shastha and Unnayan Karjakram which stands for education, health and development) an NGO, at Daudkandi Upazila, Comilla has set up such an example of modern and intensive fish farming in the floodplains, raising the level of fish production to the extent of 3.8 ton/ha. The project has formulated the steps necessary for implementation of projects like this. This culminated in the development of a community based participatory fish farming model for its replication in other floodplains. In this article the processes of fish farming and the economic and social benefits derived by the participants of Pankowri project have been described for the benefit of the readers.

The project area covers 850 bighas (103 ha) of floodplain land in six villages of North Elliotgonj Union Parishad of Daudkandi Upazila. Pump irrigated HYV Boro is cultivated in the project area during December- March/April. The land then remains under water till November and no crop can be grown in the land during this period, because of the depth of water. Before the project aquatic weeds and water hyacinth used to cover the entire water space during this period. Very low amount of natural fish production could take place due to use of pesticides in Boro cultivation season and dewatering of the whole water body during the dry season.

SHISUK formed Pankowri (name of duck species living in the floodplains) -- an organization of all the 350 households of the six villages around -- with a nine-member Executive Body and registered it under the Joint Stock Company. It formed a capital of Tk. 2 million by floating 2,000 shares, of Tk.1, 000 each. Each individual member should buy at least one share with a limit to 20. They also lease out their land in the project area for seven months for fish farming. Of the total share amount, 85 per cent was bought by the villagers and the rest by SHISUK. The main objective of the organization is to make the fullest utilisation of the water body for fish production by investing local resources through participation of people and to generate income and employment.

There was need for development of some physical infrastructures around the floodplain to control the fishes. The road-cum-embankment network outside the floodplain in the six villages were raised so that rain and flood water from outside cannot enter into the pounded area. Tree plantation was made on the embankment and raised roads. Since the time available for fish cultivation is maximum seven months of the year, old fish fingerlings of 4-5 inches or 40 gram size are released so that within this seven months these can be raised up to a marketable size. Mortality of the fingerlings is very low because of the relatively bigger size of them are released. This gives an opportunity to the local people to raise fish fingerlings in their ponds and ditches and earn some money. Women play greater role in rearing of fish fingerlings. The ripple effect of using community resources is becoming visible and tangible. Fast growing fish varieties are reared. Steps necessary for modern fish farming, like application of required amount of lime and poultry litre are applied at the preparation stage for raising the productivity of the soil. Required amount of chemical fertilizer like urea, TSP and poultry litre are applied on staggered basis for production of planktons in the water. Residue of the fertilizer used during the Boro rice cultivation also help raising the fertility of the soil. For better production of fish within the limited time of fish growth required amount of supplementary feed is also applied.

With fertilization and supplementary feed the growth of the fishes is quite good 0. 40 gram fingerlings of carp varieties, nilotica and pangus grow up to 500 grams to 1kg by November or the end of the project. In the 103 ha of water area of the project 340 metric ton of fish is produced per year with per ha rate of 3.30 ton. Almost all the species of native fishes comprising 10 per cent of the total production also grow naturally in the project area, without any investment, except the feed they consume. This also gives an opportunity to preserve the native fishes. Cost and return indicate a ratio of 1:1.8 out of the project.

Harvesting of fish particularly the small native fishes and those of relatively bigger sizes of the reared fishes starts in October. Actual fish catching starts in November with gradual draining out of water and completed in December. Smaller size reared fishes and some native fishes are preserved in the ditches and canals in the project area which come to bigger size in the next year. Traditional fishermen have taken up the role of fish catching.

Good communication linkage with Chittagong, Comilla, Noakhali, Brahmanbaria and Sylhet city markets provides opportunity for quick transportation of the fishes. Contact is maintained with the aratdars of these city markets for quick disposal of fishes. A band of traders has been developed from the project area for marketing and transporting the fishes. Some of them have located their trading outlets in the above mentioned city markets. Local people and the members have the scope to buy fresh fish at fair price from the fish landing places immediately after harvest for their consumption. It is reported that due to availability and fair price the local people consume fishes many times more than earlier.

The impact of the project is varied. Fertilizer residue, feed residue and fish droppings raise the soil quality and reduce the requirement of fertilizer use during Boro cultivation and increases rice productivity to the extent of 20 per cent. Dewatering of the whole area except the ditches and canals inside for final fish catching, is done systematically from end of November so that the land owners can transplant Boro seedlings in the muddy lands, without plowing, thus saving the cost. Farmers also get relief to the extent of Tk. 1,500 per acre as they are not to clean the land from growing aquatic weeds and water hyacinth during the wet season as the project area is kept clean throughout the fish farming season. This integrated approach has brought about greater sustainability in land usage and in agriculture.

Integrated Pest Management (IPM) is practiced during Boro cultivation barring use of insecticide and allowing biological control of pest and insects. This reduces pest population, growth of some pest eaten by fishes and reduces cost of rice production. This environment management improve biodiversity of aquatic fauna, help conservation and propagation of native fish species and protect and improve the fish species diversity.

The tangible economic benefits received by the members of the project are: (i) 20 percent increase in rice yield, reduction of production cost in respect of cleaning the land, plowing and use of pesticides, 20 per cent less use of chemical fertilizer, (ii) appreciation of the value of each share to the extent of tk. 5,000 from the face value of tk. 1,000, (iii) dividend on the share to the extent of 100 per cent, (iv) lease money on the land given for fish farming to the extent of 30 per cent of the net profit, (v) income from rearing fingerlings in the ponds and ditches for selling to the project, (vi) employment opportunity in fish feeding, catching and guarding the project area, (vii) involvement in fish marketing and transportation, (viii) reduction in land transfer or distress sale of land, and (ix) reduction of poverty.

The social benefits include organisation of people of six villages, increased interaction in the community among the six villages, sitting together on regular basis as per by law of the organisation, reviewing the activities of fish farming, participatory decision making, ensuring transparency and accountability for the activities, empowerment and awareness of making the best use of the available resource, confidence development among the leaders for managing bigger project and taking care of the benefit of the whole community, development of road and communication infrastructure reducing transportation hassle and cost, increasing enrolment of children to school and increasing mobility of people including women, training of women in population control, improvement in nutrition, reduction of migration, business linkage with urban fish markets and poultry farms and fish feed agencies, exposure development and contact with local government agencies, government departments and development partners, nutrition improvement due to consumption of more fishes, etc. Other benefits include development of growth centre with increasing number of shops and service centres, ice factory, law and order improvement due to watch and ward bringing safety and security among the people in the project area and preservation of environment.

Pankowri thus has become a role model in organising the community and empowering them to utilise the natural resources for fish farming with its consequent benefit of providing the community with food security, income, employment and other social, infrastructural and environmental benefits. It has formulated the steps necessary for organising the community and adopting modern fish farming. It helped the Ministry of Fisheries and Livestock to develop Strategic Planning and Implementation Manual for fish farming in the floodplains. With its success, around 150 fish farming projects have been started in floodplains of Daudkandi, of which nearly 100 are community based and the rest joint or individual projects. Of these projects, seven are managed by SHISUK. In these projects SHISUK kept the provision for access of the landless to buy shares though they do not have land in the project area. The landless households get support from SHISUK to buy shares and can repay the same from their dividend on shares. These organisations have contributed to the development of a new vista of fish farming in the region and added immensely to the total inland fish production in the country, by making the best utilisation of available resources. Interestingly these projects are implemented completely on the basis of community formulated capital without depending on the government or the development partners.

Almost all the communities in the floodplain areas of Daudkandi have become active in fish farming. Their knowledge, experience and skill in organisation and management of fish farming have contributed to the optimum rate of fish production. The whole floodplain region has been vibrating with fish production and marketing activities. There might be scopes left for further increase of fish production. But that has to be achieved through acquiring refined knowledge from researchers and through training. One question strikes the mind. What is next? The fishes are produced, marketed and consumed. Should this be the end? What can be done to derive better return out of the fish production? Can there be diversification in the whole processes including processing of fishes for value addition and finding out better markets?

Improvement of post harvest handling, cleaning, grading, processing, chilling, storing and transporting to urban markets and ethnic markets abroad may give better returns. Organic method of drying can attract customers and add value to the product. Fish farming communities can join together to start a fish feed mill in the area. Similar other fish related ventures can also be initiated. Additional income derived by the community people are believed to be used in buying land, investment in business, education, house building and also in some unproductive expenditure. A portion of this money can be harnessed to form capital to diversify the value addition measures that can be initiated. SHISUK may join hands with other communities to diversify fish related operations. They may seek the support of government and through government the development partners for taking the next and bigger steps. Daudkandi can be the regional hub to start such an initiative. Ministry of Fisheries and Livestock may have a thought over the issue.

There are many floodplains throughout Bangladesh which may be utilised like the 'communities' in Daudkandi. NGOs, having experience of organising the people at the grassroots level and working for ensuring participation and empowerment of people, may opt for initiating this type of fish farming projects for diversifying their operations. Floodplains in many places are controlled by the vested interest groups without making any improvement of fish farming and without allowing access to the poor people dependent on these floodplains. The Ministry of Fisheries and Livestock and the Ministry of Land can support the NGOs to initiate community based fish farming in the floodplains for providing benefit to the poor as well as the achieving PRSP target and Millennium Development Goal.

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Assessing earthquake and tsunami risk in Bangladesh

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Tsunami travels very fast as ocean waves, about 800 km/h, or 0.2 km/sec for a water depth of 5000 m, but it is still much slower than seismic waves. The velocity difference between the seismic wave propagation and tsunami wave makes it possible to issue a tsunami warning. Earthquake monitoring stations (seismic observatories) can immediately calculate various parameters such as location, magnitude, focal depth, and the nature of fault rupture, and subsequently may issue tsunami warning.

BANGLADESH having been situated in the active plate collision zone, poses a major threat from large earthquakes. It is of major debate, however, as to when and where such major earthquake would strike. Historical earthquake records suggest that Bangladesh has experienced at least four major earthquakes of magnitude between 7 and 8, and one great earthquake of magnitude between 8 and 9 in the past 250 years. These earthquakes are, namely: Bengal-Arakan earthquake of 1762, Manikganj earthquake of 1885, Great Assam earthquake of 1897, Srimongol earthquake of 1918, and Dhubri earthquake of 1930. All of these earthquakes caused extensive damage to property and life, and changed geomorphic expressions such as ground tilt, ground subsidence, and river courses etc., in most part of the Bengal delta.

It is also well established that during an earthquake the major damage occurs within 10 15 km radius from nucleation of an active fault rupture. In the context, the Bengal delta of Bangladesh is characterised by quite a good number of active faults such as Tista fault, Korotoa fault, Bogra fault, Dhaleshwari-Buriganga fault, Dauki fault zone, Surma-Sari fault, Shazibazar fault, Lalmai fault, Sitakund fault, Sitapahar fault, Kolabunia fault, Bandarban fault, and Teknaf fault. From geologic point of view all these faults are most vulnerable to reactivations and ruptures during a major earthquake that would strike nearby the respective fault zones. The question of 'how far nearby' would depend on the site characterization with respect to liquefaction, ground frequency, amplification, ground acceleration (g_value), and soil types.

The pertinent question arises from the devastating tsunami of December 26, 2004 that to what extent Bangladesh is vulnerable to any future tsunami. The historical record do not rule out one to one correlation of the possibility, neither its vulnerability is indicated straight away. Considering the orography of the continental shelf, water depth, and tectonic framework of the Bay of Bengal, tsunami vulnerability status needs to be recast. The historical records suggest that on night of 11th and 12th October, 1737 a furious hurricane stroke at the mouth of the river Ganges. At the same time a violent earthquake triggered throwing down a great many houses along the river at Kolkata. The water rose to 40ft higher than the usual level in the river Ganges (Gentlemen's Magagine, 1738 1739). Another destructive and violent earthquake triggered on April 2, 1762 that was felt all over Bengal and more severely in the northern part of the east coast of the Bay of Bengal. This earthquake had thrown volumes of water and mud from the fissures. At a place called Bakerchanak near the coast, a tract of land sank, and 200 people with all their cattle, were lost. In the northwest coast of Chedua island, about 22 ft above sea level, there said to have caused a permanent submergence of 60 square miles near Chittagong (Bangladesh District Gazetteers Chittagong, 1975). However, the above records do not justify that the coastal belt of Bangladesh is tsunamigenic.

Prior to characterisation of an area under tsunami vulnerability status, it is important to know the genesis of a tsunami. A tsunami is an oceanic gravity wave generated by submarine earthquakes or by other geological processes such as volcanic eruptions or landslides in the ocean. A train of gravity waves is set up on the surface of the sea by a disturbance in the sea bed such as submarine earthquakes, landslides, or volcanic explosions. An earthquake that causes a tsunami is termed as tsunamigenic earthquake. Most large and shallow earthquakes under the sea are tsunamigenic and hence are distributed along the subduction zone of the plate collision margin. Although the evidence suggests that most great water waves are caused by fault rupture along the submarine faults, there are other causes. Submarine landslides occurred in Sigami Bay in Japan in 1923 caused tsunami. These underwater landslides occurred due to triggering of nearby earthquake.

Sometimes a landslide or avalanche of soil and rock on mountain side into a bay, a large lake or even man-made reservoir can produce a deadly local water wave. A famous landslide-induced sea-wave occurred at Lituya Bay, Alaska after a local large earthquake on July 9, 1958. Water waves rushed into the opposite shores of the bay as far as 500 m, stripping vegetation in its path. A giant water-wave was produced by a landslide into the Vaiont reservoir in Italy in October 1963 that caused a large volume of water overtopping the Vaiont dam by 100m and sweeping the valley of the Piave River, killing almost 3000 people. The other known source of great tsunamis is the major volcanic eruptions. The water-wave following the collapse of the top of Krakatoa volcano in 1883 is one of the most violent geological paroxysms in historic times. Krakatoa Island, in the Sunda Strait between Java and Sumatra, with its peak standing to a height of 2000m experienced numerous earthquakes and volcanic activities during August 1883, and a total of about 16 km3 of ash and pumice had ejected. On August 27, 1883 the central vents where the island had stood caved in, and there was ocean water 250 m deep. The sudden collapse produced an enormously energetic tsunami. The water-wave was not high enough in the deep water to sink ships present in the Sunda Strait, but when it reached shallow water along the coast it washed away 165 villages to no trace and killed more than 36,000 people with a water height more than 35 m along the shore.

Devastating episode of a tsunami depends on the volume of on-rush of stressed water and the velocity of the on-rush water front. When a fault rupture occurs in the ocean bed, the upward motion of the faulted block exerts pressure in the overlying water column eventually stressing and moving it. The velocity of the wave fronts of the stressed water depends on water depth and the acceleration due to gravity. The relationship becomes evident wherein velocity is equal to the square root of the product of water depth and acceleration due to gravity. The nature, extent, and magnitude of a fault rupture play an important role in the genesis of a tsunami.

It is envisaged that a tsunamigenic earthquake, by and large, would be of 8 and greater magnitudes. However, local tsunami may occur by an earthquake of magnitudes between 7 and 8 provided other conditions are fulfilled.

The nature of a tsunamigenic fault movement is essentially thrust. The focal depth has to be within 10 15 km. The observation made on the earthquakes of December 26, 2004 and March 28, 2005 clearly demonstrates that one with mb 9.0 (Mw 8.2) and focal depth 10 km generated devastating tsunami while the other with mb 8.7 (Mw 8.1) and focal depth 21 km failed to generate it.

The fault plane solution of two earthquake events occurred in Sumatra, Indonesia on December 26, 2004 and March 28, 2005 respectively, and one earthquake event occurred in Java on July 17, 2006 clearly demonstrates that the earthquake generated tsunami is a typical thrust fault rupture, while the other two show vertical fault rupture but not a thrust. This anomaly fits well with the relation between the nature of fault movement and the generation of tsunami. July 17, 2006 Java earthquake of moment magnitude 7.7 and focal depth only 6 km also failed to generate tsunami. Based on the geodynamic conditions for the generation of tsunami an earthquake needs to trigger in the ocean bed with sufficient water depth close to the plate collision margin essentially within the subduction tectonic environment. It needs a major rupture and fault movement of an essential thrust with moment magnitude much greater than 7 having focal depth within 10 15 km. Only active plate subduction zones are susceptible to such kind of rupture due to thrust fault movement.

Based on the configuration of the continental shelf, water depth, and tectonic framework of the Bay of Bengal, a possible explanation on the status of tsunami vulnerability is proposed. The 200 km long continental shelf with a gradient 0.5 m/km in the upper 100 km zone and a gradient 2 m/km in the lower 100 km zone and then an abrupt shelf break with a gradient about 20 m/km acts as a potential barrier to the motion of the stressed water column. The tectonic framework of the Bay of Bengal suggests that no potential subduction tectonics is operating in the bay and the dominant fault movement is strike-slip as determined from focal mechanism solution of earthquake events occurred in the bay. Hence, characteristically the most Bay of Bengal region does not fulfil the major criteria for the generation of any potential tsunami. However, it will be scientifically unjust and unfair if a pocket located in the bay which coordinate 18oN 87oE and another long narrow strip along Andaman-Nicobar Islands chain is ignored from saying that there remains some wild chances for generating local tsunami under some unusual conditions.

Tsunami travels very fast as ocean waves, about 800 km/h, or 0.2 km/sec for a water depth of 5000 m, but it is still much slower than seismic waves. The velocity difference between the seismic wave propagation and tsunami wave makes it possible to issue a tsunami warning. Earthquake monitoring stations (seismic observatories) can immediately calculate various parameters such as location, magnitude, focal depth, and the nature of fault rupture, and subsequently may issue tsunami warning. The national networking of seismic observatory and its inter communication would serve both the purpose of mapping earthquake risk zones as well as tsunami warning. No special and separate tsunami warning system is needed.

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