



Farmers' Perceptions and Attitudes Toward Aquasilviculture in the Periphery of the Sundarbans Forest of Bangladesh

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Abstract

The Sundarbans is a protected forest ecosystem in Bangladesh. A large number of people depend on this forest for their livelihoods and income. Many farmers in the region are now adopting fish farming—specifically, aquasilviculture (multi-purpose production system that allows production of fish and perennial plants mostly trees), one of the most profitable agroforestry systems in many countries. The present study aimed to study the status, benefits, and farmers' perceptions of and attitudes towards the practice of aquasilviculture in the periphery of the Sundarbans. It was conducted in the Shyamnagar upazilla (administrative district) in the southwestern part of Bangladesh, which is recognized as the most vulnerable upazilla on the coast. About 10% of the area's shrimp farms were randomly selected and their farmers were interviewed using a semi-structured questionnaire. Most farmers (87%) had a positive attitude toward and clear perception of aquasilviculture practices. Farmers also perceived that trees helped increase their income and provide sources of fuelwood, timber, and fodder for their livestock. The respondents mainly preferred to plant *Albizia procera*, *Acacia nilotica*, *Azadirachta indica*, *Psidium guajava*, *Excoecaria agallocha*, and *Avicennia officinalis* on the dikes of fishponds. Farmers considered increased levels of salinity in water and soils, lack of access to capital, and inadequate technical assistance the main barriers to the practice of aquasilviculture in the region. Aquasilviculture could be an environmentally friendly and climate-smart aquaculture practice in the area, one that increases green coverage on fishponds' dikes while also improving the livelihoods of local farmers.

Keywords Aquasilviculture · Livelihood · Fishponds · Wetlands · The Sundarbans · Bangladesh

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Introduction

The Sundarbans is a highly productive mangrove wetland ecosystem that provides many social, financial, and environmental benefits (Islam and Bhuiyan 2018). This forest has a significant role in the country's national economy and provides the livelihood for the local people through fishing, tourism, wood, and non-wood products (Islam and Bhuiyan 2018). In 1997, UNESCO declared 1397 km² of this forest a World Heritage site for its natural resource and ecological significance (WCMC 2001). In recent decades, mangrove forests have been increasingly threatened due to anthropogenic pressures (i.e. changes of land use pattern, aquaculture ponds, decrease in fresh water flow, agricultural run-off and oil spillage from seaports) with severe adverse effects on the biodiversity of areas such as the Sundarbans (MacFarlane et al. 2007; Roy and Hussain 2015; Islam et al. 2016; Das and Mondal 2016). Restoration of mangrove forests is often suggested to minimize ecological and economic losses incurred from their decline and improve the livelihoods of local people (Saenger 2002).

Shrimp culture is an essential economic activity in the coastal areas of tropical and sub-tropical countries. In Bangladesh, it is an established practice at the coastal areas of Khulna, Satkhira, Bagerhat, and Cox's Bazar districts. Traditionally, people have enclosed tidal water in low-lying intertidal lands by constructing small dykes and harvested shrimp and fish after three to four months without any form of management (Haque 2004; Nuruzzaman 2006). In the 1970s, shrimp aquaculture in Bangladesh was conducted in ghers, traditional earthen ponds or fields situated by riversides and impounded by dikes (Islam et al 2005). About 31,200 ha of land in 1982–83 and about 94,850 ha of land in 1993–94 were under shrimp cultivation in southwestern Bangladesh (Haque 2006).

This conversion of rice fields and the rapid expansion of shrimp farming in Bangladesh has caused ecological changes (Rahman and Hossain 2009). The expansion of shrimp ponds has caused massive water logging in the region (Ito 2002). Increased levels of soil and water salinity, scarcity of drinking water, destruction of mangroves, over-exploitation of wild post-larvae of shrimp, reduction of aquatic resources and bio-diversity, loss of trees, quick changes in land use patterns, loss of agricultural and grazing land, reduction of livestock, adverse effects on cropping patterns and intensity, and crop diversity have been identified among the important environmental problems related to shrimp farming in Bangladesh (UNEP 1999; Rahman and Hossain 2009).

Of these problems, the increased salinity levels of soil and water appears to be the most crucial threat to the natural environment. Various authors have suggested salination from shrimp farming may be responsible for reductions in tree coverage (DDP 1983; Rahman et al. 1994; Caritas 1990, 1997; Karim and Aftabuzzaman 1997). Saline soil does not support plant growth primarily due to the stresses of excess salt in the soil solution which influences the survival of herbaceous plants, shrubs and trees and stunting the growth of trees (Salequzzaman 2001).

However, trees can contribute significantly to livelihood security in this farming area. Trees help to maintain biodiversity and environmental condition, and provide

subsistence and income through the production of edible fruits, nuts, fodder, timber, and firewood. Aquasilviculture, a multi-purpose production system that allows the production of fish and perennial plants, mostly trees (Huxley and Houten 1997) is a climate-smart and environmentally friendly system of agriculture that seems to be appropriate for the brackish-water shrimp culture of southwestern Bangladesh (Paul and Vogl 2011).

The study area (Shyamnagar Upazilla) is a coastal part of the country where both fresh and brackish-water aquaculture are common practices. Shrimp ponds accelerate the depletion of base minerals and make adjacent soils more acidic and saline, a process which is difficult to reverse (Ali 2006). In this context, aquasilviculture may help to improve environmental conditions by increasing tree coverage in southwestern Bangladesh. Farmers can earn money by selling fish in the short term, and a larger amount of cash after selling the timber products in the longer term.

Motivation for the farmers and selection of suitable tree species for adapting aquasilviculture is crucial. People's perceptions of and attitudes toward planting trees on the dikes of their fishponds would be emphasized by giving technical assistance in selecting suitable tree species for aquasilviculture. If perennial trees are selected by farmers themselves according to their priorities, there is a better chance they will plant trees around their fishponds. Assessment of local peoples' attitudes towards such interventions is one of the least explored aspects of mangrove restoration science (Iftekhar and Takama 2008). Such assessment may be particularly important for restoration projects in developing countries, such as Bangladesh (Pereira et al. 2005). Failure to consider local needs and values has led to the collapse of many previous conservation projects (Iftekhar and Takama 2008). However, there has been only limited research focusing on people's perceptions of and attitudes towards aquasilviculture in the peripheral areas of the Sundarbans.

Therefore, the aims of this study were (1) to investigate the present status, benefits and problems of aquasilviculture in the study area; and (2) to determine farmers' perceptions of and attitudes towards aquasilviculture in the peripheral areas of the Sundarbans forest of Bangladesh.

Materials and Methods

Description of the Study Area

Shyamnagar Upazilla of Satkhira district, which is situated on the edges of the Sundarbans, was purposively selected for this study. Shyamnagar Upazilla is located between 22°19'50" to 22°33'06" North latitude and 89°06'10" to 89°10'28" East longitude (Fig. 1). It has 46,592 households and a total area of 1968 km². Shyamnagar consists of 12 union parishads, 127 mouzas, and 216 villages. The average literacy rate in the entire Upazilla is 28%; 38% among men and 17% among women. The main occupations of the people are agriculture, fishing, shrimp farming, crab fattening, day labor, and honey collection from the Sundarbans. The main crops are rice and vegetables and main export items are rice, fish (shrimp), and honey (BBS 2013).

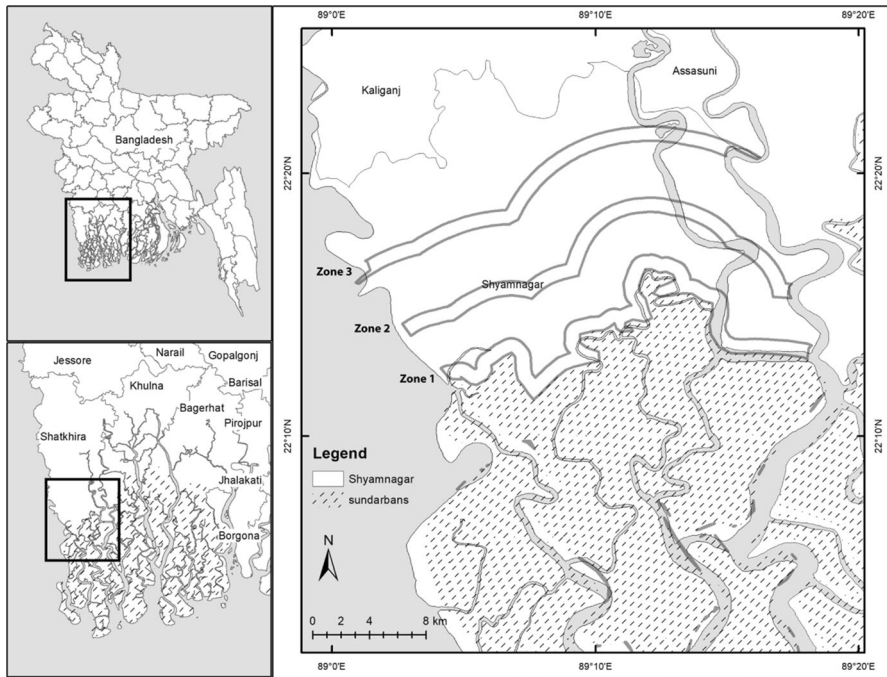


Fig. 1 Map of the study area (Shyamnagar Upazilla) showing zones 1, 2 and 3

Sampling Design

To facilitate the sampling procedure, the area of Shyamnagar Upazilla was sub-divided into three zones (Fig. 1) at increasing distance from the Sundarbans (i.e., Zone 1, 0–1 km; Zone 2, 4–5 km; and Zone 3, 9–10 km) and with differing levels of soil salinity (determined by preliminary soil tests). Soil salinity was found to be lower with increasing distance from the periphery of the Sundarbans.

The total number of shrimp ponds in each zone was counted using Google Earth and a random number assigned to each identified shrimp pond. About 10% of shrimp farms were selected randomly from each zone. A number of shrimp ponds were selected randomly from each zone (120, zone 1; 160, zone 2; and 120, zone 3). The geographical location of each selected shrimp farm was also recorded using GPS.

The study was carried out at Shyamnagar Upazilla in Satkhira district of Bangladesh from July–December 2017. A semi-structured questionnaire (Bargali et al. 2009) was prepared and interviews were conducted with the farmers of the randomly selected shrimp ponds. Interview subjects were those who are actively involved in fish farming. Questions were asked regarding their demographics and socio-economic characteristics (e.g., age, gender, literacy level, income, farm size). Information on respondents' perceptions of and attitudes toward aquasilviculture—its benefits (e.g., types of products obtained from the fish ponds and dikes), problems (e.g., difficulties that the respondents faced in planting trees on the dikes of fishponds),

and management strategies of aquasilviculture (e.g., availability of seedlings, watering, weeding etc.) in the study area was collected using a five-point Likert scale (Likert 1932). The ratings were defined by 1- strongly disagree, 2- disagree, 3- neutral, 4- agree and 5- strongly agree.

Data Analysis

The collected data were analyzed using Microsoft Excel and SPSS 20 software using a $p < 0.05$ level of significance. Frequency (f), percentage (%), average ($\bar{x}$), standard deviation, range, coefficient of correlation, and F tests were applied for analysis of the data as described by Snedecor and Cochran (1967). Coefficient of correlation tests were performed to examine the relationship among demographic features and peoples' perceptions of and attitudes towards aquasilviculture. Calculation of mean rank score of every individual item was done by multiplying the frequencies by their respective scores, summing them, and dividing by the entire number of respondents (Islam et al. 2015). Data were collected using Likert scale, and normalized with using the formula to compare the results with 1.

The WAI was calculated using the formula

$$WAI = \frac{f_5 \times 1 + f_4 \times 0.80 + f_3 \times 0.60 + f_2 \times 0.40 + f_1 \times 0.20}{F_{total}}$$

where WAI= weighted average index. f_1 – f_5 = are the frequencies of factors 1–5, and F_{total} = is the total sample frequency.

Results

Demographic and Socio-economic Features of Respondents

The field survey revealed that about 85% of respondents in zone 1 are men and 100% of respondents living in zones 2 and 3 are men. All male respondents are directly involved in fish farming and aquasilviculture practice in Shyamnagar Upazilla; female respondents are indirectly involved in the practice (Table 1). About 60% (average across three zones) of respondents practicing aquasilviculture have a primary education. 55% of the respondents who are practicing aquasilviculture for their extra income have primary or no education; 36% of respondents (average three zones) have secondary education and 8% have higher educations. Some 90% of the respondents are involved in shrimp farming as their primary occupation, while 8% report agriculture is their secondary occupation. Some (2%) are involved with small businesses and teaching (Table 1). The farmers practice aquasilviculture to earn more money. The study shows that the majority (93% across all zones) of respondents have annual income between BDT 100,000 (USD 1,200) and BDT 500,000 (USD 6,000), while only 7% reported an income over BDT 500,001 (USD 6,000).

The survey shows that 83% of farmers own a fishpond of 1–25 ha in size in zone 1 which is the highest compared to 76% of farmers in zone 2 and 63% of farmers in

Table 1 Socio-economic profile of respondents in the study area

Characteristics	Categories	Percentage of farmers		
		Zone 1	Zone 2	Zone 3
Gender	Male	85	100	100
	Female	15	0	0
Age (years)	Young (20–35)	28	8	21
Mean age 42	Middle-aged (35–50)	62	73	69
	Elderly (> 50)	10	19	10
Education level	Primary	60	53	53
Mean years of schooling ≥ 5	Secondary	33	35	38
	Higher secondary	7	12	9
Number of family members	< 5	42	68	70
Mean 3	≥ 5	58	32	30
Annual income (Taka)	< 500,000	98	91	90
Mean income $\geq 5,00,000$	> 500,001	2	9	10
Farm size (ha)	1–25	83	76	63
Mean ≥ 6	26–50	13	17	30
	51–71	2	5	5
	> 100	2	2	2
Land ownership	Owned	90	76	98
	Owned and Leased	4	9	1
	Leased	6	15	1

zone 3. In zone 3, 30% of farmers own fishponds of 26–50 ha in size, 17% in zone 2 and 13% in zone 1. Very few farmers (2–5%) have fishponds more than 100 ha in size across the three zones. Most respondents (90% in zone 1, 76% zone 2, and 98% zone 3) use their own land. Because of land scarcity, farmers lease land and must pay rent based on the productivity of the land. On average, 5% of the respondents in each zone have joint land and 7% both lease and own land to increase their farm's size. More than two-thirds (70%) of respondents use land for aquasilviculture that was previously used for paddy cultivation. Some respondents use otherwise fallow land, unused land, and old fishponds (19%, 4%, and 7%, respectively) for aquasilviculture.

Aquasilviculture in the Study Area

In the study area as a whole, 70% of respondents farm shrimp (*Penaeus monodon*) as their main income source. On the other hand, golda (*Macrobrachium rosenbergii*), mud crab (*Scylla serrata*), and others freshwater fish are farmed for primary income by 15%, 10%, and 5%, of the respondents respectively.

Aquasilviculture is more commonly practiced in zone 1, in 53% of the zone's area, whereas 26% of zone 2 and 26% of zone 3 are used for this practice. The prevalence of perennial plants on the dike in zones 1, 2 and 3 are 55%, 38%, and

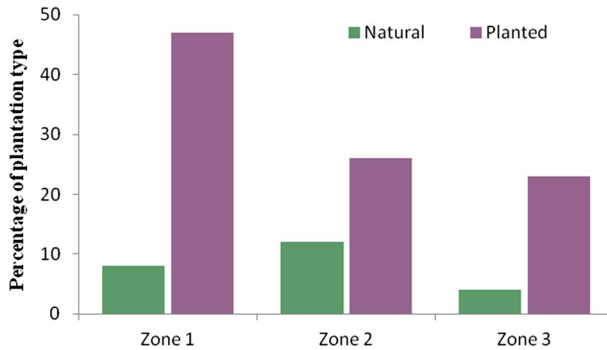


Fig. 2 Existing trees (natural and planted) on the dikes of fishponds in the study Area

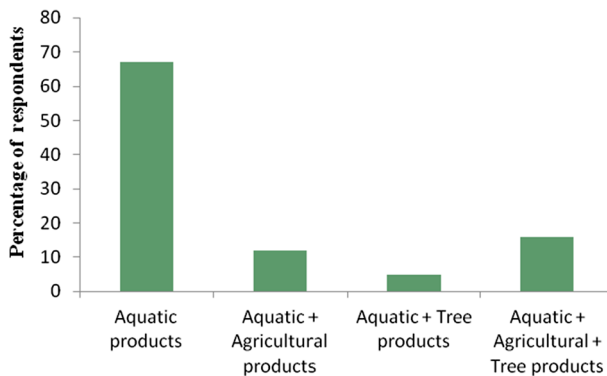


Fig. 3 Products obtained from fish ponds by respondents in the study area

27%, respectively. Among these, naturally grown plants are found at the highest rate in zone 1 (47%), whereas zones 2 and 3 have 26% and 23% naturally grown plants, respectively (Fig. 2). The highest percentage of trees planted on dikes is found in zone 2 (12%), while zone 1 and zone 3 have 8% and 4%, respectively. Zone 1 is closer to the Sundarbans than zone 2 and 3; thus, some mangrove species are naturally more abundant in zone 1 than the others.

Different types of products are produced on the dikes and in the fishponds. About two-thirds (67%) of total respondents harvest only aquatic products from their fishponds, 12% of the respondents get aquatic and agricultural products, and 16% respondents report harvesting aquatic, agricultural, and tree products from their fishponds, while only 7% obtain aquatic and tree products (Fig. 3). In Shyamnagar, most farmers plant trees to produce fuelwood, fodder, fruits, and small timber. Thus, fast-growing and multipurpose tree species are typically planted on the dikes of the fish farms.

The most common tree species, both planted and naturally occurring on the dikes of the fishponds in the study area, are *Albizia procera*, *Azadirachta indica*, *Acacia nilotica*, and *Excoecaria agallocha*. Small amounts of *Avicenia officinalis*,

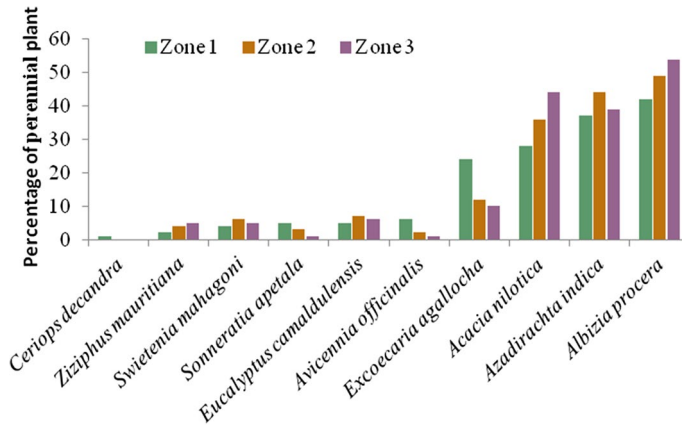


Fig. 4 Perennial plants (natural and planted) on dikes of fish ponds in the study area

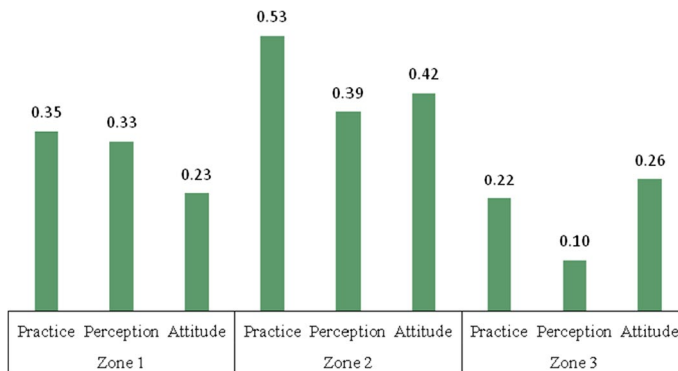


Fig. 5 Farmers' perceptions of and attitudes towards aquasilviculture in the study area

Eucalyptus camaldulensis, *Sonneratia apetala*, *Swietenia mahagoni*, *Zizyphus mauritiana*, and *Ceriops decandra* were also reported (Fig. 4).

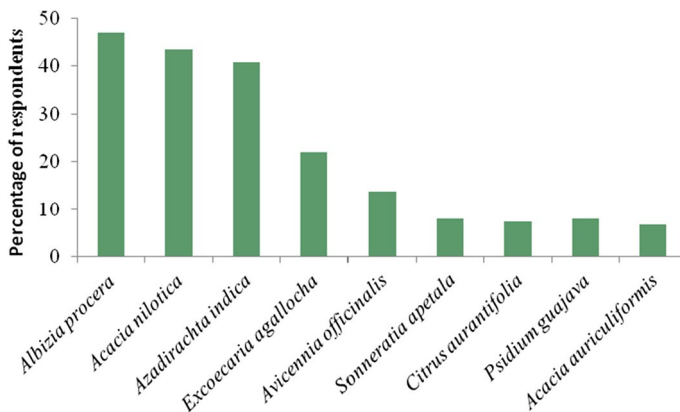
Respondents practicing aquasilviculture report cultivating various agricultural crops along with trees on the dikes of the fishponds (e.g., *Zingiber officinale*, *Solanum melongena*, *Cucumis sativus*, *Hibiscus esculentus*, *Calocasia esculenta*, *Curcuma longa*, *Cucumbrita maxima*, *Capsicum frutescens*, *Amorphophallus campanulatus*).

Farmers' Perceptions of and Attitude Toward Aquasilviculture in the Study Area

Figure 5 is prepared based on the WAI score calculated for the three zones and the highest value is just over 0.5. The X-axis represents the value of attitudes, practices, and perceptions of farmers whereas the Y-axis represents the WAI scores. Hence, for example, the value (0.53) on top of the bar represents the

Table 2 Farmers' reasons for practicing aquasilviculture in the study area

Reasons for practicing aquasilviculture	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
For dike stabilization	0	0	6	35	59
For environmental purposes	0	0	11	78	19
For timber production	0	0	6	87	7
For fuelwood production	0	0	10	84	6
Other	0	0	24	74	2

**Fig. 6** Farmers' preferred perennial trees for planting on dikes of fish ponds in the study area

highest practices among all three zones as it is more than half. On the other hand, value 0.42 shows the highest attitudes.

Based on the calculation of WAI, Fig. 5 shows that the farmers of zone 2 have the most positive attitudes toward and perceptions of aquasilviculture, and also implement it more than farmers in the other two zones.

Almost all respondents (99%) have clear knowledge about aquasilviculture; they report that the main sources of their knowledge are the Forest Department, non-governmental organizations, and friends. About 81% of respondents in the study area have a positive opinion of increasing dike width; this makes sense given 59% of farmers from all three zones strongly agree that they are practicing aquasilviculture for dike stabilization (Table 2). Farmers agree that the other motivations behind this practice are environmental purposes (19%), timber production (7%), and fuelwood production (6%).

About half of the respondents (49%) prefer *Albizia procera* for planting on the dikes of fish farms. The other preferred species include *Acacia nilotica*, *Azadirachta indica*, *Excoecaria agallocha*, and *Avicennia officinalis*. A few respondents prefer *Citrus aurantifolia*, *Psidium guajava*, and *Acacia auriculiformis* (Fig. 6).

Generally, farmers plant 1–2-year-old seedlings bought from nurseries. Almost 44% of farmers say that they are satisfied with the seedlings' survival rate with 54% of them stating that they manage the seedlings well, 23% provide only protection, 14% provide only fresh water, and 9% give fertilizer along with protection and provide fresh water.

Respondents were asked to report their reasons for not practicing aquasilviculture. The respondents reported that the main reasons are lack of land (12%), capital (6%), and training (3%). Almost all respondents (99%) strongly agreed that they would need assistance for practicing aquasilviculture, such as a supply of seedlings, financial and technical help, and so on.

Although some of the respondents (18%) in the study area mentioned that the production of fish has suffered due to the practice of aquasilviculture, most (82%) do not agree with that statement (Table 3). Only twenty six percent of the respondents in zone 1 report their fish production has suffered due to the practice of aquasilviculture (compared to 18% and 10% for zones 2 and 3, respectively). The beneficial and harmful features of aquasilviculture mentioned by farmers in the study area are summarized in Table 3. Among the beneficial features, 81% of the respondents stated that they practice aquasilviculture to produce tree products for household consumption, whereas 75% of the respondents mentioned that this practice is beneficial for the productive integrated system, meaning they get various types of aquatic, agricultural, and tree products from one farm. Half of the respondents (50%) reported that they prefer aquasilviculture for its diversified products (e.g., producing timber, fuelwood, fruits, vegetables, cereals, spices, shrimp, fishes, and crabs) and 48% of the respondents identify the practice as improving soil conditions.

On the other hand, most of the respondents (89%) reported that fish harvesting is more challenging due to the presence of perennial trees on the dike (Table 3). More than half of the respondents (58%) stated that falling leaves from trees pollute the water. About a third of the respondents (35%) also mentioned that the pond does not get sufficient light due to shade from perennial plants on the dike, while a little over a quarter (28%) of the respondents mentioned land tenure as a major problem. The respondents also reported issues such as viral infections in fish species, natural disasters, lack of proper knowledge about aquasilviculture, and financial limitations.

Table 3 Perceived beneficial and harmful features of aquasilviculture by the respondents in the study area

	Features	Respondents (%)
Beneficial	Productive integrated system	75
	Diversified products	50
	Products for household consumption	81
	Improved soil condition	48
Harmful	Fish harvesting is difficult due to trees	89
	Leaves fall into the water	58
	Shade problems	35
	Land tenure problems	28

Table 4 shows the coefficient of correlation between selected socioeconomic variables with perceptions of, attitude toward, and preference for aquasilviculture in zones 1–3. The coefficient of correlation shows that age has no statistical relationship with practicing aquasilviculture. However, other socio-economic and demographic factors are positively associated with aquasilviculture. The results signify that the socio-economic variables included in the study are correlated with perceptions, attitudes, and preferences towards aquasilviculture in the study area. The magnitude of perceptions, attitudes and preferences in agroforestry varies greatly among people with different educational levels, small and large farmers, bigger and smaller families, poorer and wealthier households, and low-income and high-income farmers.

Discussion

This study was conducted among fish farmers adjacent to the Sundarbans of Bangladesh. The study area was divided into three zones based on distance from the Sundarbans and was a proxy for salinity. Each zone was assessed separately for the abundance and type of plants growing on the dikes of fishponds and farmers' perceptions of and attitudes toward the practice of aquasilviculture.

The findings of this study highlights that the farmers of zone 2 have a generally positive attitude toward and perception of aquasilviculture and practice it at higher rates than farmers in the other two zones (Fig. 5). Notably, farmers in zone 2 have a high levels of education, land ownership, annual income, and larger average farm sizes, which may positively affect their choice to practice aquasilviculture. This finding is in line with those of previous studies (Kareemulla et al. 2009; Bijalwan et al. 2011) that found that socio-economic characteristics directly influence any new practices.

Perception is a way of seeing, understanding and interpreting something, it is deeper fundamental understanding and awareness. Demographics play an essential role in how people determine their perceptions of and attitudes toward the adoption or rejection of new ideas (Ghaury and Qureshi 1999). The correlation tests reported in Table 4 show the relationships among socio-economic characteristics and farmers' perceptions and attitudes about aquasilviculture in the study area. Other than age, these characteristics (literacy level, total family income, size of fish farm, and land ownership pattern) are all significantly related to respondents' perceptions of and attitudes toward aquasilviculture. This study confirms the importance of socio-economic characteristics in people's perceptions, attitudes, and preferences in agroforestry, which has been highlighted by other studies (Haque et al. 2003; Chowdhury 2003). However, some previous studies in other contexts (e.g., Uddin et al. 2008) have found literacy level or years of schooling and farm size to have negative relationships with the practice of aquasilviculture. This could be because educated youth may be more interested in a job for wages than farming, which is in line with Uddin et al. (2008).

Most of the farmers surveyed had a primary education. This may have been related to their perspective that the trees degrade the land by taking up all water and

Background characteristics

*Correlation is significant at the 0.05 level (2-tailed)

nutrients. This interpretation is also stated by Nouman et al. (2008) in a study set in Faisalabad, Pakistan.

In our study area, most farmers (95%) surveyed are engaged in fish farming as their primary occupation and crop farming as secondary. Islam et al. (2016) also found that most people in this region are more or less involved with shrimp farming and invested money made from other businesses in shrimp farming. Enate et al. (2016) found the same in the Philippines.

Notably, the present study found women involvement in aquasilviculture practice only in zone 1, as most of the men in that zone are directly or indirectly involved in the collection of forest products from the Sundarbans (Table 1). Similarly, women from poorer communities are also involved in the practice of aquasilviculture, as they need to earn money alongside their husbands. The negative relationship between fishpond size and people's attitudes towards aquasilviculture indicated a land ownership problem in the study area. Farmers who are practicing fish farming on leased land think that any trees they plant will belong to the land's owner at the end of the tenancy agreement. This situation is in contrast with the findings of Islam et al. (2015) in India, though Adedayo (2014) noted a similar phenomenon—that tenant farmers and squatters in Nigeria find it difficult to plant trees on their farms due to tenure restrictions. Moreover, large fish farms in the study area are managed jointly by several farmers. Most farmers do not have a positive attitude toward planting trees, as there are difficulties in sharing benefits from the tree products.

Agricultural crops raised by the local people are mostly consumed by them, whereas a very small portion is sold in the local market; these crops meet the food security needs of the local farmers. The tree species observed on the dikes of fishponds (*Albizia procera*, *Azadirachta indica*, *Acacia nilotica*, *Excoecaria agallocha*, *Avicenia officinalis*, *Switenia mahagoni*, *Zyzyphus mauritiana* etc.) were also similar to those reported by Sharmin and Das (2015) in the Satkhira region of Bangladesh. However, one exciting observation is that though *Albizia procera* is a large tree not suitable for narrow dikes, farmers mentioned that they like the tree, as it is fast-growing and produces good-quality fuelwood.

Conclusions

From the above discussion, it was observed that most farmers (87%) around the Sundarbans have a clear perception of and positive attitude toward the practice of aquasilviculture. Many farmers strongly agree that they want to practice aquasilviculture for dike stabilization, fuelwood production, timber production, and environmental purposes. However, many also noted that fish harvesting is made more difficult by aquasilviculture due to the presence of trees on the dike, and leaf shedding problems. All farmers(100%) agreed that training workshops should be conducted to equip farmers with knowledge of appropriate tree growth and management practices. They also agree that financial assistance in form of micro loans is necessary to support the practice of aquasilviculture. It is essential that awareness and objective oriented information regarding the ecological and environmental benefits of fishponds with trees should be disseminated widely to fish farmers through the media,

local educators and Forestry extension agents. The Forest Department could help promote aquasilviculture in the periphery of the Sundarbans by providing technical guidance to fish farmers about tree species suitable for planting on the dikes of fish ponds, information about fish, crop, and tree management practices, and a free supply of seeds and seedlings. The people of other part of Bangladesh can also use the information for selection of trees on the dikes of their fish ponds.

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