CHAR LAND ECOSYSTEM SERVICES VALUATION AND LIVELIHOOD IN NORTHERN REGIONS OF BANGLADESH

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Abstract: Char is newly emerged land in river channel. The research may give some illustrative indications for policy-maker on behalf of proper application of the charred area. It helps to identify the Ecosystem Services (ES) that are present in char land, the dependence of char dwellers living on the ES, and the probable value of using provisioning services. It carried out the study based on a Questionnaire survey, Focus Group Discussion, and Key Informant Interviews among the char dwellers. We identified 30 ecosystem services, where most of the provisioning ecosystem services present status are increased production, but due to low marketing facility, training, and social structure, some indigenous species are lost. The maximum of housekeepers living in the study area depended on farming/crop husbandry (major work) and dependence on provisioning ecosystem services. The total value is 2916478776.1 BDT, which is 0.05% of the total budget in the 2020-21 financial year of the people's republic of Bangladesh. Policymakers must plan and implement effective strategies and programs to minimize vulnerability and enhance the local adaptation processes to improve such households' livelihood across Bangladesh. The objective is to develop a comprehensive integrated plan and policies for char land development and livelihood sustainability.
Keywords: Char land; Ecosystem services; Valuation; Livelihood; Bangladesh

1 INTRODUCTION

"Char" are islands that form from silt deposits because of obstructions in river currents. Chars usually form in wide rivers. Over long periods, the soil in these chars slowly changes, making it inhabitable for plants and animals. Something closely intertwined the lives of these people with the river's tides and floods. Every year, these people's lives change because of floods or breakage from the river. Char land with its unique geography affords life in char land Wildlife Reserve. Char dwellers have been depending on the natural resources of the reserve. Generally, local people had open access to the char area. In the heavily engaged in fishing, hunting, grazing livestock, and collecting fodder, firewood, and different assets affecting individuals' occupations and life assets affecting individuals' occupations and life lifestyles system is defined as the complex living communities and non-living components of their environment interacting as a functional unit to interchanged cyclically and provides a diversity of benefits to people [1-6]. Ecosystem Services (ES) are defined as the benefits got from the ecosystem for human beings [7-9]. Nature provides four types of ES [9,10] e.g. provisioning, regulating, cultural, and supporting that directly influence people and supporting services that are needed to maintain other services [11]. The first is the provisioning of direct services, extracted from ecosystem processes, e.g. food, timber, woods, etc. Second, the regulatory as indirect services e.g. climate regulation, disaster risk reduction, soil erosion prevention, etc. third, cultural services as aesthetic such as spiritual, education, recreation, ecotourism and sense of place, etc. and finally supporting services as partially e.g. soil formation and retention, nutrient cycling, water cycling and habitats for species, etc. [8,12,13].

Provisioning ES to the pastoral families and weighs this responsibility to the household's annual incomes, hence, the supporting service of the woodland to the local area is changed agreeing to demographic characteristics [14]. In the provisioning services, livestock improvement was the biggest pursued by horticultural profits, while fish and woods committed the insufficient. Livestock is the dominant patron of ecosystem services. Still, animals rely upon specific ecosystems, such as grassland, woods, and cultivation. Woodlands still need to dwell for many of the unusual, subverted, and threatened species in Pakistan [15]. The value of ecosystem services is so the relative improvement of ecosystems to that goal. There are many systems to measure this increase, some of which are based on people's opinions of the benefits they get. But protecting recurrent human well-being is the wider target [16] and individual opinions are reduced and inclined [17]. So, we significantly involve getting policies to detect benefits to entities that are not perfectly-identified, benefits to whole unions, and benefits of sustainability [16]. The provision of ecosystem services (ES) is recognized to supply scarcity mitigation, in rural areas of promoting communities and the deterioration of these services is too taken to produce adverse values on human prosperity [18], or sabotage endeavors to shorten poverty [19] very of the analysis into ES and well-being focuses on promoting communities; perhaps rising from opinions that drop-in prosperity has been accompanied by raises in dependency on ES [20] and because the incomes of the modest present rely highly on the plan of ES. Introducing the (economic) price of ecosystem services prove their use [21], their improvement to public recessions [22], or spread costs and benefits of ES deterioration or revival [23]. Few reviews have reviewed relationships at all than a large or aggregate status and avoid impacts and are so scarce for checking which groups promote (and whether the needy sector Monga is the beneficiaries).

The article is handed over with illustrations in which poverty prevention accompanies ES than reduction [20,24]. To assure a balanced perception, we should know the complex link between climate change, ES, and livelihood. Human Ecological Approach (HEA), social tendencies of their climate and the ecosystem [25]. It is perhaps suitable to understand ES as stopping genuine poverty. To develop our idea of the relationships between ES and poverty alleviation. In char land susceptibility to climate change is non-vital causes (endemic poverty, famine, excessive prevalence of infection, chronic conflicts, low levels of outcome, and low adaptive facility) the most defenseless sectors are agriculture, biodiversity, water, health, forests, and energy [26]. The United Nations Intergovernmental Panel on Climate Change [27] has expressed the prospect of a variation in the type and system of wetland ecosystems because of temperature and moisture variability. These variations will have consequences for subsistence because ~80% of rural households rest on wetland supports [28]. The study seeks to store some of this gap and is based on the analysis got out in such minor people in the char land of the study area. It documents and analyses a) identifies the ecosystem services in char land; b) assesses the commercial values of used provisioning services of char land ecosystem services, and c) char dwellers' dependency on that ES in the northern regions of Bangladesh.

2 MATERIALS AND METHODS

2.1 Study Area

The range between 25° 54' to 55.08 North latitude and 89° 27' to 0.00 East longitude, 25°39' to 50.04' North latitude, and 89° 37' to 59.88' East longitude and 25°06' to 25°23' north latitudes and 89°34' to 89°46' east longitudes Lalmonirhat Sadar, Ulipur and Fulcher (Figure 1). Major rivers: Darla, Trista, Bengali, Brahmaputra, Dud Kumar, Fulkumar, Sonabhari, Gigira, Gangadhar, Halhalia, Jamuna, Karo Toya, Ghaghat, etc. According to the Department of Agriculture Extension (DAE), there are (127+300+91) = 518 chars and 74,391-hectares area. Overall (1100+1070+1058) = 3228 people in South Shivkuthir, Char Bazra, and Char Tangrakandy are in Lalmonirhat, Kurigram, and Gaibandha. The char land/area preferred conforming to community intensity, area coverage, crop management capacity, vehicle facility, and Govt., Non-govt, and alternative action opportunities.
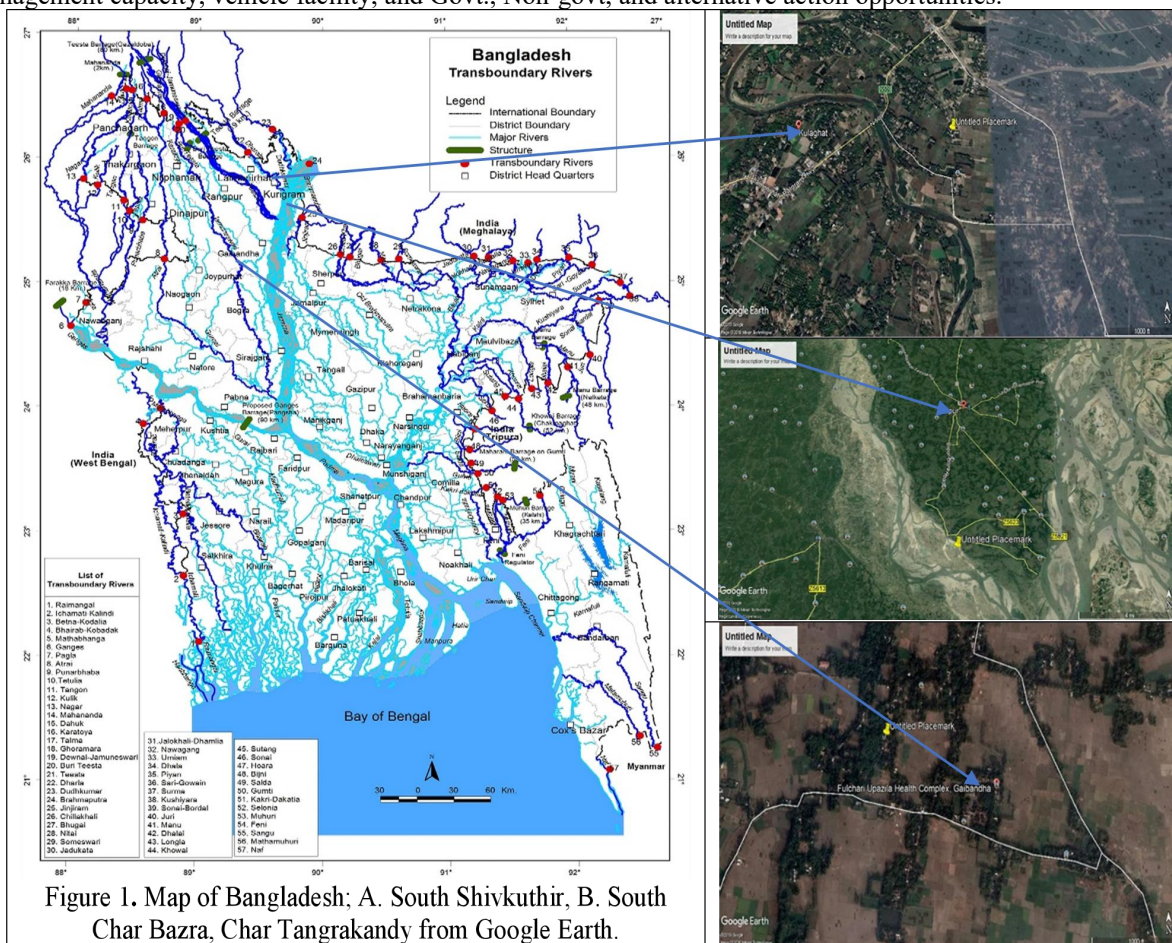

Figure 1. Map of Bangladesh; A. South Shivkuthir, B. South Char Bazra, Char Tangrakandy from Google Earth.

Figure 1 Map of Bangladesh; A. South Shivkuthir, B. South Char Bazra, Char Tangrakandy from Google Earth

2.2 Methods

A total of 320 household questionnaire interviews were attended to count the total char land goods consumed by households, 5 (five) focus group discussions, key informant interviews, and opinions operated with specific char land capital users to engender messages on the used and linked cost of the source under valuation. We too lead the discussed fisher association to accept the market price of special species of fish and alternative local markets for wild food/fruits. A list of ecosystem services was noticed, so the list developed agreeing to their benefit and attention. The listed ecosystem services are next classified into provisioning, regulation, cultural, and supporting services attending the Millennium Ecosystem Assessment Framework [9]. The market price approach applies to evaluate the direct benefits costs (fish, food, and raw materials) by determining the price in financial markets. And also measure char dwellers' dependency on provisioning services.

A household survey in a formed questionnaire, key informant interviews, and focus group discussions was conducted to collect the primary data. The data were collected from August 2019 to May 2020 and June 2022.

2.3 Economic Value of Provisioning Ecosystem Services

The economic values of used ecosystem services of char land ecosystem services were calculated by de Groot et al.[23].
Economic Value of ES = Quantity of ES per unit time*average market price (provisioning services) ----Eq (1)
This is an ongoing test in ecosystem services valuation, yet even a portion of the current valuation techniques as avoided and replacement cost is not subject to an individual impression of significant worth. For instance, assessing the tempest assurance worth of waterfront wetlands requires data on chronicled harm, storm tracks and likelihood, wetland region and area, fabricated framework area, populace dissemination, and so forth [29].

2.4 Implications on Char Dwellers' Dependency

As the dependency on the implication of changes in provisioning services was estimated based on direct income sources, only provisioning services were considered for implication analysis. For analysis, we first divided the total number of households that were surveyed by the total listed number of provisioning services completed.

Dependence on provisioning service =

Total household's dependent on provisional services
_____

Total number of provisioning services   ----------------Eq (2)
This gave the number of households (Hhs) dependent on one provisional service. Then the obtained value (through Eq. 2) was multiplied by the total provisional services value for each land cover.

3 RESULTS AND DISCUSSION

3.1 Char Land Ecosystem Services

As soon as chars stabilize, people create settlements char. In the study area, all respondents mentioned that most of these people are victims of river breakage or are homeless and occupational farmers or fishers. It enriched the soil during the Monsoon, which makes it suitable for growing rice, watermelon, nuts, vegetables, and many crops. The grass on the chars provides land for cattle grazing. It noticed that 99% of char dwellers reared domestic animals on these grassy fields. Fishers go out to the rivers right next to the char to work. Upazila Livestock office reported that the newly formed grass-type plants such as Meadow Grass, Vetiver Grass, Sun Grass, Kans Grass, etc. were primarily growth time these plants make up a Grassland. For the valuation of ES, identification is the first activity. According to the questionnaire survey, a Key Informant Interview, and Focus group discussion, the char land ES were identified below in Table 1.

Table 1 Ecosystem Services were Identified in the Study Area

Ecosystem Services	Specific services
Provisioning (11)	Food (crops, fishes, NTFPs, etc.), water (irrational and native use, aquatic production), fuelwood, fodder, natural fertilizer source, livestock grazing, edible plants, genetic resources (resistance plant pathogens species (i.e. BT Brinjal), medicinal resources (natural medicines), ornamental resources (fish-tank and plants like water lily, water chestnut, etc.), Transport (dinghy).
Regulating (9)	Climate regulation, air purification, excessive events (e.g. flood protection), pollination, siltation control, water conduct, erosion prevention, soil formation/conservation, and biological control.
Cultural (5)	Educational, recreation & tourism/ecotourism, Spiritual & artistic inspiration, identity, bird watching.
Supporting (5)	Gravel sand extraction, hydroelectricity, diversity and nursery, nutrient cycling, gene pool protection.

Concerning the value and significance of ES The most significant ES, such as fish or goats, are purchased and sold in markets, while some ecosystem services, such as wildlife viewing or a view of the river, are not exchanged in marketplaces, according to 99 percent of respondents. People are unfamiliar with purchasing such things, according to 35% of respondents, thus they don't pay directly for many ES. It doesn't mean ecosystems or their services aren't valuable or can't be measured in dollars and cents (BDT) [30]. A variety of indicators of ESs changes are currently being used in management practices linked with ES delivery in various circumstances [31]. These methodologies are still rather limited in scope, with the quantity and types of services limited to the handful that are the easiest to quantify [32,33]. According to Table 2, provisioning ecosystem services were detailed and studied and Iran ranked the basis of the household status of the services showed their importance and dependence on char dwellers' livelihood.

Table 2 Detail List of Provisioning Ecosystem Services in the Study Area

Provisioning Services	Services/values	Item/Examples	Based on the need (%) of HHs	Ranking	Present status of the services
Food	Agricultural production, Direct use, and Marketable value	1. Cereals (Paddy, Maize, Kaun)	100	1	Increased output, but the extinction of some indigenous species
		2. Pulses (Masoor, Mug, etc.)	96	5	
		4. Fruits (Mango, banana, etc.)	85	16	
		5. Vegetables (pumpkin, barbate, etc.)	97	4	
		6. Spices (kaljira, coriander, ginger, onion, garlic, etc.)	87	14	
		7. Livestock (cattle, goats, etc.)	94	7	
		8. Poultry (chickens, docks, etc.)	86	15	
		9. Wood lot/bamboo lot/bamboo garden	92	9	
		10. Fisheries	98	3	
		11. Crab	79	22	
		12. Honey (Apis florae, Apis dorsata)	80	21	Increase
		13. Macrophytes (Eclipta alba, Lemna perpusilla Torr, etc.)	79	22	Decrease
Fodder		1. Oil Cake	90	11	Increase production
		2. Rice Straw			
		3. Maize Leaf			
		4. Pulses bran			
	Grass	5. Neppier, Jumboo, Gini, etc.			
Water	Direct use value but not porches in market	1. Domestic use	99	2	Groundwater table 93%
		2. Irrigational use			
		3. Aquatic production			Shallow tube wells 95%

					Surface Runoff (90%) and groundwater table (10%)
Natural medicines	Direct use value and porches in market	1. Neem oil & Leaf	91	10	Decrease
		2. Poison Katalin			
		3. Curry leaves			
		4. Basil			
		5. Basok			
Genetic resources	Option value	BT Brinjal	84	17	Decrease
Fiber		Jute	82	19	Decrease
Fuel	Direct use and Marketable value	1. Mustard	93	8	Loss of indigenous species
		2. Ground Nut			
		3. Sesame			
Ornamental resources species	Aquatic plants and Marketable value	1. Lotus	81	20	Decrease
		2. Pani singara			
Natural fertilizer source		Dhancha and	88	13	Decrease
		other leguminous plants			
Livestock grazing	Direct use and Marketable value	(49,421.08+3874.612+2564.954) ac =55860.646 ac in three Upazila respectively	89	12	Increase
Edible plants		Lettuce	83	18	Increase
		cucumber			
		Coriander			
Transport		Small boat	95	6	Main transport due to increased flooding.

3.2 Occupational Status

Most of the chars in the study area worked in with (main occupation). According to the survey, 60%, 20%, 12%, 5%, 2%, and 1% of the average char residents are engaged in agriculture, livestock, fishing, daily work, small businesses, and other occupations Figure 2. Roy *et al*., showed that 66% of farmers[34], 7% of agricultural wage workers, 4% of white-collar workers, 8% of businesses, and 15% of others more or less agreed with the study.
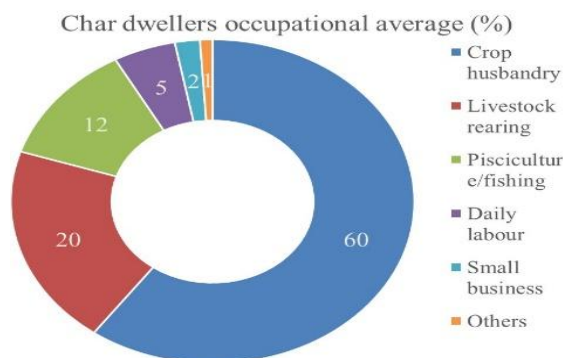
Figure 2 Char Dwellers Occupational Status

3.3 Economic Valuation of Used Provisioning Services of Char Land Ecosystem Services

Economists measure the worth of ecosystem services to individuals by estimating the amount of money they will pay to maintain or improve their services. In the survey section, we asked respondents about the evaluation and importance of ES. 99% of respondents are aware that major ecosystem services such as fish and timber are being bought and sold, and many ecosystem services such as wildlife discovery and river views are not traded in the market 35% of respondents don't pay for any ecosystem services because people are not accustomed to purchasing such products and their willingness to pay may not be clearly defined. Insist. Did it. However, this doesn't mean that the ecosystem or its services are of no worth or cannot be evaluated economically. Several environmental factors which will have an effect on ES are currently being measured to assess their utility as predictors and indicators of change. Although (the cultural importance of watercourse, and bird species), scenario-building approaches and new visualization tools have helped fill these gaps [35,36]. Farmers have an interest in growing vital crops such as rice, jute, potatoes, nuts, corn, cabbage, pepper, pumpkin, cabbage, beans, eggplant, cucumber, tomatoes, carrots, radish, and tobacco. Instead of growing traditional crops, Binadhan7, Aush, Skim (ACI2, BR3, BR8), Aman (Sarna, Guti Sarna, Sarna29, Sarna52, BR11, China). This cultivation practice is changing due to climate change [37].

Table 3 A List of Char Land Provisioning Services (Marketable Value)

Provisioning Services		Production year−1		Price/mon		Total Cost (BDT year−1)		HHs Remark of the services
		Present	20 years before	Present	20 years before	Present	20 years before	
Paddy	Rice	39664	28466.67	973.33	220	38800107	6565333	high demand but low purchasing market capacity
	Wheat	1033.33	1100	986.67	233.33	934666.67	226666.7	
	Maize	38400	6400	733.33	196.67	27053333	1403333	
	Kaun	408.33	750	1086.67	180	404000	157000	
Vegetables	Brinjal	1566.67	950	853.33	106.67	901333.33	119666.7	lack of awareness about vegetable production and lack of training
	Potato	400	366.67	693.33	146.67	276000	52666.67	
	Tomato	206.67	183.33	733.33	133.33	158666.67	18666.67	
	Cauliflower	350	180	760	156.67	274666.67	18666.67	
	Cabbage	283.33	169.67	600	2683.33	170000	25333.33	
	Gourd	715	500	600	46.67	331000	22666.67	
	Bean	475	383.33	666.67	146.67	305000	55333.33	
	Carrot	215	166.67	640	173.33	134000	13333.33	
	Radish	230	203.33	440	26.67	114666.67	6733.333	
	Pumpkin	566.67	250	666.67	60	333333.33	18000	
	As gourd	500	243.33	640	46.667	297333.33	15533.33	
	Bitter gourd	215	150	933.33	153.33	262666.67	11333.33	
	Pointed Gourd	240	156.67	1000	150	305333.33	11333.33	
	Cucumber	848.33	333.33	926.67	136.67	660400	41333.33	
	Barabati	275	140	800	120	245000	6400	
	ChiChinga	176.67	140	800	133.33	164000	6533.333	
Fuel	Mustard	350	433.33	1866.67	506.67	656666.67	255333.3	high demand but low cost, farmers are not interested to cultivate
	Ground Nut	131.67	86.67	3333.33	550	460666.67	30666.67	
	Sesame	109	100	4200	683.33	494666.67	46666.67	
Fiber	Jute	803.33	1400	500	583.33	401666.67	818333.3	
Fodder	Rice Straw	42733.3	30066.7	573.33	66.667	15533333	1506667	
	Maize Leaf	750	1066.67	246.67	56.667	87666.667	63333.33	low cost, Supply

Category	Indicator							Notes
	Grass (neppier, Jumboo, Gini etc.)	566.67	333.33	360	56.67	124000	20666.67	more than the demand
	Oil Cake	273.33	300	1533.3	520	441333.33	180000	
	Pulses bran	154.33	133.33	1306.67	256.67	199066.67	27333.33	
Aqua product	Shrimp	350	240	1526.67	896.67	535333.33	438666.7	high demand but species are becoming lost
	Fish	1944.67	1333.33	7333.33	1800	15184000	3600000	
Migratory birds		475	1333.33	4000	1306.67	1900000	813333.3	migratory birds are becoming less
Natural medicines	Neem oil & Leaf	80	-	5000	-	400000	-	low cost and high demand at present
	Poison Katali	80	80	1666.67	100	200000	8000	
	Curry leaves	80	80	1333.33	100	160000	8000	
	Basil	80	80	2666.67	200	320000	16000	
	Basok	58.33	80	30000	9000	3600000	720000	
Genetic resources	BT Brinjal	200	87.5	31600	4550	2476000	364750	future generations will be more hybridized
(If any more please listed)	Sunflower oil	70		1600		320000		high price and demand but lack of processing system

Table 4 A List of Char Land Provisioning Services (Non-marketable Value Present)

indicator	Area (ha) and or Unit value (BDT ha-1 y-1)	Total Value (BDT y-1)	Data source
Woodlands	5.25 ha. and 25/-	131.25 lack	
Grasslands	5.75 ha. and 95/-	546.75 lack	
Inland wetlands/riparian areas	15 ha. and 200/-	3000 lack	
Tropical rainforests area	N/A	N/A	
Flood-prone area (km2), number of impacted families and people, Flood-damaged crops (acres), and the number of flood-affected homes	140 ha, 2300 families, 11050 people, 380 ha, 4600 houses	N/A	
Damage due to river erosion (Number of families)	1300 families	N/A	
Temperature, Precipitation, Waterlogging/Flood, Erosion, availability of drinking water (groundwater depth), levels of Arsenic	10^0-30^0c, 1300mm, June-September (Monsoon), Specially during flooding, 30-40 ft, N/A	N/A	
Salinity Level (River) (Summer Season)	N/A	N/A	DAE
Agricultural Area, Forest Area (ha), Number of farmers	555ha, 25ha, 7265 farmers	N/A	
Area of Wetland (ha), wetland fish output in metric tons (t/y), pond area (ha), Pond-based fish production (t/y), Production of shrimp (t/y), the total number of fishermen, riverine environment (ha), Production of fish from the river (t/y)	355ha, 2700 metric tons (t)/y, 12ha, 180ha, 0.35(t)/y, 3010 fishermen, 300ha, 3200(t/y)		
Area of the canal (km2)	15 km	N/A	
Roads	Solid, Kasha and Sandy	N/A	
sluice gates	3	N/A	
The number of healthcare and educational facilities	4	N/A	
Household structure	Tin-shade	N/A	

Table 3 showed provisioning services' marketable value (before 20 years and present) and Table 4 non-marketable value present status according to UAE, UFO, and ULO Department of Agricultural Extension (DAE), Department of Fisheries (DoF), and Department of Livestock (DoL) in Fulcharri, Ulipur, and Lalmonirhat Sadar.

3.4 Implications on Char Dwellers' Dependency

For agricultural production, fish and water, raw materials, genetic and medicinal resources, etc. provisioning services values were estimated by Eq (1), Table 3. total cost (BDT year−1), and Table 4. total value (BDT y-1) 115639907 BDT. According to Eq (2) dependence on provisioning services value (2020 and 2000) difference 2848675776.1 BDT. The total value is 2916478776.1 BDT which is 0.05% of the total budgetary for the 2020-21 financial year of the people's republic of Bangladesh.

Table 5 A List of Char Land Provisioning Services Valuation

Item	Equation	Value BDT	Total value BDT	Reference
According to Eq (1) Total Economic Value (TEV) of provisioning Services	(Production year−1* Price/mon)	115639907	Difference between (value 2020-value 2000) = (3363964894.63 - 515289118.53.47) **2848675776.1**= Total (Marketable + Non-marketable Value) 2848675776.1+ 67803000=**2916478776.1**	(Chaudhary, Chettri, Uddin *et al.*)[38].
According to Eq (2) dependence on provisioning services value (2020)	Total household's dependent on provisional services/Total number of provisioning services	(320/11) = (29.09* 115639907) =3363964894.63		
According to Eq (2) dependence on provisioning services value (2000)		(320/11) = (29.09* 17713617) = 515289118.53.47		

3.5 Ecosystem Services and Their Ranking

Through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs), a total of 30 ecosystem services were discovered in the 3-char region. Table 1 was completed by char dwellers, provisioning (11), regulating (9), cultural (5), and supporting (5) are all important. Provisioning services were at the top of the list, followed by regulatory, cultural, and supporting services. During the talks, the provisioning services were further graded based on their use and preferences. Cereal crops were placed first assuming that every family consumed their main meal. Water (domestic, irrigation, and aquatic usage) was placed second, with 99 percent of families assuming it. Vegetables were ranked third, with 97 percent of households assuming it. Because tiny boats let people communicate during floods, transportation put fifth on the list, assuming 95 percent of homes. Table 2 shows the details of the services ranked and their utilization percentage.

3.6 Dependency on Ecosystem Services

About 95 percent of the total families identified using Eq. (1) get their income directly from the char area's provisioning services. The combination of main and secondary revenues was found to be 14 sources of family income in a study of 320 households. The principal source of agricultural revenue contributed significantly a Mean±SD 45.35±8.65currently and 37.30±7.42 15 years ago, T-value is 13.971 where P-value was 0.001**. The primary source of non-agriculture income contributed a Mean±SD 27.55±5.90 currently and 18.29±2.89 15 years ago, T-value is 28.497 where P-value 0.001** total yearly household income in the char area. Food security currently Mean±SD 36.28±6.14 and 15 years ago 28.79±3.63, T-value 21.225 where P-value 0.001**. Satisfaction currently Mean±SD 26.74±7.26 and at 15 years ago 16.88±3.22, T-value is 24.629 where P-value 0.001**.

3.7 Impacts on Ecosystem Services

It's a great natural gift by God that" Sedimentation" in northern char area. In Table 3 paddy, vegetables, fuel, fiber, fodder, and natural medicines have high demand, low purchasing market capacity, lack of awareness about vegetable production and lack of training, high demand but low cost, farmers are not interested to cultivate, low cost, supply more than the demand, low cost and high demand at present, respectively. Aqua products migratory birds and genetic resources have high demand, species are becoming lost, migratory birds are becoming less, and the future generation will become more hybridized, respectively. The services from char land declined by about 90%, and 57 percent reported services from the river to be the highest service providers Table 4. This implies that important provisioning services, including food, fodder, water, medicinal plants, genetic resources, fiber, fuel, decorative resource species, and natural fertilizer supplies have all decreased dramatically. Grazing cattle, food plants, and transportation were also affected. As the top service provider, particularly in erosion management, water purification, and species habitat, all of which were declining. Grasslands have increased in terms of grass, thatch, litter, and species habitat Table 5.

3.8 Impacts on Dependency

A decrease in provisioning services influences reliance. The loss in char land ecosystem services hit 97 percent of households, whereas the decline in agricultural (crop husbandry, livestock rearing, fishing) services touched 92 percent. Figure 3. Environmentally, most households have reduced their reliance on provisioning services over the last fifteen years, despite the high value in money (BDT) Table 5. So, the northern char dwellers becoming migrated to Dhaka or any industrial city for their livelihoods.

4 CONCLUSIONS

Study shows that the dramatic change in the previous two decades, particularly the reduction in agriculture as the top service provider, is a major source of concern for biodiversity and people who rely on char land. Because of the drop-in ecosystem services, households reported a fall in their reliance. Even fundamental material necessities for local well-being, such as food, fuelwood, and so on, have been shown to have dramatically decreased. The local economy and people's well-being have deteriorated. It might further reduce the local population's adaptive potential, making them more susceptible and keeping them in poverty. Community institutions such as buffer zone management committees or youth groups might work with government and non-government organizations to promote awareness and promote renewable energy schemes with renewable power. Promoting agroforestry may reduce dependence on firewood and grasses, while individual fishing communities may minimize river fishing. More significantly, alternative livelihoods should be promoted through interventions.

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COMPETING INTERESTS

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