

“The Sundarbans is our mind”: An exploration into multiple values of nature in conversation with traditional resource users

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Abstract

This study captures and depicts the understanding on multiple values of nature (MVN) by traditional resource users (TRUs) of the Sundarbans. The research, using multiple evidence-based approaches, combining participatory insights of the TRUs of the Sundarbans and interdisciplinary heterodox perspectives, demonstrates that valuation of environmental resources through market penetration pricing does not reckon the social benefits and values coproduced through complementarity between humans and nature. The TRUs of the Sundarbans treat the forest as their mind, through which human-nature sociality flourishes. The traditional knowledge system can significantly contribute to the sustainable management of biodiversity resources, both within the protected areas system and potentially within other effective area-based conservation measures, if given a chance and supported by governmental and non-governmental agencies. Moreover, TRUs argue that due to lack of a proper market structure and equal distribution of power, rents are dissipated through market pricing, going into the pockets of the rent-seeking powerful class. This rent-seeking behaviour induces unproductive, expropriating activities that bring positive returns to the individual but not to society. Dividing the transformational pathways into three phases – stabilization, transformation and sustainability – this chapter argues that such processes require appropriation of nature, as opposed to expropriation, for harmony of nature with people.

Keywords: Interdisciplinary Valuation, Multiple Evidence-based Approach, Traditional Resource Users, Indigenous and Local Knowledge, Human Sociality, the Sundarbans

Country	Bangladesh
Province	
District	Khulna, Satkhira and Bagerhat
Size of geographical area	6,071 km ²
Number of indirect beneficiaries	3.5 million
Dominant ethnicity	Bengali

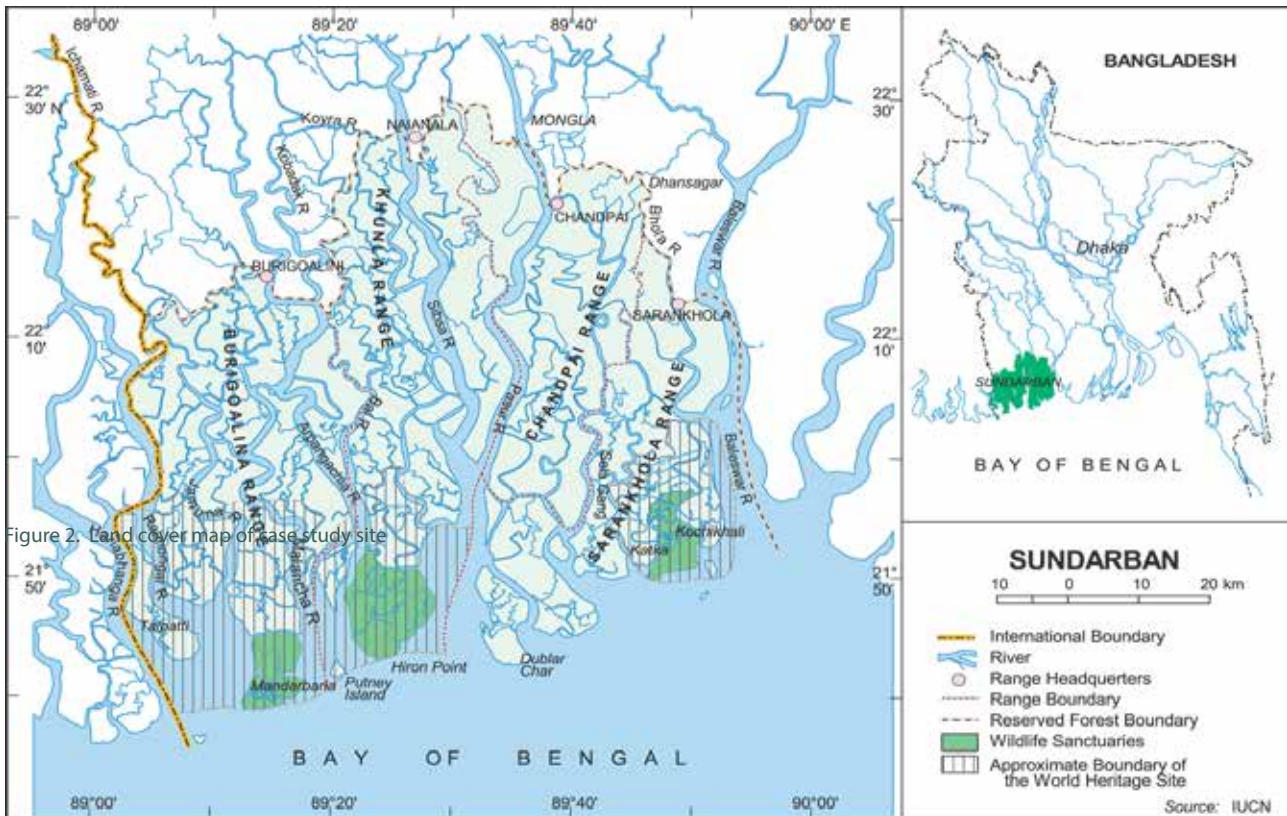


Figure 2. Land cover map of case study site

Figure 1. Map of the country and case study region, the Sundarbans

Size of case study/project area	1,775 km ²
Number of direct beneficiaries	350 persons
Geographic coordinates (longitude and latitude)	21°30' and 22°30' N and 89°00' and 89°55' E
Dominant ethnicity	Bengali



Figure 2. Land cover map of case study site (Source: Google Maps)

1. Introduction

This is an investigation into understanding the multiple values of nature (MVN) perceived by traditional resource users (TRUs) of the Sundarbans (see Fig. 1 and 2). The TRUs pursue their livelihoods as *Bawalis* (wood collectors), *Jele* (fishermen), *Mouals* (honey collectors), *Chunari* (shell collectors) and crab collectors. This study particularly draws on the traditional knowledge of the forest people of three cooperatives that the research institute Unnayan Onneshan helped set up— *Harinagar Bonojibi Bohumukhi Unnayan Samity* (Harinagar Forest People Multipurpose Development Cooperative), *Koyra Bonojibi Bohumukhi Unnayan Samity* (Koyra Forest People Multipurpose Development Cooperative) and *Munda Adivasi Bonojibi Bohumukhi Unnayan Samity* (Munda Indigenous Forest People Multipurpose Development Cooperative). A significant amount of data has been collected from the members of these three cooperatives through participatory observations, key informant interviews and focus group discussions for gathering Indigenous and Local Knowledge (ILK). This study has also used the data reservoir of the Unnayan Onneshan, which has undertaken several biodiversity conservation programs and conducted research on the Sundarbans. Moreover, evidence collected from the field has been comprehensively rechecked and cross-examined with the available relevant literature. Apart

from this, an attempt has also been made to explain the findings with analytical abstractions. Therefore, information has been verified based on multiple evidence. By using a multiple evidence-based approach, both scientific and traditional knowledge can be brought onto the same platform, striking a balance and creating a comprehensive and integrative understanding. Thus, attempts have been made to gather primary information from TRUs, as well as to collate corroborative evidence from the literature about pricing and valuation; rent, power and political settlement; and valuation, conservation and sustainable customary use of the resources.

The Sundarbans is the largest single-tract mangrove ecosystem of the world, enriched with high biodiversity. The combination of various types of ecosystems (forest, coastal and wetland) makes the Sundarbans home to uniquely adapted aquatic and terrestrial flora and fauna (see Fig.3). The Sundarbans was declared a Natural World Heritage Site (139,700 hectares of forest land comprising Sundarbans East, Sundarbans West and Sundarbans South) in 1997 by UNESCO and as a Ramsar Site of international importance in 1992 (IUCN Bangladesh 2014). It has also been listed for the selection of seven wonders of the world. It is located at the great delta of the Ganges, Brahmaputra and Meghna (GBM) rivers at the edge of the Bay of Bengal. With majestic beauty, tranquility and wilderness of nature, it is a hotspot

of biodiversity. It harbors 334 species of trees, shrubs, herbs and epiphytes and about 400 species of wild animals (Behera & Haider 2012). Of the 50 true mangrove plant species recorded throughout the globe, the Sundarbans alone contain 35 species (Rahman & Asaduzzaman 2010). It is also rich in its faunal diversity with 448 species of vertebrates including 10 amphibians, 58 reptiles, 339 birds and 41 mammals (DoE 2015).

The resources of the Sundarbans have been declining gradually (Iftekhar & Islam 2004; Gopal & Chauhan 2006; Giri et al. 2007, 2015; Rahman, Rahman & Islam 2010; Rahman & Asaduzzaman 2010; Uddin et al. 2013; Aziz & Paul 2015; Sarker et al. 2016). The forest structure is becoming simpler and the average height of the trees is decreasing, causing a decline in habitats for birds, monkeys and other tree-dwelling species. This globally important ecosystem is now vulnerable due to anthropogenic pressures amidst fragile institutions and an ineffective command-driven governance system (Titumir & Afrin 2018).

The traditional knowledge system can significantly contribute to the sustainable management of biodiversity of resources, both within the protected areas system and potentially as other effective area-based conservation measures (OECMs), if it is given a chance and is supported by governmental and non-governmental agencies (Titumir & Afrin 2018).

The value of nature can be understood from multiple angles, beyond monetary valuation, as emphasised by the

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Thus, conceptualizing values considers a “plurality of worldviews” of nature since people differ in how they understand the word “value” and in how they attribute importance to nature (González-Jimenez et al. 2018). Likewise, there are different scientific concepts of value—intrinsic, instrumental and relational values, which cannot be conceptualized solely through a market-pricing mechanism. As these values are subject to experience-based and/or traditional forms of knowledge, exploring human-nature relationships from different angles, operating with specific paradigms and methodologies, is regarded as a crucial way of valuing nature (González-Jimenez et al. 2018). Thus, IPBES places emphasis on multiple values and how they change across individuals, contexts and scales (González-Jimenez et al. 2018). As such, IPBES advocates for an accumulated approach that takes into account real world experience and the needs of local decision-makers (eds. Barton & Harrison 2017). The ultimate purpose is to integrate local level knowledge platforms into mainstream policy tracks to value natural ecosystems on multiple grounds.

Breaking down natural resources into commodities, mainstream economics considers the value of nature in monetary terms. Thus, natural resources are understood under this framework as valuable assets that yield flows of services to people (Freeman III, Herriges & Kling 2014). The valuing of nature in this way largely ignores the intrinsic value of the resources, and in this process the resources are regarded as extractable as much as possible for the benefit



Figure 3. Mangroves in the Sundarbans (Photo: Unnayan Onneshan)

of human beings, leading to the destruction of the resources. Moreover, neo-classical economics regards environmental pollution and natural resource degradation in terms of "market failure" and argues that a distorted market cannot ensure efficient allocation of natural resources. For efficient allocation of natural resources, the market of environmental goods and services has emerged, which entails that the market has the power to allocate environmental resources efficiently and in a socially optimal way by initiating corrective measures like taxes and subsidies which require the intervention of a regulatory or government agency (Beder 2011). Thus, mainstream economics argues for market-based mechanisms on the one hand, while it proposes some solutions through government interventions on the other.

New institutional economics, modifying market centrism with some new explanations, argues that the overuse of natural resources occurs due to lack of well-defined property rights. As a result, resources become readily available too cheaply to their current users, which forces the degradation of the resources. The argument is that when property rights are clearly defined, compensations change hands according to which party holds the natural resource, ensuring an efficient degree of economic activity. Though this school of thought emphasizes formal institutional arrangements, it focuses less on informal institutions like social norms, values and customs, which are also crucial for resource conservation and management.

Nevertheless, market-centric approaches fail to understand the dynamic nature of the problem and offer solutions that ignore political-economic factors such as power, political settlement and social order, and as a result, the solutions are found to be failing in addressing the problems. These approaches see the crisis of nature or environment as a technical problem that can be fixed within market-based mechanisms and technological innovations (Clark & York 2012). Accordingly, it ignores the issues of equitable distribution, intergenerational effects and the sustainability of resources. Moreover, in determining the optimal management of natural resources, such approaches neglect humans and their behavior (Fulton et al. 2011).

The political economy approach, which is adopted here, helps deal with the impact of power structures and power relations on the usage, management and distribution patterns of natural resources and argues that an unequal distribution of power induces over-extraction and degradation of natural resources. The political economy approach, in fact, does not explicitly discuss the problem of natural resource degradation, rather it offers guidelines to scrutinize the problem by incorporating some major factors that help explain how the resources are being accumulated

for personal gains under the capitalist market economy. Nevertheless, integrating human behavior into the formal model of natural resource management is still a major challenge (Janssen & Jager 2000; Fulton et al. 2011; Milner-Gulland 2012; Schlüter et al. 2012).

Against the backdrop of valuation by IPBES and critique of different market-centric approaches, this study attempts to discover how TRUs value the Sundarbans using multiple evidence-based approaches, guided by political economy. It has been demonstrated that market pricing does not reflect the true values of the Sundarbans. Moreover, due to lack of proper market structure and equal distribution of power, rent through market pricing gets dissipated, going into the pockets of the rent-seeking powerful class. This rent-seeking behaviour induces unproductive, expropriating activities that bring positive returns to the individuals but not to society. Thus, it has been argued that, for the conservation and sustainable use of the resources of the Sundarbans, traditional customary knowledge of the TRUs and their way of valuation should be brought under consideration.

2. "The Sundarbans is our mind": an alternative conceptualization of values by the TRUs

The conceptualization of values by the TRUs goes beyond orthodox market-centric price-based mechanisms—they value the Sundarbans as their "mind". As "mind" involves various states of action and every state of mind is determined by matter, the Sundarbans have created an orientation in which they serve as the "mind" of the people. This orientation encompasses the people's existence, their social harmony, the breeding of their offspring, natural safety and security. Human beings are dependent on the Sundarbans. They have come in touch with the services provided by this forest which amalgamate plentiful values, including both use values and non-use values.

The TRUs cite numerous examples of direct, indirect and option use values. For example, the direct use value includes supplies, such as food, fuel, and water, while indirect use value incorporates the likes of climate regulation, cyclone protection, erosion control and option values such as research, education and aesthetics. The non-use values, according to them, are bequest and existence values. For example, the bequest value includes the Sundarbans as cultural heritage and historical legacy, with biodiversity and habitat among the existence values. These values not only ensure their present existence and the interlinked harmonious relationship between forest and people, but also assure goods and services for future generations (see Fig. 4).

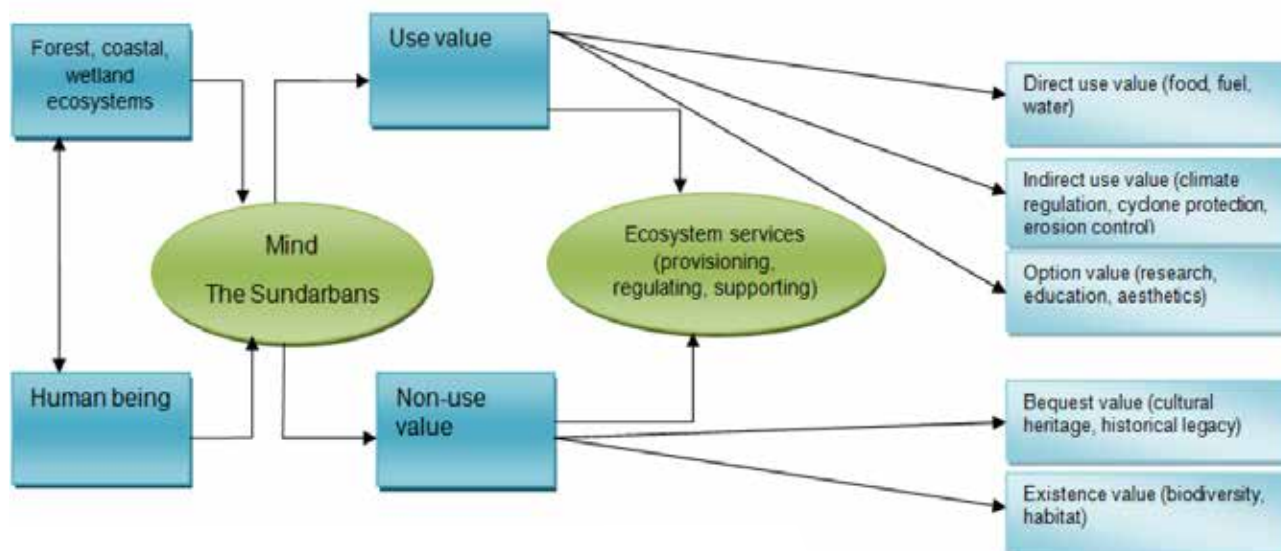


Figure 4. The Sundarbans as the “mind” of the people (Photo: Prepared by the authors)

This age-old relationship has taken different shapes through different passages. Local forest people use traditional knowledge to conserve the forest. It is not about any deliberate attempt to save the forest, rather it comes from the mind instinctively through human-nature sociality¹.

3. Multiple values of nature: Reflections from the field

According to TRUs, the services received by humans from the Sundarbans have innumerable types of value (Table 1). Not all of these values can be calculated by market-centric approaches. During focus group discussions (FGDs), they also argue that high prices derived from marketization of the natural resources causes over-extraction of the resources, which is seriously damaging the ecosystems of the Sundarbans. Instead of market-based valuation, the TRUs value the Sundarbans based on their age-old relationships with the forest.

3.1 The TRUs’ perspective

All of the study participant argue that prices of the resources in the market are getting high. For this reason, it has become profitable to collect the resources of the Sundarbans. So marketizing the resources is leading to the vast intrusion of people from outside, who do not care about the conservation and sustainability of the resources. Omar Ali,

one of the respondents, sums up: “Since the market price of resources has increased, the number of resource collectors is also increasing. Now they are coming from outside areas and extracting as many resources as they can. As a result, the forest is losing its resources.”

The TRUs have abided by customary sustainable use practices in the Sundarbans area over the ages. The way they collect resources and value nature is significantly different from the people outside this area and from the mainstream valuation perspective. Anju Ara, a female respondent, quips, “Sundarbans not only gives us various valuable resources, but also it is our intimate relative, our life. We cannot survive a single day without the existence of this forest.”— which reiterates the perpetual human-nature relationship and sociality.

The respondents believe that valuation to the TRUs is equal to life. They consider the Sundarbans as part of their day-to-day life, which directly contradicts the mainstream market-centric approach of valuation. Based upon the FGDs, services and values have been summarized in Table 1.

The resources are valuable to the forest people in various ways. Different parts of flora and different types of fish (and different sizes of same kind) are used by the local people for various purposes (Table 2). This elucidates that forest resources are more valuable to the local people than commodification alone entails.

Table 1. Services from the Sundarbans (Source: Prepared by the authors)

Services	Example	Value type
Food	Fish, shrimp, prawns, shells, honey, salt, crabs, fruits.	Direct use value ²
Water	Transportation	Direct use value
Raw materials	Algae, sand, seaweed	Direct use value
Medicinal resources	Cortex of <i>Poshur</i> (<i>X. mekongensis</i>), <i>Hargoza</i> (<i>Acanthus ilicifolius</i>), fruits of <i>Sundori</i> (<i>Heritiera fomes</i>)	Direct use value
Ornamental resources	Shells	Direct use value
Air purification	Removing toxic elements like SO ₂ , CO ₂ to reduce air pollution	Indirect use value ³
Protection from disasters	Protection from storms, floods, tsunami, etc.	Indirect use value
Nutrient cycling	Mineralization of nitrogen and phosphorus by fish through excretion	Indirect use value
Biological control	Ecological balance through maintaining population of wildlife	Indirect use value
Life cycle maintenance	Reproduction of various species of flora and fauna	Indirect use value
Pollination and seed dispersal	Seed dispersal by aquatic animals, water, air and insects	Indirect use value
Habitat	Spawning and nursery grounds for various species of flora, fauna and organisms	Existence value ⁴
Hydrological cycle	Movement and storage of water	Indirect use value
Recreation and leisure	Nature watching, sailing, recreational fishing, etc.	Direct use value
Aesthetic services	Seascape, landscape, abundance of beautiful biodiversity, etc.	Option value ⁵
Cultural heritage and identity	Contribution of the Sundarbans to certain cultural traditions, e.g. different songs, dance, rituals, etc. of local community	Bequest value
Future generation possible use	All goods and services which can be used by future generations	Bequest value ⁶
Right of existence	Flora, fauna and organisms that cannot be used but their existence is important to the forest and to the people	Existence value

Table 2. Usage of different parts of flora (Source: Prepared by the authors)

Name of part	Usage/importance
Flower	Honey, fruit, seeds
Fruit	Reproduction of trees, food for birds and animals, food item for human beings, such as pickles from <i>Keora</i> (<i>Sonneratia apetala</i>) fruit
Leaf	Fallen leaves increase the fertility of the forest land, herbal usage, e.g. leaf of <i>Hargoza</i>
Root	Prevents soil erosion
Branch	Holds leaves to provide shadow
Cortex	Used as herbal medicine, e.g. cortex of <i>Poshur</i> works against dysentery
Wood	Making of furniture, boats, pillars of houses, etc.
Others	Fishes hatch on the roots of the forest trees. Thus, trees help breeding of various species of fish

Table 3. Amount of major resources and respective revenue earnings from the Sundarbans during 2001-2002 and 2014-2015 (Source: DoF 2015 cited in Islam & Hossain 2017)

Types of ecosystem service		2001-02		2014-15	
Provisioning	Produces (unit)	Amount	Revenue (in USD)	Amount	Revenue (in USD)
	<i>Excoecaria Agallocha (Gewa)</i> (ft ³)	84,630	33,187	6,026	3,894
	<i>Ceriops Decandra (Goran)</i> (no.)	15,865 (MT)	47,742	118,451 (no.)	7,520
	Thatching material <i>Nypafruticans (Golpata)</i> (MT)	17,525	33,123	16,868	57,338
	Thatching material grass (MT)	3,621	790	668	225
	<i>Phoenix Paludosa</i> (Hantal)	543 (MT)	348	19,761 (no.)	1,044
	Fuel wood (ft ³)	69,370	47,523	14,455	10,190
	Honey (MT)	84	7,970	67	24,048
	Wax (MT)	23	1,665	63	8,108
	Fish (MT)	2,061	58,374	3,432	158,368
	Crab (MT)	123	2,148	1,123	52,026
	Dry fish (MT)	1,095	18,998	2,773	179,761
Cultural	Tourist (no.)	59,169	14,588	100,817	144,832

3.2 Corroborative evidence

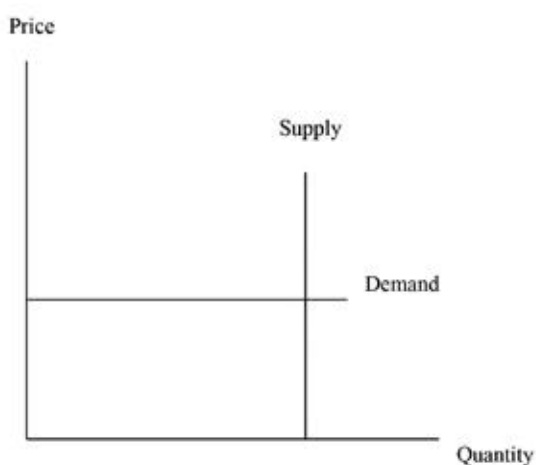
Over extraction of resources has created serious threat to the conservation of the biodiversity resources. Therefore, present resource extraction as well as revenue earning is at stake, leading to overvaluation of the current resources by powerful syndicate.

It becomes visible that extraction of most forest resources has increased over the years (Table 3). As a result, producer surplus of the forest has reduced. On the other hand, the government is losing revenue due to over-extraction by

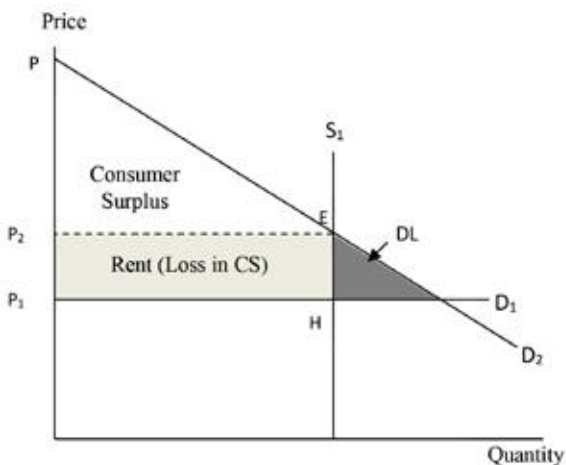
powerful groups who are grabbing the resources and selling them in the market at high prices. Thus, consumers are also facing losses in their accounts. As a result, benefits for the local forest people are decreased.

3.3 Analytical abstraction

When non-marketable goods are transformed into marketable goods, it creates rent and deadweight loss. This valuation through pricing mechanisms results in higher prices, loss of consumer surplus, loss in growth and loss in the endowment of the resources (i.e. the producer surplus).



Panel A: The nature of DD and SS



Panel B: When resources are marketable goods

Figure 5. Price effect if natural resources are turned into marketable goods (Source: Titumir, Afrin & Islam, n.d.)

Figure 5 (in Panel A) explains the same as the reality of the natural resources markets. The x-axis in horizontal line indicates price, where y-axis in vertical line indicates quantity. Initially, at a very low level of price or sometimes with no price, the demand for natural resources is infinite measured through a perfectly elastic demand curve. Simultaneously, the earth herself is endowed with a fixed amount of resources. There are some resources that have regenerative capacity, but are depleted when the harvest rate is greater than the regeneration rate. Consequently, the supply curve is perfectly inelastic.

Panel B of the same figure attempts to depict the price effect on natural resources if they are metamorphosed into marketable goods. When non-market goods transform into marketable goods, the positive demand curve will change and consumers get to interact with different prices. The changing demand curve produces some alternative distribution and sharing. Firstly, the new equilibrium point sets at E, spiralling up the prices from P_1 to P_2 . Consequently, the consumer surplus gets reduced from $PEHP_1$ to PEP_2 . Thus, loss of consumer surplus as rent is P_2EHP_1 . Another important change in distribution occurs if non-marketable goods transform into marketable goods. The change generates rent and deadweight loss (shaded area) due to higher demand and lack of supply, causing consumption

inefficiency. Consequentially, TRUs are losing their consumer surplus, the government is losing the share of revenue and the forest is losing its endowment of resources, whereas the powerful groups are getting the lion's share of the rent (Titumir, Afrin & Islam, n.d.).

3.4 Summary of multiple values based on IPBES guidelines

Local people conceive of values based on their day-to-day interrelations and interdependence with the Sundarbans. They often value the resources of the Sundarbans by what they get from them, both directly and indirectly, including both use value and non-use values of nature. For example, they use various flora and fauna, based on which the use values can be categorized but at the same time, they also acknowledge the non-use values of nature (Table 1). These non-use values include both bequest value and existence value, which can be sorted into intrinsic value as well as relational value (Table 4), i.e. cultural heritage, historical legacy, habitat, biodiversity, etc. On the other hand, instrumental value takes the form of indirect use value, e.g. climate regulation, cyclone protection and erosion control. Certain multiple values of nature as conceived by the TRUs (Table 1), therefore, are summarised in Table 4 as illustrations, using IPBES guidelines.

Table 4. An illustrative summary of the different meanings of value: collated from the TRUs of the Sundarbans, using IPBES guidelines (Source: Prepared by the authors)⁷

	Principles	Importance	Preferences	Measures	(Explanation)
Intrinsic	The right of the Royal Bengal Tiger to survive The survival right of the other floral and faunal species	National interest in maintaining the world's biggest cat as the world's charismatic mega-fauna and maintaining ecological balance to keep the ecosystem sustainable and resilient	Tigers are natural saviors of forest and the national symbol of Bangladesh Diverse species maintain ecological balance that conserves the ecosystem	Tiger Population Census, Narratives, Indigenous knowledge based testimonies, Oral history	Bequest value, Cultural heritage of myths and beliefs, Aesthetic value, World's largest mangrove forest, World Heritage site
Instrumental	Ecosystem-based disaster risk reduction and climate regulation, Cyclone protection	Contribution as natural fortress in reducing natural disasters and contribution of carbon sequestration to global stock	Interest in maintaining habitat and biodiversity of this diverse ecosystem	Quantitative, Narrative, Indigenous knowledge based testimonies, Oral History	Resist soil erosion, combat salinity intrusion and provide fresh air
Relational	Living in harmony with nature, Customary rights, Rights to self determination, Sustainability and resilience	Identifying TRUs as key to conservation and sustainable use of biodiversity for sustainability and resilience	Interest in maintaining these multiple ecosystems that provide different ecosystem services (provisioning, regulating and supporting)	Economic price based measures are inadequate and the following are to be explored: Narrative, Indigenous, Deliberations, Multiple evidence-based approaches	Provides livelihood services (food, water, fuel etc.), Identity and autonomy, Living well in harmony with nature, Spirituality of nature, Cohesion, Governance and justice



Figure 6. Sundarbans with complex network of tidal waterways (Photo: Unnayan Onneshan)

4. Valuation, conservation and sustainable use: indigenous and local knowledge and customary use

The consultations suggest that the rules and practices the TRUs follow help conserve the forest as ecological harmony remains unchanged and their socio-ecological life cycle thrives. They treat the resources of the Sundarbans as blessings and try to make sustainable use of them so that resources are not harmed. They have respective values, norms and behaviors which create conventions, restrictions, taboos and other socially-formed characteristics for using the Sundarbans.

4.1 The TRUs’ perspective

In terms of netting the fish, Habibur Rahman Gazi, a fisherman says, “We catch fish by rocket nets that do not kill the carp. Therefore, fishes are not being killed by the local people.” In conjunction with Gazi’s words, another fisherman says,

“Outsiders catch fish by using ‘Bainjal’ which kills most of the carps.” Like the fishermen, other TRUs also follow traditional norms, rules and practices to conserve the resources of the forest. Khalilur Rahman says, “Certain religious rituals are followed before going to the forest for honey and Golpata collection, like performing special prayers and collecting ‘tabij’ (amulets) so that tigers cannot harm them.” These norms, rules and practices come from their belief that the forest is the perpetual kin to the TRUs, and they tend to instinctively use the resources of the forest sustainably. Ambia Khatun, a TRU woman opines, “The Sundarbans is our life. If it dies, we will not be able to survive for a single day. You cannot buy life with money.” (see Fig.6)

Apart from the traditional norms, other rules by which TRU fishermen sustainably use forest resources are worth mentioning. To understand these more clearly, a comparison between the traditional rules followed by the TRUs and the practices of non-traditional users are provided in Table 5.

Table 5. Traditional rules vs. non-traditional practices followed by the fishermen of the Sundarbans (Source: Prepared by the authors)

Item	Traditional rules followed by TRUs	Practices of non-traditional users	Remarks
Spatial restrictions	Temporary closure of 1-2 weeks to get substantial amount of fish in certain areas which are abundant with more species of fish.	No spatial restrictions are followed; extraction of fish is performed constantly from all the water bodies.	Fishing opportunities are decreased and some important species of fish are getting reduced.
Temporal restrictions	Normally they do not go fishing on Friday. Also, some small period restrictions are imposed when necessary to get more fish.	No temporal restrictions are maintained.	Because of incessant fishing by outsiders, fish resources are getting fewer day by day.

Gear restrictions	They do not use fishing techniques which destroy the carp.	Detrimental nets like "bainjal", "chorjal" are used for fishing.	Because of the pernicious fishing techniques, larvae, carp and fish eggs are diminished.
Effort restrictions	There is mutually negotiated fishing opportunities using traditional nets like "chawrpata" and "khalpata".	No particular restriction over using techniques, spaces and who can use or not.	Outsiders are extracting as much fish as they can evading the rules and regulations.
Species restrictions	Restrictions are put in place during ovulation periods of certain species like "paissha", "dadne", "vetki" and other fishes.	During the use of nets like "chawrjal", "bainjal" and some foreign nets, fishes including carp get caught in the net.	Carp die which results in less fish in the canals, rivers and coastal areas.
Catch restrictions	Only consumable species of fish are caught.	Most species of fish are caught.	Natural biodiversity gets disrupted and harmed.
Water color	When the water gets reddish, they predict more Hilsha production in the coastal region. Amount of fish increases in turbid water. Number of fish decreases in polluted water.	Outsiders are mostly unaware of this idea.	Due to use of engine boats and trawlers by the outsiders, water gets polluted which kills many species of fish and hampers reproduction.
Water, wind direction and current	Fish increase during high tide. Wind from both southern and southeast directions indicates increase in amount of fish.	Non-traditional resource users do not follow this perspective. Many of them have learnt traditional rules recently.	More extraction of fish occurs as outsiders utilize the derived knowledge of the traditional fishermen.
Lunar periodicity	During a full moon the amount of fish increases. Hence it is wise to wait for the full moon to catch more fish.	They go fishing all the time irrespective of full moon and new moon.	More extraction occurs and carp get killed.
Sediment and topography	High amount of siltation is dangerous to the topography of the water bodies. They also detect type of mud using their fingers and can predict the best fishing sites.	Non-traditional forest users cut trees incessantly, which create more sedimentation.	Due to more sedimentation, marine and coastal ecosystems are disrupted and fishing sites decrease.
Traditional celestial navigation	They use traditional method of static (e.g. location of the site) information to calibrate the relative position of the fishing boat.	Non-traditional resource users mostly have wristwatches to get the direction of the fishing site.	Traditional method is more reliable because of years of experience in practice.
Birds	They consider birds like pigeons, egrets, common tern, and kingfishers as sacred. These birds also help them find suitable places for fishing.	No particular affiliation with any particular species of birds.	Birds are also killed by hunters which damages the biodiversity of the forest.
Fishing sites	They divide fishing sites based on different canals, e.g. "Bustamkhal", "Keora kata" and "Kodal kata".	They tend to go fishing where they can extract more fish.	Due to encroachment in almost every waterbody, traditional fishermen are getting deprived of fish more than before.
Netting the fish	They use "rocketjal", "berjal" mostly to catch fish.	They use "bainjal", "chawrpata" and some foreign nets to catch fish.	Because of nets used by outsiders, carps and larvae get caught and killed also, causing less fish reproduction.
Nets	The nets have medium to big holes which are mainly used to catch medium to big fish. Length of "berjal" varies from 4-5 meters to 90-100 meters and width is around 7-8 meters.	The nets they use are normally more than 100 meters long and have very tiny holes.	As the nets of the non-traditional users are dense with very tiny holes, carps and larvae get caught and killed.
Boats	They make boats using "sundori" mostly. The boats are traditionally called "dingi nouka".	Most of the non-traditional resource users use engine boats and trawlers made from different kinds of wood like "gewa", "goran" and "sundori".	As more outsiders come for fishing, they are using more engine boats, which are polluting the water and destroying the ecosystems of the fish.

Besides the fisherman, other TRUs also uphold traditional rules. When collecting honey from honeycombs, usually during the months of April, May and June, the *Mouals* (honey/wax collectors) usually cut a specific section (about two-thirds) of the honeycomb and leave the rest for reproduction. They also try to make sure that no young bees are killed while collecting honey and squeeze beehives by hand, never using metal tools. They revisit the colonies after a period of one month or more depending upon the size of the colony and the flowering conditions of nearby vegetation. When collecting the honey, the *Mouals* produce smoke using dry leaves but never put fire on a beehive. The *Bawalis* (wood collectors) leave at least one stem in each clump of trees after cutting. Once the *Bawalis* have harvested wood from a compartment, they will not use the same compartment for harvesting the following year, rather will harvest on a cyclical basis so that there is an adequate re-growth of plants. They usually cut wood where there is abundance. They do not cut young and straight trees.

According to the rules followed by *Golpata* (*Nypa fruticans*) harvesters, exploitation in any area is not allowed more than once a year and is not allowed during June to September specifically as it is the growing period of *Golpata*. They cut only leaves that are approximately nine feet long, and the leaves are cut in a way so that the central leaf and the leaf next to it in each clump are retained. They maintain the rule that the flowers and fruits shall in no way be disturbed when cutting leaves. They also maintain that young plants with only one utilizable leaf should not be cut (see Fig.7).

4.2 Corroborative evidence

Traditional knowledge is followed in conservation of natural resources in other countries as well. In Papua New

Guinea (PNG), the Solomon Islands, Vanuatu, and Fiji, there are examples of temporary reef closures before religious ceremonies (Polunin 1984) to replenish supplies of fish and invertebrate species (Hviding 1989; Aswani & Weiant 2004; Hickey 2006), after the death of a landowner or village chief (Wright 1985; Hickey 2006; Macintyre & Foale 2007), and after a marriage or birth (Ravuvu 1983). In Maluku, Indonesia, certain community leaders used customary management to ban cyanide fishing associated with the live reef food fish trade (Thornburn 2001). In some areas, particular groups have rights to specific fishing techniques, which are restricted for others (Carrier & Carrier 1983). Currently, coastal groups in the Roviana Lagoon, Solomon Islands, are not only excluding non-owners from using restricted technologies such as spear fishing at night, but they are also relentlessly demanding that inclusive stakeholders should not use these fishing methods (Aswani & Hamilton 2004). Also, there are restrictions on who can catch particular species of fish, which methods are to be followed and which areas allow for fishing (Cinner & Aswani 2007).

4.3 Analytical abstraction

The existence of interrelationships between human sociality and nature is the key to optimal usage and conservation of natural resources. In the following graph (see Fig. 8), the vertical axis measures the individual's preferences. On other hand, the horizontal axis measures welfare, as well as the cooperation and defection that depend on two different functions of the individual preferences. The graph explains the rational choice view versus social cooperation. At point A, the expected cooperation and the expected defection intersect, showing a lower level of welfare and a low level of individuals' consensus. Individuals as social beings belong to the web of ecological and social environment. Therefore,



Figure 7. TRUs in the Sundarbans collecting *Nypa fruticans* using their traditional knowledge (Photo: Unnayan Onneshan)

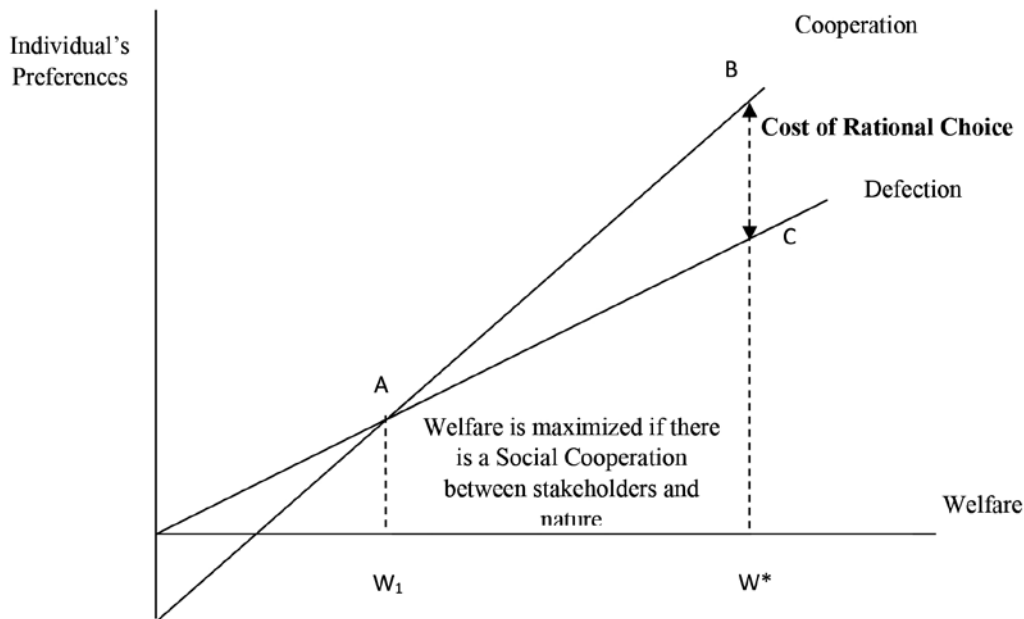


Figure 8. Rational choice vs. social cooperation (Source: Titumir, Afrin & Islam, n.d.)

ecosystem carries the function of individual social being as the process of reservation and reiteration. The graph shows that, as a social being in a particular ecosystem, the individual can enlarge its welfare at W^* , which is greater than point A. So, the total welfare generates the area of AW_1W^*B (Titumir, Afrin & Islam, n.d.).

The essence of this proposition is that social norms can organize the equitable benefit-sharing of the resources. The traditional evolution of norms and knowledge can efficiently manage the resource rent and the sustainability of resources. The power of sanction imposed by the stakeholders can informally organize the rights of resource consumption and accretion. Social norms are so powerful that social beings are ready to sacrifice to prolong the relationship between nature and human beings. The recognition of social norms and social ownership, thus, can sustainably manage natural resources and the equitable sharing of natural resource rents (Titumir, Afrin & Islam, n.d.).

4.4 Institutionalizing traditional knowledge and customary practices

The rights of the local communities of the Sundarbans are not clearly defined and acknowledged in Bangladesh. A few issues regarding the rights of the forest people are found in certain project circumstances.⁸ Likewise, project-based participation has little impact on the activities of government organizations. Thus, existing acts, policies and regulations provide few opportunities for local people to participate in the conservation process of the forest. According to the law, the state is entitled with the responsibility for the protection of the Sundarbans. The main responsibility to protect the

Sundarbans is incumbent on the forest department. But the people who are dependent on this forest are not entitled with any responsibility. Participation of TRUs, recognition of their knowledge and practices, and the well-defined rights of TRUs are considered to be crucial for management and conservation of the Sundarbans (see Table 6).

5. Rent, power and political settlement

The opinions of the TRUs demonstrate that there is a triangular-shaped power distribution among employees of the government agencies (e.g. forest department, law enforcement), (illegal) businesses, and politicians. These powerful groups dictate the pricing strategy of the resources and control the market structure through political settlement. Despite several rules, regulations and embargoes, they get extra privilege by giving bribes to the employees of the forest department and police. In some cases, they too also get involved in extraction of resources. TRUs have to get permission to access the forest (e.g. boat licenses, *Golpata* and honey collecting licenses). This process requires some amount of money, but the forest people also have to give an extra toll of money in the form of bribes to the forest department, which compels them to extract more resources from the forest. As a result, biodiversity reproduction is hampered and damage occurs to the ecosystem of the forest. On the other hand, even if powerful groups get caught by the forest people while violating any ban or rule, they immediately get released by giving extra amounts of money. Local forest people have mentioned such a group, known as the "black party", which extracts resources regularly, violating the laws. If anyone by any

Table 6. Institutional steps for resource management and appropriation (Source: Prepared by the authors)

Institutional steps	Present state	Suggestions
Participation of TRUs in policy making, management of ecosystem and conservation of biodiversity of the Sundarbans	Little scope of participation by TRUs	TRUs' practices, perspectives and participation are needed to yield better conservation outcomes and sustainable use of biodiversity Enacting laws and regulations to ensure the rights and empowerment of TRUs to practice their ILK in the conservation of the forest Engaging TRUs in co-management and conservation process
Recognition of traditional knowledge and practices in management and conservation of the forest	No/little recognition of traditional rules, norms, values and practices in existing management and conservation framework	Legally recognizing traditional rules, practices and values of TRUs Incorporating these in formal conservation and management strategies
Definition of rights of the TRUs in laws and regulations	Declining user rights of the TRUs in existing rules and regulations	Clearly defining the rights of the TRUs, not exclude them from forest resources but to ensure customary and sustainable use by TRUs

chance sees them violating the law, they capture the person and do not release him until their extraction is finished. Thus, rent dissipation and unequal distribution of power have created a clientelistic network through which extraction of resources occurs randomly in order to accumulate more rent. This state of affairs is highly responsible for the degradation of the ecological biodiversity of the Sundarbans.

5.1 Governance structure of the Sundarbans and signs of unsustainable resource extraction

The Sundarbans was declared a reserve forest in 1875. About 32,400 hectares of this forest have been designated as three wildlife sanctuaries. These wildlife sanctuaries were established in 1997 under the Bangladesh Wildlife Preservation Amendment Act, 1974. Afterwards, the Sundarbans was declared an Ecologically Critical Area (ECA) by the Department of Environment (DoE) of Bangladesh in 1999 under the Bangladesh Environment Conservation Act, 1995, which was amended in 2010. According to the Conservation Act of 2010, an Ecologically Critical Area refers to an area which is rich in unique biodiversity, or due to the importance of its environmental aspects, is necessary to protect or conserve from destructive activities. The ECA also falls within the category of natural and cultural heritage.

Despite the ECA designation, rules were not enforced and most importantly, the rights of inhabitants of the Sundarbans were equivocal and trifling for the most part. As a result, opportunist groups took advantage, engaging in over-exploitation of the resources of the forest. Problems arose including lack of participation of the TRUs in the conservation process, declination of user rights, lack of implementation of laws and rules, emergence of imposed development projects and also use of top-down approaches in the co-management process of the Sundarbans. As a

result, decisions are being made from a level of authority and are transmitted to the lower level without any substantial degree of discussion. Likewise, due to a lack of recognition of traditional knowledge and other kindred circumstances, the significance of the ECA designation has been smothered to a large extent. Recently, a coal-based electric power plant named *Rampal* is being constructed only 14 kilometers away from the Sundarbans ECA zone. Another electric power plant has been planned for construction only 10 kilometers away from the ECA area. According to the environment law of Bangladesh, establishing this kind of power plant within 10 kilometers of the ECA zone is strictly prohibited.

Despite objections and violations of the existing laws, industrialization is advancing on the periphery of the Sundarbans. Hence, it could be recapitulated that the legal and governance structure of the Sundarbans has been feckless and contradictory in terms of its implementation process. As a consequence, conservation strategy is being hampered while sustainability of the forest is at stake due to incessant exploitation by powerful groups and the ineffective role of the administration.

5.2 The TRUs' perspective

The respondents argue that their collection processes are not harmful to the conservation of the forest. As Abu Musa, one of the respondents argues, "TRUs usually collect resources keeping in the mind that if they cause any harm to the forest, they will be sufferer." However, after enactment of laws, rules and regulations, access to the forest has become restricted, and the powerful are extracting resources secretly by bribing the police and personnel of the forest department. Abu Musa further added, "As the powerful class is getting access to the forest bribing huge amounts of money, they are extracting as many resources as they can without caring about

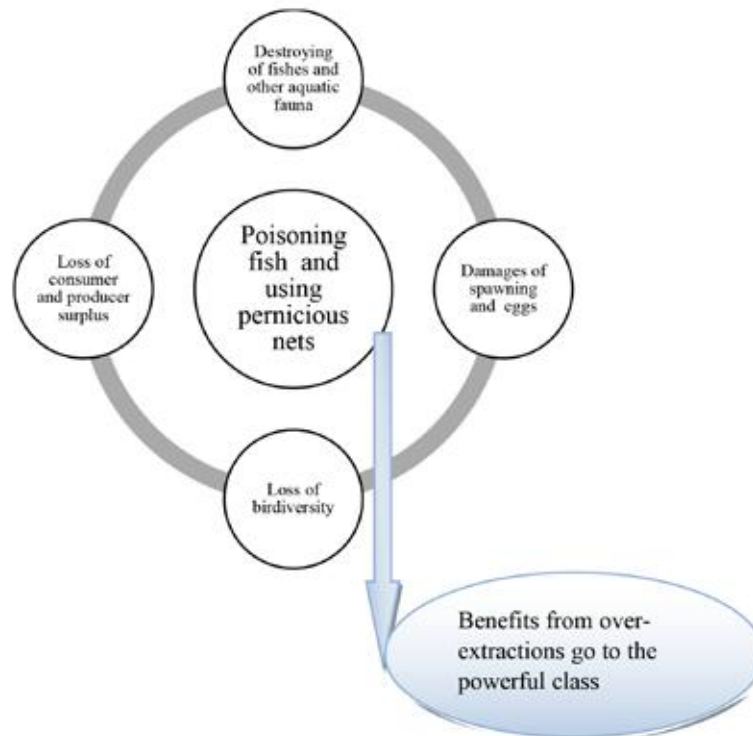


Figure 9. Effects of poisoning and use of prohibited nets for catching fish (Source: Prepared by the authors)

the survival of the forest. But TRUs are being deprived." Though clientelist groups are illegally extracting resources through unsustainable practices, the TRUs say, illegal activities go unpunished. Rather TRUs are being harassed, and they do not have any voice in decision-making processes of the forest management. Tanjila, a TRU woman says, "*They (forest department and other governance body) do not listen to us. They only pay heed to the opinion of the powerful class. We, the TRUs, are the victims*". During the FGDs it came forth that the rent-seeking groups who are powerful both politically and bureaucratically are using illegal means to extract resources. Moreover, a group of people are using poison and prohibited nets to extract more fish at a time, which not only destroys all kinds of fishes but also other aquatic species (see Fig. 9).

5.3 Corroborative evidence

A few studies show that the existence of organized groups of mongers who illegally cut and remove valuable trees are acutely prevalent in the Sundarbans (Rahman, Rahman & Islam 2010). The forest department allows illegal means of fishing by taking bribes from the fishermen (Hassan, Nabi & Mozumder 2012). Moreover, the existence of vertical relations in society and upward enforcement of rules enable the powerful groups to capture resources with impunity (Adhikari & Goldey 2010). Due to unequal distribution of power and wealth, conflict and discrimination among different stakeholders emerge (Hassan, Nabi & Mozumder 2012). Accordingly, biodiversity degradation not only occurs

due to the non-existence of markets, but also because of unequal power distribution among different groups. Thus, infiltration and illegal removal of valuable wood from the forest occurs due to the absence of sustainable management practices and well-functioning institutional arrangements (Rahman, Rahman & Islam 2010).

5.4 Analytical abstraction

The agents assert control over the potential rent under the extractive institutional arrangements that are historically prevailing, not only by the dominant goals of production, but also by the prevailing social relations and the scale of production, as well as relations of distribution and property regimes. Specifically, it can be said that in a developing economy, the likelihood of unstable property rights for natural resources is very high. A strong institutional arrangement can check the stability. Here, we try to visualize the way in which different agents behave in strategic ways under vulnerable institutional arrangements to further their own interest under a game theory approach, and which ultimately results in the destruction of natural resources.

To explain the phenomenon as well as the rational incentive to break the contract under weak institutional arrangements, the above graph (see Fig. 10) that depicts the prisoner's dilemma and the Nash equilibrium⁹, can be very useful. Here, the vertical axis measures the resource extraction by agent A, and the horizontal axis measures the resource extraction by agent B. Under mutual contract, both agents

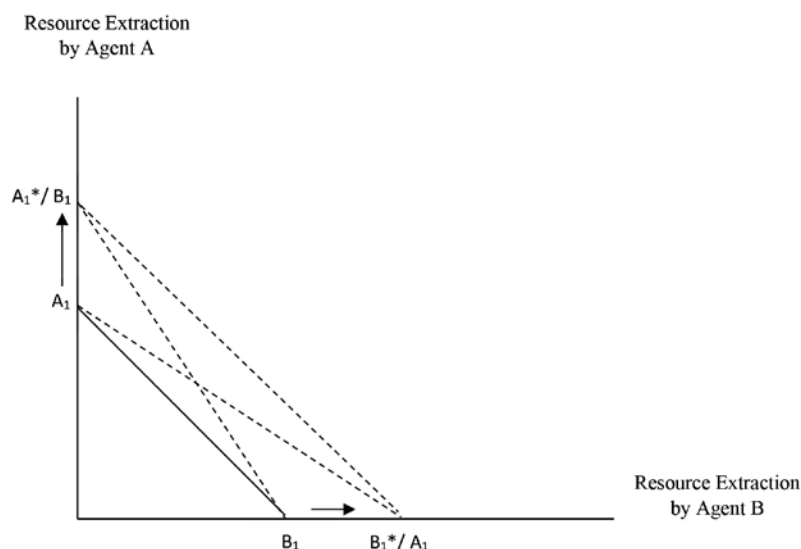


Figure 10. Institutional vulnerability and destruction of resources (Source: Titumir, Afrin & Islam, n.d.)

extract resources on the A_1B_1 line. The next scenario is that as a rational being, agent B can maximize his extraction if B thinks that by holding agent A constant he (B) can extract more resources as there is no one to monitor him. So, agent B will go for more extraction at B_1^* , and keeping the A_1 fixed is the symptom of cheating, pointing to B_1^*/A_1 in the graph. Similarly, another rational agent of this model A will do the same at A_1^* , keeping the B_1 fixed is another symptom of cheating, pointing to A_1^*/B_1 . Therefore, under weak institutional arrangements, the contract does not hold. In the graph, the new resource extraction line is now A_1^*/B_1 and B_1^*/A_1 , galloping up from A_1B_1 . Despite the Nash equilibrium, it is not stable. Until the complete extraction of natural resources happens, the shift and alteration of the non-cooperative game will persist. The key underlying essence of this proposition is that the faulty persistence and the adverse development of the institutions of the ex-colonial country are the reasons for massive resource destruction (Titumir, Afrin & Islam, n.d.).

6. Towards transformational pathways

Transformational pathways require stabilization of ecosystems, that is, the conservation of the Sundarbans through damage limitation. For stabilization of ecosystems, it is necessary to identify the drivers of ecological degradation. These drivers include both natural and anthropogenic pressures on the Sundarbans. Moreover, institutional and governance structures are seen to be involved in degradation processes through various means of exploitation of natural resources, even though they are supposed to serve as the savior of the Sundarbans. Since indigenous local knowledge has been kept outside of this

governance and institutional framework, it is crucial to incorporate it in the stabilization process. This stabilization will transform the biodiversity and ecosystems of the Sundarbans bringing about a situation where sustainable use and benefit-sharing between human beings and nature will be ensured. Transformation of natural resources towards sustainability and resilience would thus create an ambience of well-being for both humans and nature (see Fig. 11). When nature and humans live in harmony, ecosystems become balanced through sustainable use, access and benefit-sharing.

If the transformation of ecosystems to sustainability is not achieved, there will be imbalance in the ecosystem, leading to destruction of biodiversity, which is delineated in the following three scenarios.

6.1 Scenario A: Loss of biodiversity (level of alienation)

The TRUs say human beings consider themselves, at the present time, to be independent and the master of nature, though they are part of nature. They argue that generally people treat nature as "mere matter" that can be extracted for human purposes, destroying the natural resources in various ways. In this way, according to them, human beings alienate themselves from nature. People become alienated from the world when they fail to recognize its humanity, when they are unable to see the world as their world and themselves as the part of the world. Thus, alienation derives from people's failure to recognize the sociality between humans and nature. These alienated relations, as they suggest, lead to commodification of natural resources through market pricing. In this way valuation becomes equal to the market price and the intrinsic values of natural

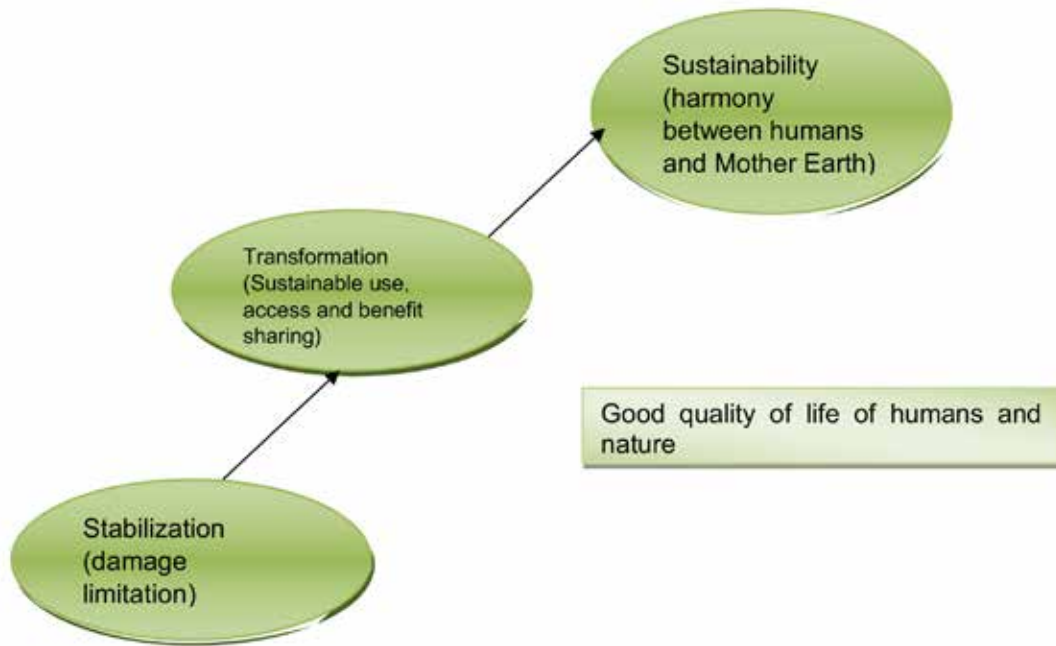


Figure 11. Transformation pathways (Source: Prepared by the authors)

resources and the sociality between nature and humans is ignored, leading to over-extraction and thus destruction of the natural resources (see Fig. 12). On the contrary to the virtuous cycle of the ecosystem, they draw the vicious cycle of how producers, consumers and decomposers - all of them start to get alienated from each other and have to bear loss in each of the provisions.

6.2 Scenario B: Loss of biodiversity (commodity fetishism)

The TRUs often talk about pervasive commodification of natural resources. Everything produced or received from nature is seen as commodities in their mind. In this way, commodities turn into fetishes in the sense that human

beliefs on commodities have created an obscure hierarchy of value of the natural resources on which demand for commodities depend. The high price commodities are seen as the most valuable. This commodity fetishism induces over-extraction of the resources through primitive accumulation of nature (see Fig. 13). The more money the powerful class gets, the more influence it can wield on extracting resources from the Sundarbans. Through this pervasive motivation, according to the TRUs, a clientelistic network emerges wherein members of the network thrive through primitive accumulation. Through this, only material provision of the forest comes forward ignoring the intrinsic and underlying values of mutual existence. Degradation of the forest, loss of biodiversity and overall socio-ecological imbalance occur.

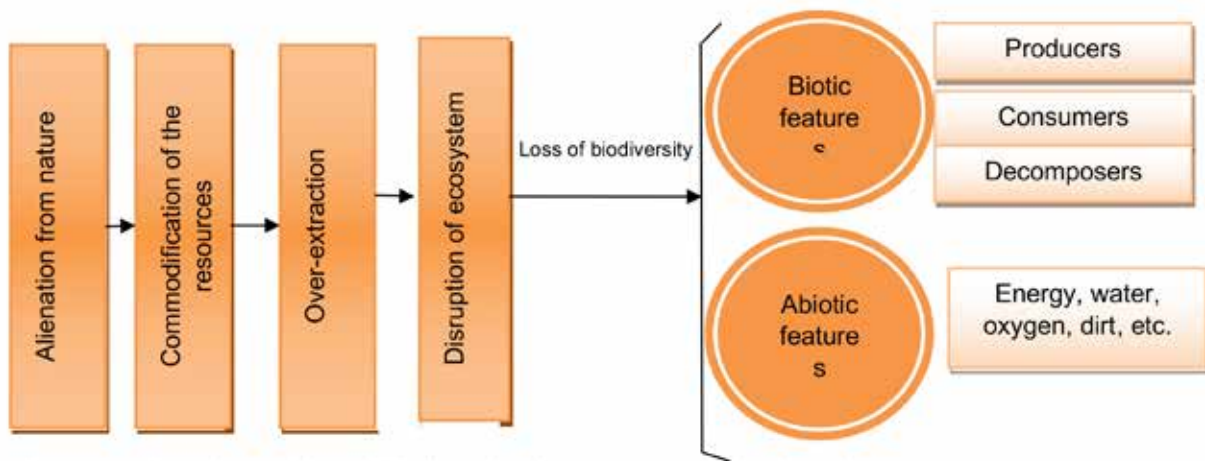


Figure 12. Alienation and loss of biodiversity (Source: Prepared by the authors)

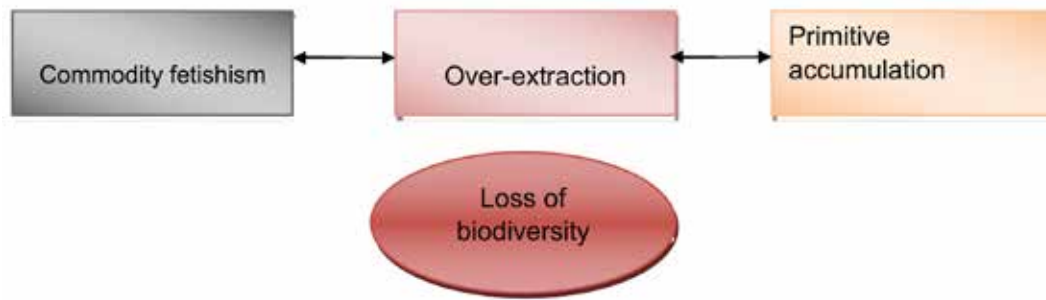


Figure 13. Commodity fetishism and biodiversity loss (Source: Prepared by the authors)

6.3 Scenario C: Sustainable and non-sustainable scenarios (appropriation and expropriation)

As stated above, alienation occurs through materialistic provision of commodities where the capitalist class tends to get access to the resources and sell them in the market at high prices. By using the power of institutions, powerful agents expropriate the resources. The extractive institutions exclude the TRUs and the primary producers from equitable benefit-sharing of natural resources. Likewise, the state also loses a significant share of revenue in natural resource rents. The TRUs claims that the officials of the local forest department, police and leaders of political parties "successfully" marginalize the general people or community people.

Contrary to this non-sustainable use of the resources, proper appropriation of the natural resources of the Sundarbans is healthy. In conjunction with this statement, it is important to consolidate the customary and traditional rules and practices of the forest people who actually treat the forest as their mind. The key understanding is that these socially

constructed norms and values, which are an informal institutional set-up, can solve the natural resource problem. The norms and values create a collective organization that can preserve the natural resources sustainably and equitably. The authority to impose credible threats and sanctions by the stakeholders of the resources on the resource distribution could immensely contribute to solving the natural resource problem and ensure distribution of benefits. As forest people regard the forest as their intimate relative, they do not think of harming the natural resources of the forest. Therefore, their values, norms and traditional rules and practices should be incorporated in the conservation processes of the Sundarbans (see Fig. 14).

7. Conclusions

By using a multiple evidence-based approach, the diverse knowledge system of the TRUs and corroborative scientific evidence, this chapter conceptualizes nature and its values. TRUs consider the Sundarbans as their mind, through which human-nature sociality thrives. The TRUs challenge

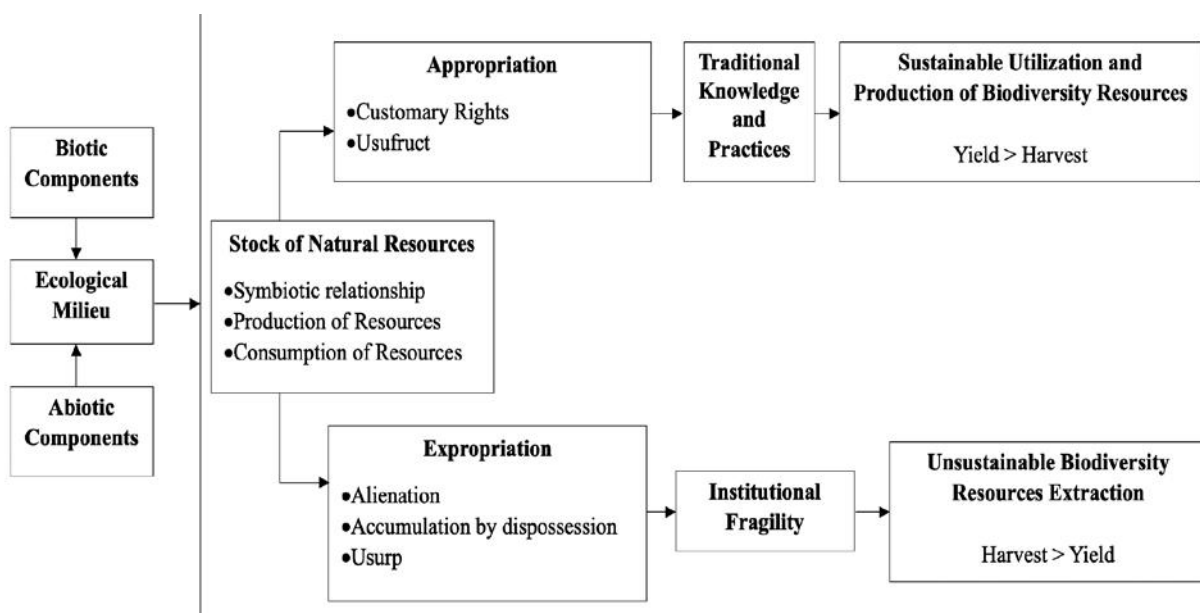


Figure 14. Human-nature-sociality framework: sustainable utilization, customary rights (Source: Titumir, Afrin & Islam, n.d.)

mainstream valuation methods and argue that valuation of environmental resources through market penetration pricing does not reckon the social benefits and values coproduced through complementarity between humans and nature. Their reasoned knowledge and practices, documented and demonstrated, cast a shadow on the orthodox view of sustainable governance as an abstract tradeoff between human activities or environmental protection based on cost-benefit analysis (CBA), which assumes human beings are the external agents to the natural resources governance. In such processes, any monetary tag does not reflect the social opportunity costs stemming from the dependence of the community on the resources for income, jobs and livelihoods. As a whole, the value of the production network within the socio-ecological production landscape remains undervalued in the market-based valuation system. The TRUs argue that a weak market structure and unequal distribution of power cause rents to be dissipated, going into the pockets of the rent-seeking powerful class. As a result, rent-seeking agents including bureaucrats, businesses and politicians extract resources as much as they can, thereby destroying the biodiversity. These unproductive, expropriating activities bring positive returns to the individual but not to society. Finally, the TRUs demonstrate that the traditional knowledge system can significantly contribute to the sustainable management of biodiversity resources, both within the protected areas system and potentially in other effective area-based conservation measures, if they are given a chance and are supported by governmental and non-governmental agencies.

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- 7 These are examples that could be made into an article of their own if an attempt were made to capture them in their entirety.
- 8 For example, a special operation named "smart patrolling" has been being carried out for the protection of the tiger under the financial assistance of USAID, which is known as "Bagh". Also another program of the forest department named "IPAC" is run by the financial assistance of USAID. In these programs, people from nearby villages were included in co-management of the forest, but their participation halted when the program ended.
- 9 The Nash equilibrium is a steady state where the each agent has no incentive to deviate from their chosen strategy assuming the strategy taken by opponent.

- 1 Human groups maintain a high level of sociality despite a low level of relatedness among group members (Gintis 2000). This signifies that pro-social behavior exists in human-beings, as Gintis called it "strong reciprocity", which in part may explain sociality.
- 2 Direct use value means the economic or social value of the goods or benefits derived from the services provided by an ecosystem that are used directly by an economic agent. These include consumptive uses (e.g. harvesting goods) and non-consumptive uses (e.g. enjoyment of scenic beauty).
- 3 Indirect use value includes benefits derived from the goods and services provided by an ecosystem that are used indirectly by an economic agent. For example, indirect use values are the provision of cyclone protection by the forest or the usage of natural water of the forest, etc.
- 4 Existence value is often reflected as a sense of well-being, such as existence of coastal and marine biodiversity and habitats. People may not have experienced or utilized this value directly but they benefit from the knowledge of it.
- 5 Option value refers to the value of retaining options for the future. These values include the potentials of biodiversity that are presently unknown and need to be explored. It is the value of knowing that there are biological resources existing in this biosphere that may prove to be an effective option for something important in future. For example, research helps explore the diversity of myriad flora and fauna of the forest. Education and aesthetics are also examples of option value.
- 6 Bequest value refers to the readiness of present day mankind to spend goods in order to preserve biological diversity and its components for future generations. Bequest value is often termed as beneficial or altruistic value. For example, cultural heritage and resources for future generations, which are also expressed through consumers' willingness to pay or less/delayed consumption of the resources for the sake of future.