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Analysis of forest-related policies for supporting ecosystem services-based forest management in Bangladesh

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ABSTRACT

The role of the ecosystem services concept in natural resource management policies is gaining popularity globally as a means to offer increased protection of biodiversity conservation, integrated natural resource management and for promoting sustainable forest management. However, assessments of the concept in supporting forest management, through its inclusion in forest policy, is yet to be fully understood in a developing-country context.

We analysed national forest-related policy to determine if the elements of the ecosystem services concept or ecosystem services categories were represented in order to support regional and national forest and tree management and rural livelihoods in Bangladesh. Specifically we assessed the policy objectives, statements and proposed programmes of ten policy/legislative documents. We applied a weighted scoring system to assess the coherence between existing policies and the ecosystem services concept and three categories of ecosystem services (provisioning, regulating and cultural services). It was found that, while ecosystem services were mentioned in all forest-related policies in Bangladesh, only one policy covered the ecosystem services concept. No policies provided details on operational aspects, including ecosystem services assessment, the decision-making process and scales of implementation. Different specific forest- and tree-based ecosystem services were not identified clearly in any current policy. All policies reviewed explicitly mentioned regulating services (i.e. carbon sequestration and water regulation) more often than provisioning and cultural services. Given this, we recommend that the current policies should consider ecosystem services-based management goals and decision-making in order to maximise the local benefits of forests and trees in the contexts of diverse social-ecological systems. Different specific forest- and tree-based ecosystem services should be clearly identified in the current forestry and other natural resource management policies in order to enhance the synergy between forests and competing land management practices.

1. Introduction

The ecosystem services concept is gaining importance in studies of the broader benefits of sustainable forest management, and is becoming a mainstream approach in policies aimed at achieving wider sustainable development, biodiversity conservation and human well-being (Costanza et al., 1997; Dick et al., 2018; Robinne et al., 2019). A number of international initiatives (e.g. the Millennium Ecosystem Assessment, The Economics of Ecosystems and Biodiversity, and the recent International Panel on Biodiversity and Ecosystem Services) have identified the role of the ecosystem services concept in policies that support the value and protection of natural capital, particularly biodiversity. Ecosystem services are contributing to the aims and targets of the Sustainable Development Goals of the United Nations and Aichi Targets of the Convention of Biological Diversity (Geijzendorffer et al., 2017). The ecosystem services concept is also likely to be particularly relevant to forest policy for supporting the sustainable management of forests (Deal et al., 2012; Boyd and Banzhaf, 2017), while ensuring benefits for both local livelihoods and global environmental sustainability (Wang & Fu, 2013). There is evidence for the growing acceptance of the ecosystem services concept in informing forest policies at the global (i.e. Convention on Biological Diversity) (Leadley et al., 2014), regional (i.e. EU) (Bouwma et al. 2018) and national (i.e. UK, Australia) scales (Pittock et al., 2012; Raum, 2017; Verburg et al., 2016). In the UK, ecosystem-

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services-based policy has been found to be effective in achieving biodiversity conservation, integrated natural resource management and the sustainable forest management (Raum, 2017).

The global Millennium Ecosystem Assessment recognised the role of ecosystem services in rural livelihoods, focusing on policies that incorporated this concept to guide the management of ecosystems in developing countries (MA, 2005). Recent research has examined how socio-economic conditions and context have influenced people's appreciation of ecosystem services in Indonesia (Muhamad et al., 2014), the impacts of social and cultural process on the distribution of ecosystem services in India (Lakerveld et al., 2015) and Nepal (Acharya et al., 2019), and the wealth-based use of provisioning services by rural households in rural Zambia (Kalaba et al., 2013), China (Robinson et al., 2019) and Bangladesh (Ahammad et al., 2019a, 2019b). Throughout, the usefulness of the concept is promoted in order to explore human-ecosystem relationships and identify the most appropriate management for safeguarding ecosystems and the wide range of benefits they provide to specific social and economic groups. However, the implications of the concept in supporting forest management, through its inclusion in forest policy, is yet to be fully understood in a developing-country context. As such, until recently, the policy implications of the ecosystem services concept have only been explored in relation to developed regions, such as the EU (Bouwma et al., 2018), and countries such as the UK, Australia and New Zealand (Greenhalgh & Hart, 2015; Pittock et al., 2012; Raum, 2017). The pressures on ecosystems may be exacerbated by misguided policies and institutional arrangements, such as inappropriate subsidies and inequitable patterns of ownership and access to resources in developing countries. Forest-related policies have not accounted for the role of the Indian Himalayas in providing ecosystem services, which has resulted in a lack of information regarding the multiple uses of services for conservation, agriculture, development and tourism (Badola et al., 2015). Lack of community engagement and shared values of the diverse stakeholders in the forest policies result trade-offs within the ecosystem services in China (D'Amato et al., 2017), Bangladesh (Ahammad et al., 2019a, 2019b) and Chile (Alfonso et al., 2016).

Globally, it is estimated that up to 1.5 billion people receive benefits from forests in their livelihoods in the form of employment and incomes (Agrawal et al., 2013). Forest- and tree-based ecosystems provide a wide range of direct benefits, in terms of food, primary energy, healthcare and construction materials in Bangladesh. Approximately 10 million people are engaged in forestry sector in Bangladesh while no clear estimates of the primary dependency on fuel wood and construction materials timber are currently available. The estimated value of timber and fuel wood produced in the country is around USD 2.5 billion alone (Bangladesh Forest Department [BFD, 2016a). There is an estimated increase in the demand for timber from 8.57 million^3 at current harvest rates to 9.77 million^3 by 2030 and 10.62 million^3 by 2050 (BFD, 2016a). The heightened demand for forest produce is resulting in an overexploitation of resources, however, causing the degradation and decline of natural forests. In Bangladesh, this decline is being driven by the illegal felling of trees for subsistence use, exacerbated by population growth, ineffective governance and policy inaction.

In Bangladesh, the contribution of the forest management estate to the improvement of forest conditions and the sustainable use of forest benefits remains unclear. There is particularly limited information on, or an incomplete assessment of, the present and future dependency of people on critical forest ecosystem services, and the management approach required to achieve broader sustainable forest management in Bangladesh. Given this limitation, this study aimed to examine how the ecosystem services concept and ecosystem services are represented in policies for supporting forest management and rural livelihoods in Bangladesh. We attempt here to address the research question, "To what extent does the current forest-related policy and management in Bangladesh recognise the ecosystem services concept and ecosystem services categories?"

This paper begins with a summary of key government forest policies and legislation in Bangladesh (BFD, 2016a, 2016c, 2017; DoE, 2016; GED, 2015; MoEF, 2012, 2017a, 2017b, 2020a, 2020b), and outlines the method used for the assessment of ecosystem services concept or ecosystem service categories in the policies (Bouwma et al., 2018). Then, we present our results, followed by a discussion on the ecosystem services concept and a description of the ecosystem services identified in forest policies in Bangladesh. We also discuss the roles of ecosystem services concept and ecosystem services within forest policies to address the broader benefits and options for the integration within particular forest and tree management in Bangladesh with reference to global studies.

2. Methods and materials

2.1. Settings of policies and laws for forest management in Bangladesh

Forest management in Bangladesh is largely regulated by state-directed policies and rules (Ministry of Environment and Forests [MoEF], 2016)[1]. The government manages almost 90% of this forestland, with the remaining 10% being privately or community owned. The forest areas in Bangladesh are estimated to cover 2.6 million ha, which represents 17.5% of the total land area in the country (BFD, 2016b). Forest areas are broadly classified on a topographical consideration, with hill forests in the northern and eastern hilly areas, plains forests in the central region, and littoral forests, including natural and planted mangroves, in the south-western coastal region. At present, 15% of the forested land is managed for protection, being valuable for biodiversity, watershed management and cultural benefits (BFD, 2016b).

In Bangladesh, a policy is followed by its legal framing, which includes primary and subordinate legislation. The Forest Act 1927 is the key regulatory instrument that supports national forest policy implementation through laws related to forests, the transit of forest produce and the duty levy on timber and other forest-products. This Forest Act is still applied in Bangladesh today. The first National Forest Policy (NFP) was enacted in 1979, following the independence of Bangladesh in 1971. This forest policy mainly emphasised the nationalisation of government forestland, with forest expansion occurring through plantations along coastal areas and in unclassified state forests in the Chittagong Hill Tracts region, and the undertaking of optimum harvesting of forest products for local needs and industrial raw materials. The second National Forest Policy was adopted in 1994. This included a number of measures, including targets for afforestation to achieve tree cover over 20% of the country's land area (by 2015) on both private and government land, the involvement of local communities in the planting, the development of forest-based small industries, the conservation of biodiversity and the maintenance of the traditional rights of ethnic populations. The second National Forest Policy made substantial progress in integrating forest management and conservation practices, in the context of broader rural development and poverty alleviation, by promoting tree cover expansion, using a participatory/social forestry approach, and actions for co-management of protected areas for biodiversity conservation (IUCN & BFD, 2016). The most recent Forest Policy was published in 2016 (BFD, 2016c).

Aside from the National Forest Policy and the associated Forest Act, a number of strategic documents have been prepared by the government agencies concerned (i.e. BFD, MoEF), such as the Five-Year Plan (FYP), the Forestry Master Plan (FMP) and the Country Investment Plan (CIP) (BFD, 2016a, 2016b; MoEF, 2017b). These policy documents support the implementation of the NFP through ensuring the activities, proposed projects and required funding are in line with the stated aims and

[1] The MoEF was renamed the Ministry of Environment, Climate Change and Disaster in 2019, but since the sources we cite are from MoEF, this is used in this paper.

objectives. In addition to forest policy and law, and related strategic policy and plans in Bangladesh, a number of other relevant natural resource management and conservation policies and laws also exist. These include specific legislation, such as the Social Forestry Rules 2004, Wildlife (Conservation and Security) Act 2012 and Bangladesh Biodiversity Act 2017, which regulate benefit sharing in participatory forestry, biodiversity conservation and the management of wildlife and protected areas.

The Bangladesh Forest Department (BFD) of the MoEF is the main agency with a mandate for the management, conservation and sustainable development of all types of forest in Bangladesh (BFD, 2018). BFD was formed after the independence of the country in 1971 with responsibilities such as regulating reserve areas set aside for conservation, or establishing and managing plantations in deforested areas and on marginal land. Two broad approaches have been used to date in forest management—co-management and participatory forestry. Since the early 2000s, the co-management approach in protected areas has involved local communities, limiting their access to forest products in buffer zones. Large areas of such protected areas are still not adequately managed, however, primarily due to weak institutional capacity, and funding limitations. The co-management approach has only been established in the forests of the north-eastern uplands (part of the hill forests) and the central region (plains forests) of Bangladesh. On the other hand, the participatory forestry management approach focuses on increasing tree cover on public lands, including marginal areas that are not used for cultivation, such as along roads and on fallow land, in collaboration with local communities through benefit-sharing with adjacent local communities under the Social Forestry Rules 2004. Participatory forestry is aligned with the last National Forest Policy 1994, which mentions the establishment of plantations as a key objective towards increasing tree cover, and integrating forests in the context of broader rural development through a participatory/social forestry approach for tree cover expansion (Sadath & Krott, 2012). Overall, both management approaches consider a generally collaborative forest management agenda, rather than embracing any specific conceptual foundations.

2.2. Analytical approach

The main information used in this paper derives from the analysis of six government policies and four legislative documents related to forest management in Bangladesh (see Table 1).

For this paper, a policy is broadly considered to be a written document intended to guide and determine present and future decisions and actions (FAO, 2010). Such policies usually comprise a set of goals or objectives and an outline of a course of action that will achieve these. While a forest policy provides direction, legislation is an instrument for establishing rules, rights and responsibilities for implementing a forest policy. The six policies were selected as they contain the goals and activities to be achieved in forest management in Bangladesh. To achieve the policy objectives, there are four key pieces of legislation to regulate management of different forests and tree based systems.

We selected the policy documents and legislation for analysis in three stages following Bouwma et al (2018). First we made search in the government database (i.e. relevant ministries and departments of the government of Bangladesh) for the policies and information published about policies. Initially the broad topic “forest policy”, “ecosystem services” and “Bangladesh” was used to search the documents about policies. A scoping study was also undertaken during 2015–2016 to identify the key policy documents in relations to forest management in Bangladesh (Ahammad and Stacey, 2016). Second, from the initial search and scoping study, we identified ten policy documents and reviewed them in the abstract/preface and table of contents in the context of ecosystem services for Bangladesh. By following Bouwma et al. (2018), then further analysis involved the review of policy and legislation components in the documents’ aims, objectives, general statements and proposed programmes/actions to obtain information mentioned about the mentioned ecosystem services concept and specific ecosystem services. We used the criteria and applied weighted scores based on the extent of a reference to, or mention of, ecosystem services and ecosystem services concept, on a scale from 1 to 6 (Table 2) following Bouwma et al. (2018). The analysis assessed the coherence between existing policies and the ecosystem services concept by applying a weighted scoring system, adapted from Bouwma et al. (2018) (Table 2).

The review identified policies that set specific ecosystem services to be achieved through forest and tree management. The ecosystem services concept and the categories of different ecosystem services used in MA (2005) and by Bouwma et al (2018) was also applied in this study: provisioning, regulating and cultural ecosystem services. The specific ecosystem services identified from the statements (e.g. fuelwood, water regulation, aesthetic use) of the policies and legislations were then categorised into the broader classes of provisioning, regulating and

Table 2
Description of the criteria and weighted scores for assessing policies and their inclusion of the ecosystem services concept and specific ecosystem services (adopted from Bouwma et al., 2018).

Criterion	Score
No explicit mention of ecosystem services or the ecosystem services concept	1
Mentioned the ecosystem services concept broadly, with no further statements	2
Mentioned the ecosystem services concept or some services, with general indicative measures or actions	3
Mentioned the ecosystem services and concept in the objectives, with further actions identified	4
Contained ecosystem services in the objectives and proposed corresponding measures for ecosystem services, but remained unclear	5
Mentioned ecosystem services throughout the policy, including in the objectives, and provided explicit details for their implementation	6

Table 1
List of policy and legislative documents reviewed from the respective government agencies.

	Document	Year of enactment	Acronym	Responsible agency sources	Sources of the policies and legislation
Policies	1) National Forest Policy	2016	NFP	BFD, MoEF	BFD (2016c)
	2) Bangladesh Country Investment Plan for Environment, Forestry and Climate Change	2016	CIP	BFD, MoEF	MoEF (2017b)
	3) Forest Investment Plan	2017	FIP	BFD, MoEF	BFD (2017)
	4) Seventh (7th) Five-year Plan for the Forestry Sector	2017	FYP	BFD, MoEF	GED (2015)
	5) Bangladesh Forestry Master Plan	2017	FMP	BFD,MoEF	BFD (2016a)
	6) National Biodiversity Strategy and Action Plan of Bangladesh	2016	NBSAP	DoE, MoEF	DoE (2016)
Legislation	1) Forest Act	1927	FA	BFD, MoEF	MoEF (2020a)
	2) Social Forestry Rules	2004	SF	BFD,MoEF	MoEF (2020b)
	3) Bangladesh Biodiversity Act	2017	BBA	BFD, MoEF	MoEF (2017a)
	4) Wildlife (Conservation and Security) Act	2012	WA	BFD, MoEF	MoEF (2012)

(BFD – Bangladesh Forest Department, DoE – Department of Environment, GED – General Economics Division).

Table 3
Categories of ecosystem services considered in the policy review following the MA (2005) and Bouwma et al. (2018).

Broad category	Specific ecosystem services
Provisioning services	Food
	Fuelwood
	Raw construction materials
	Primary medicines
	Fodder
	Clean drinking water
Regulating services	Water purification
	Carbon sequestration
	Air quality
	Soil protection
	Soil fertility
	Pest and disease control
	Pollination
Cultural services	Aesthetic
	Spiritual
	Educational
	Eco-tourism

cultural ecosystem services (Bouwma et al., 2018) (Table 3). The policies were further reviewed to identify any specific actions mentioned in relation to three broad categories of forest types (hill, plain and mangroves) and ecosystem services categories. In relation to livelihoods, the types of provisioning services mentioned (e.g. fuelwood, timber, non-timber forest products [NTFPs]) in the policies and legislation were identified. The policy and legislation documents were also combed for references to promoting or supporting the delivery of socioeconomic benefits from the forests to local communities.

3. Results

Six policy documents and four legislation documents were analysed in the context of forest management and biodiversity conservation (because these are closely related in Bangladesh) (Table 1). For each document, the aims/objectives, statements and proposed activities were assessed to identify whether the ecosystem services concept or specific ecosystem services and livelihood aspects (i.e. socioeconomic benefits, access to forested land, participation in forest management) were mentioned.

3.1. Review of forest policies

The forest policy documents were reviewed in order to identify statements relating to the ecosystem services concept and ecosystem services (Table 4). The most recent National Forest Policy 2016 *does* incorporate ecosystem services into the main aim "to produce a wide array of goods and ecosystem services for the benefit of Bangladesh's present and future generations" (BFD, 2016c, p. 3). In Objective 10 of the National Forest Policy, there was a clause "to include valuation and payment for ecosystem services in the planning and management of forest ecosystems" (BFD, 2016c, p. 3). This focus on the valuation of ecosystem services that forests provide in Bangladesh also appeared in Section 1 of the policy statement of the National Forest Policy. However, ecosystem services were not formally recognised in this policy as a framework for forest management operations or in recognition of the wide range of forest benefits.

The Bangladesh Country Investment Plan for Environment, Forestry and Climate Change (CIP) explicitly recognised ecosystem services as a conceptual framework (MoEF, 2017b, Section 1.4). Both ecosystem services concept and ecosystem services are explicitly mentioned in the CIP (Tables 4 & 5). The CIP specified all of the broad categories of ecosystem services, including provisioning ecosystem services (i.e. bamboo, cane, murta [*Schumannianthus dichotoma*], medicinal plants, honey and wax, and goal pata [*Nypa fruticans*]) (Table 4). It also mentioned ecosystem services outcomes under cross-sectoral priority

Table 4
Summary of statements from forest policy documents relating to the ecosystem services concept and ecosystem services in Bangladesh.

Policy document	Statement relating to the ecosystem services concept and to ecosystem services	Relevant section of the policy document	Score
NFP (2016)	Recognition of the value of ecosystem services, but with no suggested actions or measures	1.6 (Objectives 2 and 10)	5
CIP (2016)	Explicit recognition of ecosystem services as a conceptual framework and a proposed programme for sustainable forest management and ecosystem services outcomes	1.4, 6 and 1.1.3	6
FIP (2017)	Some ecosystem services mentioned, such as carbon sequestration, with further actions for plantation management	1.12 and 2.11	3
FYP (2017)	No explicit mention of the ecosystem services concept, only a programme for the evaluation of goods and services without any specific actions or implementation measures	8.3	2
FMP (2017)	Ecosystem services were mentioned in broad terms, but with no further statements	Page viii	2
NBSAP (2016)	No specific mention of the ecosystem services concept, but emphasis given to economic evaluations of ecosystem services and their comprehensive assessment; no strategies mentioned	3.1.3 and 3.2	5
FA (1927)	No explicit mention of ecosystem services or the ecosystem services concept	ns	1
SF (2004)	No explicit mention of ecosystem services or the ecosystem services concept	ns	1
BBA (2017)	No explicit mention of the ecosystem services concept, but a broad recognition of ecosystem services through biodiversity conservation	ns	2
WA (2012)	No explicit mention of the ecosystem services concept, but cultural ecosystem services through the conservation of community-conserved forests were acknowledged	ns	3

ns – not specified.

programmes to achieve these and sustainable forest management (Section 1.4) (MoEF, 2017b, p. 6). The CIP proposed the sustainable development and management of natural resources as one of the priority (pillar) areas and programmes for investment over a five-year period (2016–2020). Under this priority, relevant programmes, such as sustainable forest management, enhanced socioeconomic benefits from forests, biodiversity conservation, the sustainable management of wetlands, rivers and marine ecosystems, and soil and groundwater management, are mentioned. In particular, the CIP focused on achieving regulating (i.e. carbon sequestration, soil protection and water regulation) and cultural (ecotourism) services (Table 5) (Table 6).

None of the other five policies (i.e. NFP, FIP, FYP, FMP and NBSAP) identified specific programmes or actions in relation to ecosystem services. The Forest Investment Plan did not directly mention ecosystem services in its objectives, but it did incorporate some targets for carbon sequestration through sustainable forest management (BFD, 2017, p. 36). The seventh Five Year Plan did not contain any explicit aspects of ecosystem services, and there was no clear statement on incorporating ecosystem services into the planning or implementation phase of the FYP. The Bangladesh Forestry Master Plan, whilst mentioning ecosystem services in general, did not indicate any aspects for their integration in

Table 5
Specific forest-based ecosystem services addressed in the examined Bangladesh policy documents.

Policy document	Provisioning ecosystem services	Regulating ecosystem services	Cultural ecosystem services
NFP (2016)	Timber, Non-timber Forest Products (ns)	Water regulation, carbon sequestration	Spiritual, ecotourism, educational
CIP (2016)	Bamboo, cane, murta (*Schumannianthus dichotoma*), medicinal plants, honey and wax, goal pata (*Nypa fruticans*)	Water regulation, carbon sequestration, soil protection	Ecotourism
FIP (2017)	Fuelwood, timber, pulpwood	Water regulation, carbon sequestration, soil fertility, soil protection	ns
FYP (2017)	Bamboo, cane, murta, medicinal plants, honey and wax, goal pata (*Nypa fruticans*)	Water regulation, carbon sequestration	Ecotourism
FMP (2017)	ns	Water regulation, carbon sequestration	ns
NBSAP (2016)	Fuelwood, timber, medicinal plants	Water regulation, carbon sequestration	Aesthetic, ecotourism

ns – not specified.

Table 6
Policy statements in relation to broader forest categories (hill, plain and mangroves) and specific ecosystem services.

Policies and legislations	Statements in relation to broader forest categories (hill, plain and mangroves)	Target ecosystem services
NFP (2016)	- Generally stated about the mangrove protection and afforestation in coastal areas, but no specific programmes are identified	- Carbon sequestration, water regulation, soil fertility
	- Hill and plain land forests are considered for managing to promote spiritual purpose	- Spiritual
	- Hill forests are generally mentioned for reforestation	
CIP (2017)	- Hill forests are given priority in particular Chittagong Hill Tracts region for improving land use practices	- Water regulation, soil erosion
	- Mangroves (natural and planted) has been mentioned without specific interventions	- Carbon sequestration, water regulation
FIP (2017)	- Programme proposed for afforestation in hill and plain forests	- Carbon sequestration, water regulation, soil fertility
	- Plantation based tree cover expansion in private owned lands along homestead, farms are specified	- Timber, fruits, fuel wood and NTFPs
FMP (2016)	- Hill forest is generally mentioned with measure for plantations	- Water regulation, soil erosion
	- Mangrove plantation is specified along coastal regions	- Bamboo, cane, Nypa fruticans, fruit
	- Plantations proposed with a focus on NTFPs	

the planning and implementation of the FMP (BFD, 2016a).

Our review of the categories of services mentioned in the policies and legislative documents revealed that regulating services were the most frequently mentioned services, and in the greatest detail, followed by provisioning and cultural services (Table 5). All six forest-related policy documents (NFP, CIP, FIP, FYP, FMP in Table 5) mentioned carbon sequestration, timber and biodiversity as the main ecosystem services to be enhanced. The 2016 National Forest Policy emphasised regulating (carbon sequestration, biodiversity and water regulation), provisioning (NTFPs and timber) and cultural ecotourism services, whilst the FIP proposed programmes for enhancing the carbon stock, protecting biodiversity and maintaining fuelwood and timber supplies, although it did not mention any cultural services. The seventh FYP proposed undertaking measures to improve the provisioning services relating mainly to NTFPs (bamboo, cane, murta, medicinal plants, honey, wax, goal pata), and the conservation of watersheds for securing fresh water.

3.2. Review of legislation

Four legislation documents were analysed in the context of forest management and biodiversity conservation (because these are closely related in Bangladesh). None of these four acts and rules referred to the ecosystem services concept or specific categories of ecosystem services, but only Forest Act did indirectly mention the benefits of forests as 'forest produces' (Interpretation clause 4 in Chapter 1 of the Forest Act 1927). The Forest Act of 1927 mentioned only provisioning services by listing forest products although their linkage to rural livelihoods is absent. No benefits of regulating and cultural ecosystem services of forest management is mentioned within the forest act. The other three acts (SF 2004, BBA 2017 and WA 2012; Table 1) did not specifically mention the concept or any ecosystem services, but *did* contain general statements about biodiversity conservation and the cultural benefits of community-conserved forests (MoEF, 2017a, 2012).

None of the legislations studied provided any integrated approach towards managing forest and tree based ecosystem services. They only considered specific aspects of forest management (protected area based forest management) and conservation. The protection of forests remains the core aim of the rules in the Forest Act 1927 which has rarely indicated any clear management outcome or objective to be achieved in terms of specific ecosystem services and their livelihood benefits. One of the shortcoming in the Forest Act 1927 is its limited updating the rules in the context of forest and tree based ecosystem managements. The Social Forestry Rules 2004 has only identified the benefit sharing process for forest and tree products, but there is no specific statement provided about the ecosystem services of forest and tree management. Although Bangladesh Biodiversity Act 2017 is relatively recent, it has not provided any indicative measures for implementation of conservation rules in different forest regimes. The Wildlife Act 2012 stated about the cultural ecosystem services by acknowledging the role of community based conservation.

4. Discussion

4.1. Ecosystem services in the forest policies of Bangladesh

The ecosystem services concept and specific ecosystem services have been introduced into forest policies in the last three years in Bangladesh. All of the forest policies have nominally mentioned ecosystem services or the ecosystem services concept in their objectives or general statements and proposed programmes. Our findings support that of Geijzendorffer et al. (2017) who report that the term 'ecosystem services' is not often explicitly stated in policy objectives, but is rather mentioned only as number of specific ecosystem services in such documents. Pittock et al. (2012) had earlier reported a similar result, in a specific-country context (Australia)—that the increasing use of the term 'ecosystem services' in public documents relating to natural resource management was generally superficial. The National Forest Policy 2016 and – Forestry Master Plan mentioned the need for evaluations of ecosystem services to support planning for, and a national accounting of, natural resources in Bangladesh. The CIP – only mentioned the ecosystem services concept and priority areas, including programmes relating to improving ecosystem services (water regulation, soil fertility and soil protection). As a result, most of the policies generally lacked explicit

goals to be achieved and the implementation support needed to achieve those ecosystem services.

The reviewed forest policies recognised a number of individual ecosystem services, such as fuelwood, NTFPs, timber, carbon sequestration, water regulation and ecotourism, which are common across all these policies. Most of the policies mentioned water regulation, and referred to the need for watershed management in hill forests, but it remains unclear what management approaches to forests and trees will be needed to achieve these services. None of the policies provided details about the actions required to enhance water regulation benefits in forest and tree management in Bangladesh. All of the policies also recognised the roles of forests and tree plantations to provide carbon sinks or enhance sequestration capacity. But only three policies specified actions for achieving carbon sequestration and biodiversity conservation in their proposed programmes. However, these actions are symbolic for aligning with the international commitment to, and in supporting the implementation of, the Reducing Emissions from Deforestation and Forest Degradation in Developing Countries Program (REDD) and the Convention on Biological Diversity (BFD, 2018). Implementation of ecosystem services require legitimisation from key political actors and a supportive framework embedded within government and non-government institutions (Loft et al., 2015; Keenan et al., 2019) which appears to be lacking in Bangladesh.

In relation to livelihoods, most of the forest policies and legislation reviewed mentioned two provisioning ecosystem services (NTFPs in general and timber) for providing socioeconomic benefits. In recent years, the demand for specific provisioning services, such as fuelwood, has declined, although the demand for timber is on the rise, in response to population growth and development. This points to specific actions that will be required for the management and sustainable use of timber from different forest- and tree-based ecosystems. However, there were no appropriate measures included regarding land ownership and the diverse management regimes (state, private, community) in the policies and legislation that would secure the livelihood access of local communities. A lack of supportive policies for tenure and land ownership in local communities impedes sustainable forest management goals, especially tree management in land use, and their impact on livelihoods and ecosystem services (Catacutan et al., 2017; Carrasco et al., 2016). At present, unclear management goals, overlapping ownership contexts (state, private and community land tenures) and limited market opportunities for tree plantations have already led to tree management being a contested land investment in hill forests of Chittagong Hill Tracts region. The National Forest Policy 2016 *does* cover the land-use rights of local communities for their access to traditional forest management, but the Forest Act of 1927 does not incorporate any legal mechanism for achieving this, or for improving land-use rights and the participation of local communities in forest management in specific regions. Without an explicit focus on the provisioning, regulating and cultural ecosystem services' in these policies, there is limited likelihood that forest usage will sustain or enhance the multiple benefits from tree-covered land-uses in local livelihoods.

4.2. *Ecosystem services based forest and tree management in Bangladesh*

Most forest policies in Bangladesh incorporate set goals for the protection of natural and referred planted forests, but lack any mention of specific ecosystem services in relation to plantations, or how the multiple objectives of ecosystem goods and services will be achieved. The Convention on Biological Diversity indicate that planted forests be managed in ways that benefit biodiversity, both in the planted forest itself and in areas of natural forest that have been retained in the planted forest landscape, in order to sustain ecosystem services (SCBD, 2009). This stance has been supported by Baral et al. (2016) who reported on the careful monitoring of short- to long-term ecosystem services contributions in local plantation management. Li et al. (2020) called for actions to minimise the trade-offs of newly land developed for plantations or forest protected for conservation purposes in Indonesia. It is useful for multiple stakeholders, including policy-makers, investors, environmental non-governmental organisations, and local communities involved in land-use planning, to consider the wide-ranging importance of planted forests. In fact, policies that address the goals of plantation forests, in terms of specific ecosystem goods and services, may be useful to implementing agencies, private stakeholders and local communities, by allowing them to explore the trade-offs available in land-use choices, and reach consensuses in decision-making (Bauhus et al., 2010). In the Chittagong Hill Tracts region, the low appreciation of forest gain by local communities is reportedly due to the negative impacts of monoculture plantations on overall ecosystem services (i.e. declines in fresh water sources and wild foods, as well as decreases in fuelwood and timber construction materials) (Ahammad et al., 2019a, 2019b). This implies that, with regard to plantation management, ecosystem services should be carefully considered at each level of decision-making in order to enhance synergy among those services.

Current policies have mentioned the importance of valuation of ecosystem services, but have not indicated any understanding of what knowledge is required to support forest management and planning in Bangladesh. Ecosystem-service-based research is key to operationalising the concept, as it guides knowledge accumulation and its uptake, the use of appropriate methods in evaluation and planning, and the connection among diverse stakeholders (Dick et al., 2018). The low level of awareness of the ecosystem services concept and its added value in decision-making, and the risk of its incompatibility with existing institutional arrangements, has impeded its conceptual embeddedness in UK policies, as reported by Russel and Turnpenny (2020). Only recently has ecosystem-service-based research been focused on economic evaluation (of mangroves), spatial distributions of ecosystem services (protected areas) and user knowledge (perceived ecosystem service benefits) in Bangladesh (Mukul et al., 2017; Uddin et al., 2013). These studies have provided the initial information required to understand the role of ecosystem services assessment, rather than providing detailed scientific knowledge about the ecosystem services, which is what is needed to shape the policies in Bangladesh in order to operationalise the concept and lead actions in the field. However, the ecosystem-services-based research has yet to make scientific evidence available for guiding policy decisions when a new window to incorporate ecosystem services opens (Rose et al., 2017). So, the next challenge is to influence these policies in Bangladesh by producing an evidence base on ecosystem services at different scales and subsequent engagement with diverse stakeholders.

All six policies contain statements about both sustainable forest management and biodiversity conservation, providing an opportunity to incorporate the ecosystem services concept as means to achieve both goals. In a review on forest policy in the UK, Raum (2017) reported on the growing role of the ecosystem services concept in forest management, and its acceptance by forestry stakeholders. The concept of ecosystem services has much in common with approaches for sustainable forest management—the achievement of multiple benefits for present and future generations. Pittock et al. (2012) also found that the concept of ecosystem services in natural resource management policies played a useful role in Australia, in terms of sparking a productive, interdisciplinary dialogue about the different needs and viewpoints of ecologists, economists and policy-makers. Recognition of the ecosystem services concept in Bangladesh's forest policies is in the formational stage. Whilst symbolically mentioning sustainable forest management in the National Forest Policy 2016, the incorporation of ecosystem services in existing management approaches should be considered. In Bangladesh, a process is needed in order to influence policy-makers to incorporate ecosystem services into policy, and to promote a broader view of ecosystem services to the relevant stakeholders at different levels.

The policies have not provided any specific indication how to incorporate ecosystem services within specific forests and trees

management approaches. The national forest policy has mentioned 'co-management' and 'participatory forestry' as its main implementation strategies. The present co-management approach only considers biodiversity conservation as a symbolic goal in protected areas whereas a participatory approach focuses on livelihood support. One of the key challenges in both the approaches is a lack of a clear operational linkage to sustainable forest management. There is no emphasis provided on the concept of forest management or explicit identification of ecosystems services to be achieved through these approaches. Although all policy documents proposed plantations in unclassed forests in the Chittagong Hill Tracts region, no management guidance on local people's access to different forest types was provided. Most forest areas are owned by state while private owners and community based conservation of forest is small to secure the local demand for accessing forest resources in the region. There is no clear statement in the Forest Act on how to deal with the diverse socio-economic benefits within different management regimes (state, private and community forests) in achieving the ecosystem services for the region.

5. Conclusions

The findings of the analysis of forest-related policies in Bangladesh has shown that the ecosystem services concept is explicitly mentioned in one policy, and three categories of ecosystem services (provisioning, regulating and cultural) are considered in various ways in some policies. In all six policies, regulating ecosystem services are explicitly mentioned as requiring enhancement, as opposed to the provisioning and cultural services. Specific proposals are provided in three policies to achieve mainly carbon sequestration in general and water regulation for the hill forest regions. However, the role of forest and tree sourced foods, fuel woods and primary medicines (provisioning ecosystem services) are understated in all the forest-related policies reviewed, despite the services being identified as irreplaceable in the livelihoods of rural people in Bangladesh and other tropical developing countries (Ahammad et al., 2019a; Ickowitz et al., 2014). The provisioning services should be clearly identified in the policies and in particular the Forest Act to allow low-wealth people to access forest and other lands for developing small-scale plantations as well as a guiding framework to ensure their sustainable use. Only the national forest policy mentioned cultural ecosystem services (aesthetic, ecotourism, research and education) without specifying any proposed actions for integrating the service within the sustainable forest management. Nevertheless, the cultural value of ecosystem services is contextual and related to people's traditions, beliefs and knowledge of their forest landscapes that should be considered in the implementation of policies in specific regions of the country.

Despite the concept of ecosystem services having tapped into potential opportunities for its integration into policies, there are bottlenecks with both planning and implementation stages. The current forest policies in Bangladesh have been mostly focused on management-oriented approaches—mainly co-management and participatory forestry—which have rarely integrated any conceptual aspects, such as the ecosystem services discussed here, for understanding the benefits of forests and trees. Therefore, ecosystem-services-based management would add value to the informed decision-making process and build awareness across the stakeholders on how to manage forests and trees to reap multiple benefits. The concept can be applied as a guiding framework for specific to socio-ecological systems, as well as for monitoring sustainable forest use. There is a high rate of conversion of natural forest into agriculture land in the Chittagong Hill Tracts region, and demand for a wide range of benefits (i.e. fuel wood, timber, non-timber forest products which generate income and food sources) to long-term water regulation and the cultural aspects of forest utilisation in the region. In such competing context between forests, trees and other land uses, an ecosystem-services-based land management can contribute to better understanding the drivers of forest loss, and to finding solutions for sustainable forest management and sustain their multiple benefits.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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