

Biodiversity of Bangladesh

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ABSTRACT

Biodiversity has become an issue of global anxiety over the past decades due to its rapid decline worldwide. Bangladesh as one of the most densely populated countries in the world is no more exception. The country, although, was once very rich in biodiversity, during the last few decades as a consequence of the rapid reduction in forest area, urbanisation, habitat modification, unsustainable natural resources use and collection and overall climate change it has decreased alarmingly. Of late, the government, as a signatory of various regional and international conservation treaties, has taken various initiatives to improve country's dwindling biodiversity. This paper reviews the present situation of biodiversity in Bangladesh, management trends and major causes of biodiversity loss. A separate statutory body is fundamental to ensure conservation, sustainable use and equitable sharing of benefits arisen from biodiversity in the country.

Keywords: biodiversity loss; conservation; deforestation; Bangladesh

1. INTRODUCTION

Bangladesh is situated in the world largest deltaic plain – the Ganges- Brahmaputra delta, in the north-eastern part of South Asia between 20°34' and 26°38' North latitude and 88°01' and 92°41' East longitude. The country mostly consists of flood plains with some hilly areas, with a sub-tropical monsoon climate (Islam, 2003). In the country, about 80% of the land is low-lying and/or flooded at least during the monsoon, makes the country the single largest flood-basin in South Asia. The majority of country's land is formed by river alluvium from the

Ganges and the Brahmaputra and their tributaries (Sohel *et al.*, 2015). Geographically, the country falls near the Indo-Burma region – one of the global biodiversity hot-spot and believed to have more than 7,000 endemic plant species (Mittermeier *et al.*, 1998).

Bangladesh, due to its unique geophysical location and a suitable climatic condition is exceptionally endowed with a rich variety of biodiversity (Nishat *et al.*, 2002). Nevertheless, in last years, like most other regions of the world, Bangladesh also went through a critical period unsuitable for country's biodiversity and ecosystem. The government so far along with various international conservation agencies has also been trying to improve and manage this overwhelming situation. This chapter aims to provide an insight of the biodiversity of Bangladesh, from ecosystem to species level, genetic diversity, and major threats to the biodiversity in the country with key initiatives so far taken for biodiversity conservation.

2. MAJOR ECOSYSTEMS OF BANGLADESH

Ecologically Bangladesh supports a diverse set of ecosystems. The country, has the world's largest continuous mangrove forest – The Sundarbans on its southwestern part- habitat of the world's largest surviving population of the Royal Bengal tiger (*Panthera tigris*); in its eastern part it has a large tract of evergreen to semi-evergreen hill forests, once very rich in biodiversity but mostly degraded now; besides in the north-eastern part there are many wetlands, locally called haors that harbor a huge number of aquatic plants, migratory birds and freshwater fish species (Khan *et al.*, 2007).

The forests of Bangladesh cover three major vegetation type occurring in three distinctly different ecosystems, i.e. hill forests (evergreen to semi-evergreen); plain land Sal (*Shorea robusta*) forests and mangrove forests. Although, once very rich in biodiversity during the last few decades all forest and ecosystems of the country have been heavily degraded (Mukul *et al.*, 2008). There have some contradictions on the actual forest coverage of the country. Although the official forest coverage is 2.53 million ha (see Table 1) representing nearly 17.5% of the country's total land area, only 1.52 million ha of them are under the jurisdiction of the Forest Department (Khan *et al.*, 2007; FAO, 2006). In addition to that, most of the forests of the country are geographically located only in few districts and are poorly stocked (Figure 1).

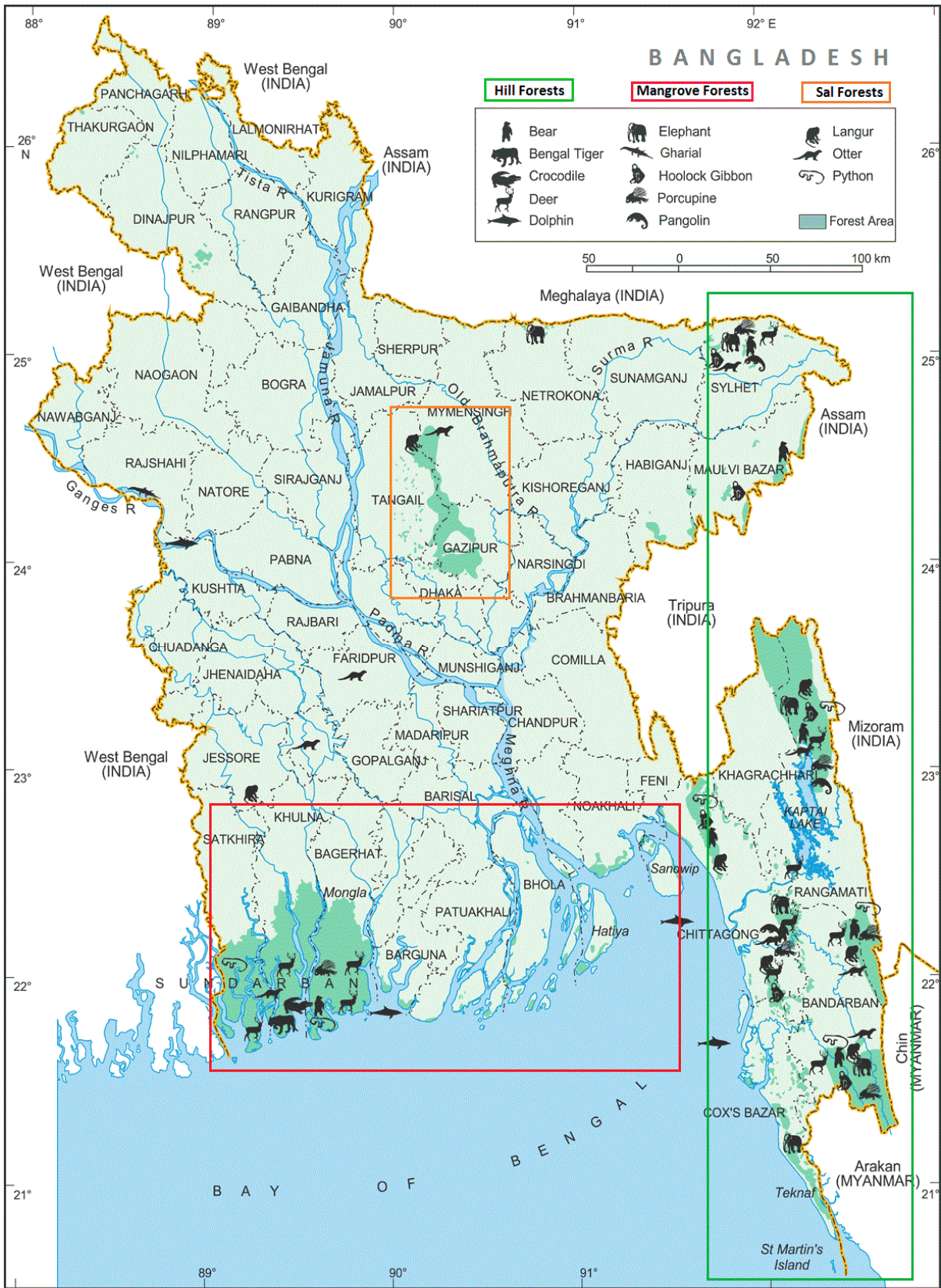


FIGURE 1. Major forest types and distribution of wildlife in Bangladesh.

TABLE 1. Major forest types and areas in Bangladesh

Forest type	Location	Area (million ha)	Remarks
Hill forests			
Managed reserved forest (evergreen to semi-evergreen)	Eastern part of the country (Chittagong, Chittagong Hill Tracts and Sylhet)	0.67	Highly degraded and managed by the Forest Department.
Unclassed State Forest (USF)	Chittagong Hill Tracts	0.73	Under the control of district administration and denuded mainly due to faulty management and shifting cultivation. Mainly scrub forest.
Plain land Sal forests			
Tropical moist deciduous forest	Central and north-western region (Dhaka, Mymensingh, Tangail etc.)	0.12	Mainly <i>Sal</i> forest but now converting to exotic short rotation plantations. Managed by the Forest Department.
Mangrove forests			
Sundarbans	Southwest (Khulna, Satkhira)	0.57	World's largest continuous mangrove forest and including 0.17 million ha of water.
Coastal plantations	Along the shoreline of twelve districts	0.10	Mangrove plantations along the shoreline of 12 districts. Managed by Forest Department.
Village forests			
	Homestead forests all over the country	0.27	Diversified productive system. Fulfill majority of country's domestic timber, fuelwood and bamboo requirements.
Tea gardens and rubber plantations			
	Chittagong Hill Tracts and Sylhet	0.07	Plantations of tree and rubber with various short rotation species as shade tree.
Total		2.53	17.49 % of country's landmass

Source: Mukul *et al.* (2014a); Khan *et al.* (2007)

3. PLANT AND WILDLIFE DIVERSITY IN BANGLADESH

In Bangladesh, some 2,260 species of plant reported alone from the Chittagong Hill Tracts, which falls between two major floristic regions of Asia (MoEF, 1993). Until now, an estimated 5,700 species of angiosperms alone, including 68 woody legumes, 130 fibre yielding plants, 500 medicinal plants, 29 orchids, 3 gymnosperms and 1,700 pteridophytes have been recorded from the country (Firoz *et al.*, 2004).

The country also possesses a rich faunal diversity. Bangladesh is home of about 138 mammal species, more than 566 species of birds (passerine and non-passerine), 167 species of reptiles, 49 species of amphibians (Figure 2; IUCN 2016). In addition to that, at least 253 species of fish (inland freshwater), 305 species of butterflies, 305 species of shrimp/prawn, 2,493 species of insects, 362 species of mollusks, 66 species of corals, 15 species of crabs, 19 species of mites, 164 species of algae, 4 species of echinoderms are believed to be exist in the country (IUCN 2015 & 2000; Islam *et al.* 2003).

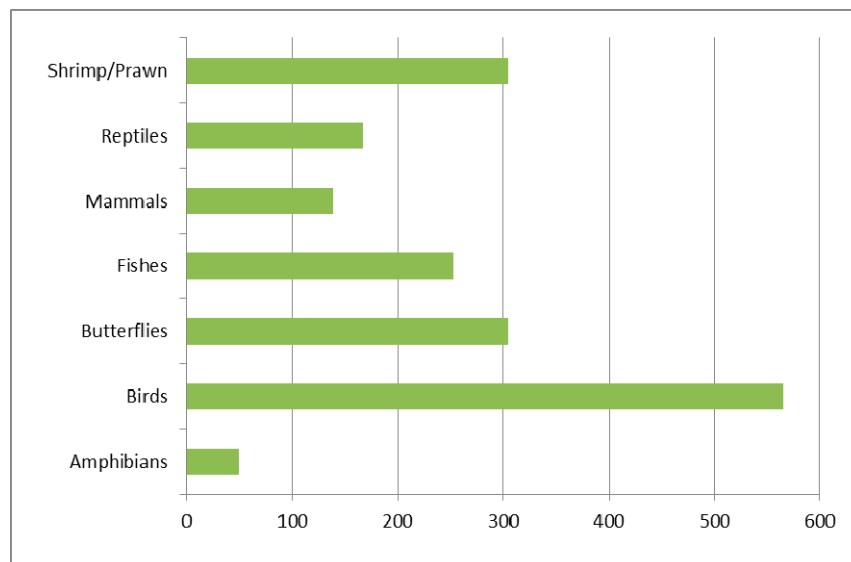


FIGURE 2. Faunal diversity of Bangladesh

4. GENETIC AND CROP DIVERSITY IN BANGLADESH

Bangladesh has a very rich in agro-biodiversity and supposed to have more than 8,000 rice varieties along with 3,000 crop varieties. Other than these more than 3000 varieties of pulses, 781 varieties of oilseed, 3516 vegetables (both species and cultivar), 156 spices, 89 fruits, are recorded alone by the Bangladesh Agricultural Research Council (Chowdhury, 2012). There are also more than 5000 varieties (both species and cultivar) of jute, and 475 varieties of tea recorded from the country. Many of these species varieties are however currently under threat due to the massive cultivation of certain high yielding rice and crop varieties and excessive use of agrochemicals in crop fields.

5. THREATENED BIODIVERSITY IN BANGLADESH

A great number of plant and wildlife species have already gone extinct from Bangladesh over the last decades (Rahman, 2004). Table (2) outlined the extinct mammal species in the country. A substantial number of country's remaining plants, mammals, birds and reptiles are currently under tremendous pressure. IUCN (2015) has listed a total of 156 species of mammals, birds, reptiles and amphibians under various degrees of risks in the country (Table 3). A reliable statistic on country's plant diversity is still unavailable, nevertheless, it is anticipated that already 10% of country's plant species gone extinct. A recent inventory by Bangladesh National Herbarium identified 106 vascular plants with risks of various degrees of threats (Khan *et al.*, 2001).

TABLE 2. Mammalian species extinct from Bangladesh in the past decades

Common name	Scientific name
Great one-horned rhinoceros	<i>Rhinoceros unicornis</i>
Javan rhinoceros	<i>Rhinoceros sondaicus</i>
Asiatic two-horned rhinoceros	<i>Didermocerus sumatrensis</i>
Blue bull /nilgai	<i>Boselaphus tragocamelus</i>
Wild buffalo	<i>Bubalus bubalis</i>
Gaur	<i>Bos gaurus</i>
Banteng	<i>Bos banteng</i>
Swamp deer	<i>Cervus duvauceli</i>
Marbled cat	<i>Canis lupus</i>
Sloth bear	<i>Melursus ursinus</i>

Sources: IUCN (2015 & 2000)

TABLE 3. Present status of inland and resident vertebrates in Bangladesh

Group	Total no. of species	Extinct	Threatened			
			Critically endangered	Endangered	Vulnerable	Total
Amphibians	49	0	2	3	5	10
Reptiles	167	1	17	10	11	39
Birds	566	19	10	12	17	58
Mammals	138	11	17	12	9	49
Total	920	31	46	37	42	156

Source: IUCN (2015)

6. BIODIVERSITY CONSERVATION INITIATIVES IN BANGLADESH

Despite a rapid loss and degradation of wild habitats, biodiversity conservation has received a wider attention in Bangladesh in the present years (Mukul *et al.*, 2017; Mukul, 2007). The government of Bangladesh, as a signatory party to various regional and international conservation related agreement and conventions, are now increasingly committed to

conserving country's remaining biodiversity. Already the government has ratified five major biodiversity-related conventions (i.e. Convention on Biological Diversity, Convention on International Trade in Endangered Species, Convention on the Conservation of Migratory Species, Ramsar Convention, and World Heritage Convention).

The country has also adopted various *in situ* and *ex situ* conservation measures to maintain its rich biological heritage. Declaration of protected areas, ecologically critical areas, World Heritage Site, Ramsar Sites are among the widely used ways for *in situ* conservation (Mukul *et al.*, 2008). At present, the country has 38 protected areas including 17 national parks and 21 wildlife sanctuaries distributed across the country. Together, the protected areas of Bangladesh cover nearly 17.5% of the forest area and 1.8% of country's total land area (Mukul *et al.*, 2017; Mukul *et al.*, 2008). In addition to that, the country has seven eco-park, two safari park and botanical gardens which also contribute significantly to the conservation of country's dwindling biodiversity.

7. CHALLENGES AND MAJOR THREATS TO BIODIVERSITY IN BANGLADESH

Biodiversity loss in Bangladesh is attributed to several socio-economic, bio-physical and organizational factors (Mukul *et al.*, 2014b & 2012a). Following are some key reasons behind the rapid biodiversity loss in the country.

- i. High population density, extreme poverty, and unemployment: Bangladesh is one of the world's densely populated countries with an extreme poverty and high unemployment rate. More than 85% population of the country are living in rural areas and somehow depends on various natural resources which lead to exploitation of plant and animal products for people's livelihood and income (Mukul *et al.*, 2012a). Rural fuel consumption pattern, which is strongly concerned with degradation of natural forest area is another important issue related to biodiversity depletion in the country (Mukul *et al.*, 2014c).
- ii. Climate change and sea level rise: Bangladesh is one of the largest victims of climate change and associated sea level rise. The majority of the country will go under water if the water level rises by 50 cm. The country has already experienced severe change in precipitation pattern, temperature etc. The climate change in the country will largely impact the persistence of large living animals and the ecosystems of which they are part (Alamgir *et al.*, 2015).
- iii. Habitat loss, degradation and fragmentation: Biodiversity conservation is strongly associated with the intact ecosystems and natural landscape, however, transformation of land use patterns, expansion of agricultural lands, changes in cropping pattern, introduction of high yielding varieties, urbanization, expansion of road networks, embankments, and other manmade factors have caused immense damage to wild habitats in all ecosystem types in the country. Following are some common reason of habitat loss, degradation, and fragmentation:

- o Land use change and agricultural expansions
 - o Encroachment
 - o Shifting cultivation
 - o Urbanization
 - o Commercial shrimp cultivation in coastal areas
- iv. Illegal poaching, logging and fuel wood collection: There is a big international market (largely illegal) of unregulated wild animals and their parts (e.g. teeth, bones, fur, ivory) mainly for their aesthetic and medicinal value (see Mukul *et al.*, 2012b& 2014b). Besides, illegal logging, fuelwood collection, unsustainable harvest of non-timber forest products including medicinal plants are also responsible for the depletion of biodiversity in the country (Mukul *et al.*, 2010; Khan *et al.*, 2009).
- v. Environmental pollution and degradation: One of the major threats to aquatic biodiversity in Bangladesh is pollution of soil and water. The aquatic ecosystem is the greatest victim and is polluted by toxic agrochemicals (i.e. chemical fertilisers, insecticides) and industrial effluents that cause depletion of aquatic and/or marine biodiversity.
- vi. Invasive alien species: A large number of exotic and non-native plant species have been introduced to the country since British colonial period for agriculture, horticulture, forestry, and fisheries (Mukul *et al.*, 2006). Some of the species have become escapes accidentally and having adapted to local conditions proliferated profusely. Some species although have naturalised but many have become invasive over local flora and fauna. Besides, replacing natural plantation with the monoculture of short rotation and fast growing species have threatened the existence of local fauna as they have not adapted to those species (Uddin *et al.*, 2013).
- vii. Limitations in legal and policy framework: Lack of adequate institutional or administrative frameworks and suitable policies, weak implementation of existing policies, lack of integration of sectoral activities are other additional challenges to the biodiversity conservation in Bangladesh (Chowdhury *et al.*, 2014; Rashid *et al.*, 2013). Besides, poor coordination and cross-sectoral integration, weak national information system and inadequate knowledge on ecosystem structure and function are the vital reason for biodiversity loss in the country.
- viii. Lack of political commitments and willingness: Unfortunately, there are no dealings of biodiversity, forestry or other relevant issues in the political campaign of the parties. In some cases, politically influential and elite persons are found involved in environmental degradation and illegal forest activities (e.g. encroachment).
- ix. Lack of public awareness: Lack of biodiversity-related information and knowledge inevitably leads to poor awareness and capacity for biodiversity conservation. Gaps in

awareness have identified at various levels from policy makers to grass root people that sometimes even leads to misappropriation of existing law. Besides, the lack of appropriate implementation of existing biodiversity laws and regulation are common in the country.

8. CONCLUDING REMARKS

Bangladesh is one of the most vulnerable countries due to global climate change and consequential sea level rise. The government should immediately seek for proper adaptation measures to cope with this inevitable event. Besides, focusing only on ecological aspects will not provide a long-term security of biodiversity conservation in the country since people still substantially depend on these resources for their existence. The government should actively involve local community people in natural resource management to secure the future of country's biological diversity. A well-coordinated program on monitoring and management of country's biodiversity is an urgent task. Inadequate institutional capacities and lack of trained manpower are the attributes of biodiversity and conservation issues malfunction in dealing with. Finally, government laws concerning biodiversity issue requires urgent reform considering country's changing socio-political context and the environment.

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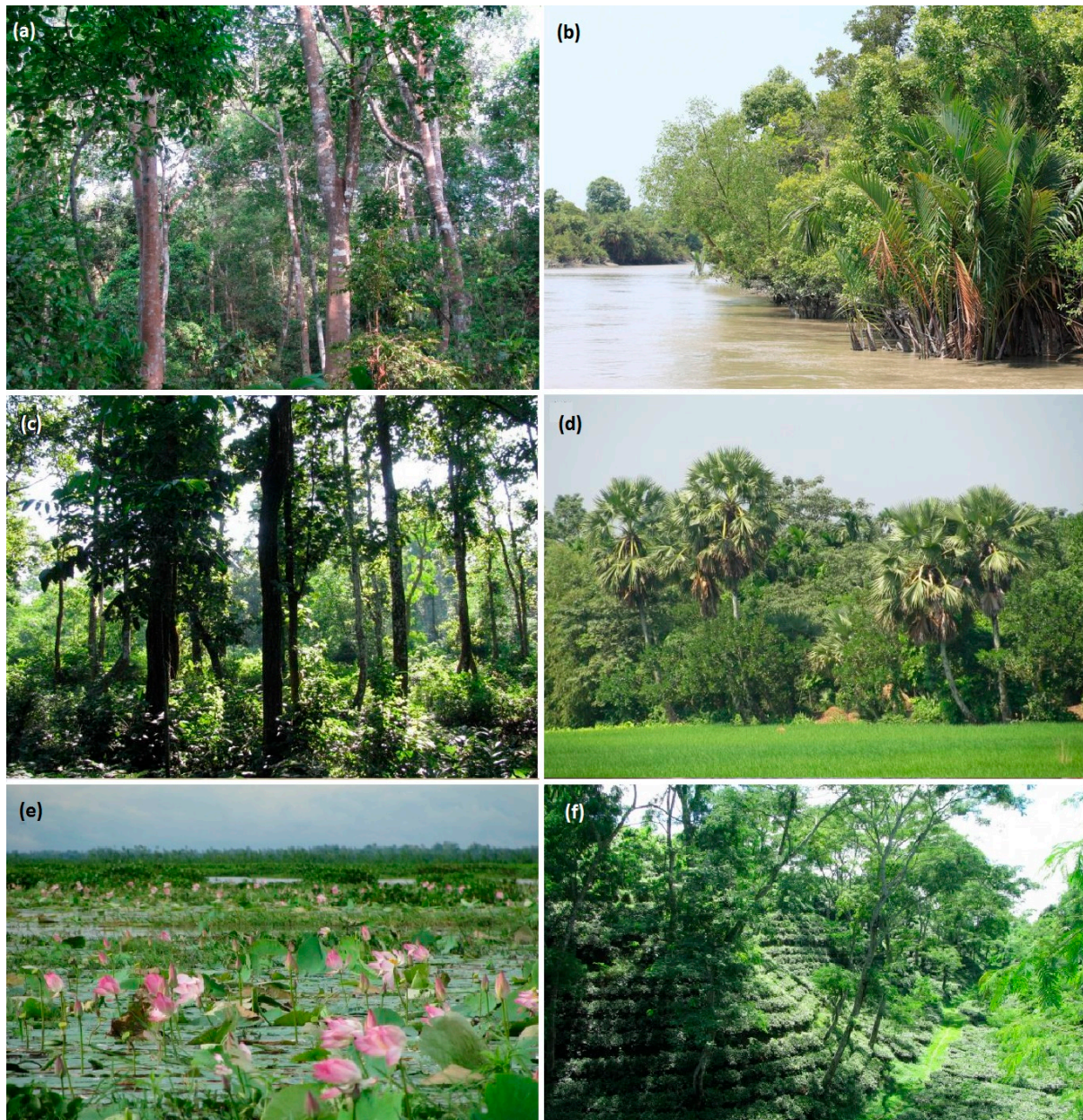


PLATE 1: Ecosystem diversity in Bangladesh: from top left - (a) hill forests dominated by dipterocarp species, (b) mangrove forests of Sundarbans, (c) Sal (*Shorea robusta*) forests in central Bangladesh, (d) homestead forests managed by the rural landowners, (e) Lotus (*Nelumbo nucifera*) flower in wetlands, and (f) Tea (*Camellia sinensis*) gardens in north-east Bangladesh.

(Photo credits: Sharif A. Mukul)

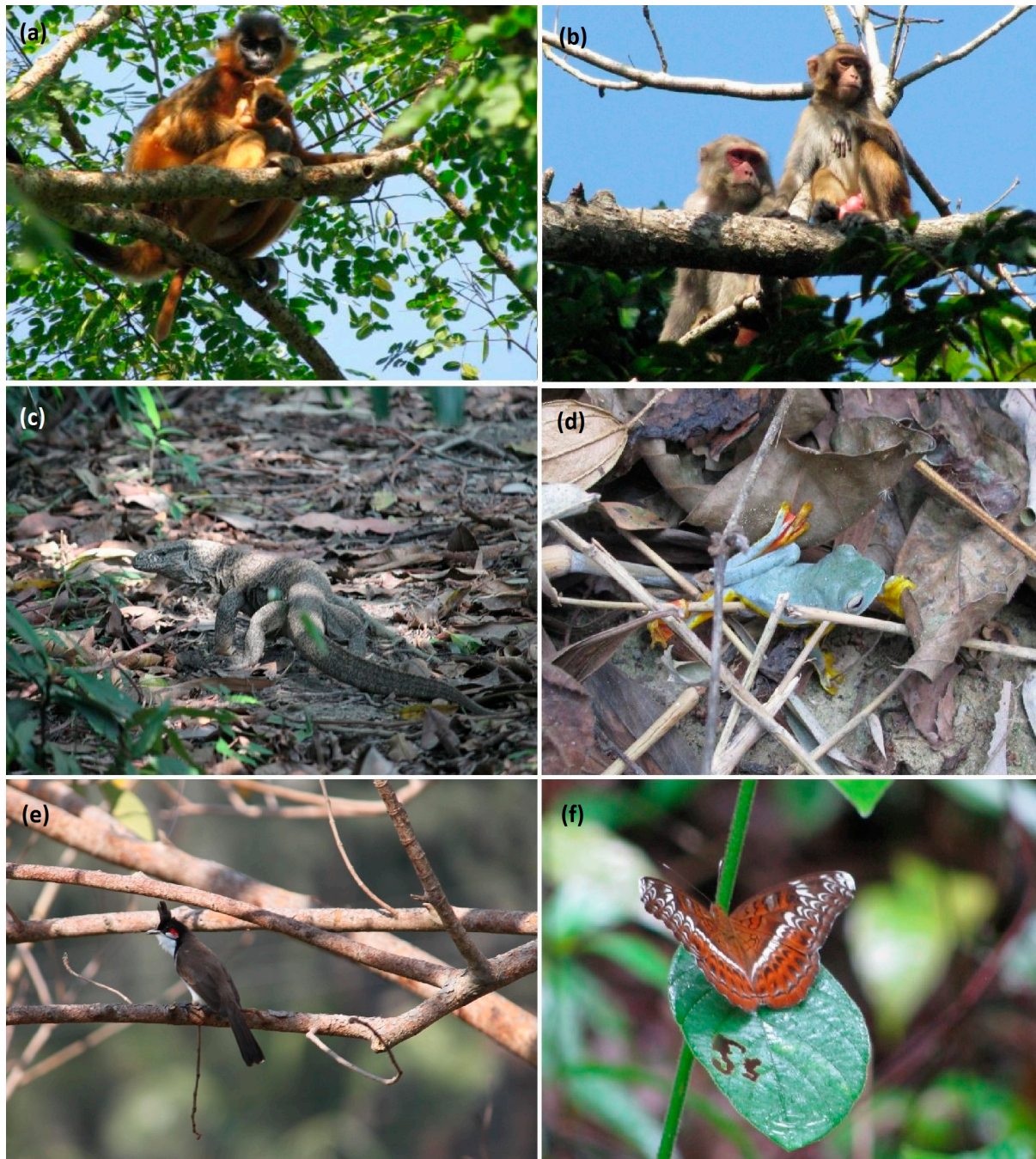


PLATE 2: Wildlife diversity in Bangladesh: from top left - (a) Capped langur (*Presbytis pileatus*), (b) Rhesus macaque (*Macaca mulatta*), (c) Bengal monitor (*Varanus bengalensis*), (d) Twin-spotted tree frog (*Rhacophorus bipunctatus*), (e) Red-whiskered bulbul (*Pycnonotus jocosus*), and (f) Knight Butterfly (*Labadea martha*).

(Photo credits: Sharif A. Mukul)



PLATE 3: Plant diversity in Bangladesh: from top left - (a) Kadam (*Anthocephalus chinensis*), (b) Akanda (*Calotropis gigantea*), (c) Ban chalta (*Dillenia pentagyna*), (d) Bhat (*Clerodendrum fragrans*), (e) Lantana (*Lantana camara*), and (f) Bon jam (*Ardisia colrata*).
(Photo credits: Sharif A. Mukul)

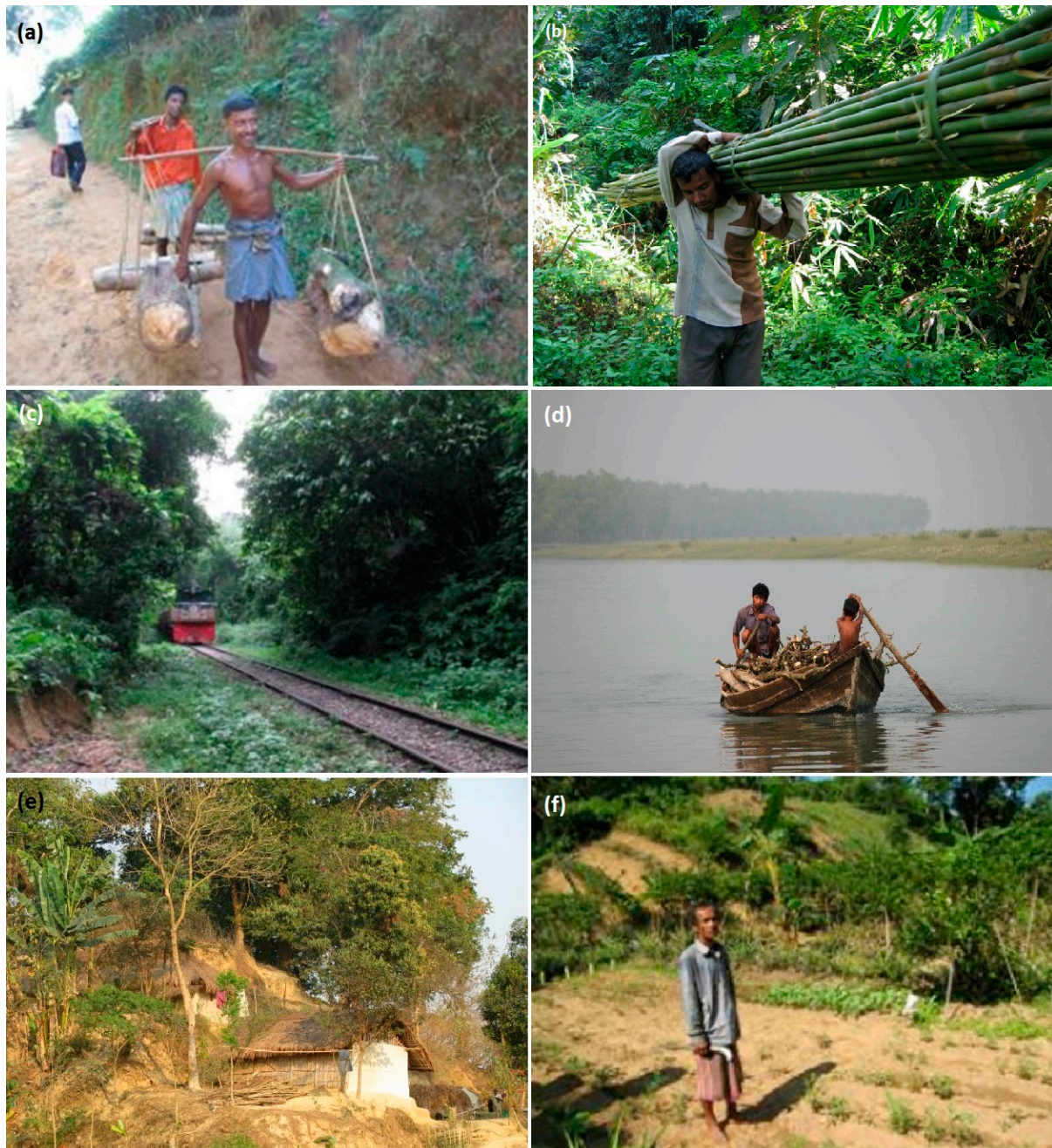


PLATE 4: Major causes of forest loss and disturbances in Bangladesh: (a) illegal logging in forests in Sylhet, (b) unsustainable non-timber forest products collection, (c) transportation through natural forests, (d) fuelwood collection, (e) encroachment of forest lands, and (f) agricultural expansion in forest lands.

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