

The Integration of Nature-Based Solutions into Climate Adaptation Policy and Planning in Bangladesh

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<https://doi.org/10.38126/JSPG180204>

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Keywords: national policies; climate change; ecosystem-based adaptation; ecosystem services

Executive Summary: Bangladesh is regarded as one of the most climate-vulnerable regions in South Asia due to its unique geographical location and socio-economic conditions. Natural disasters, changing temperatures, precipitation, and sea level rise have affected agricultural production, infrastructure, and livelihoods in the country. To face these challenges, nature-based solutions (NbS) can address climate change adaptation, protection and management of natural ecosystems, and biodiversity conservation. For example, in Bangladesh, coastal mangroves can protect communities from storm surge and sea level rise, forests in hilly regions can prevent landslides, and green spaces in urban areas can reduce heat stress and promote the well-being of inhabitants. However, effective design, implementation, and upscaling of NbS requires support from national policies and plans.

This study reviews relevant Bangladeshi national policies from the past three decades to investigate NbS as a potential framework to address climate change and societal challenges in the country. We systematically analyzed twenty policy documents across three sectors: national development; disaster management and climate change; and environment and forest. Our study found growing emphasis on preservation, protection, and management of natural ecosystems in the national policies. However, our analysis showed that among the twenty policies, nineteen of them have no direct mention of NbS terminology. Instead, the policies include various strategies and terminologies that fall under the NbS umbrella, such as ecosystem-based adaptation, ecosystem services, and green and eco-building. However, these policies are still widely missing specific implementation guidelines, robust financial support, and institutional mechanisms for monitoring and evaluating NbS initiatives in Bangladesh. We recommend several policy actions to facilitate effective and inclusive NbS interventions in Bangladesh: enhance inter-ministry cooperation; develop national funding support; develop a national promotional campaign; pursue evidence-based research and capacity-building activities; and involve youth, marginalized people, and women. These actions can optimize the benefits of NbS to enhance the country's resilience against climate change and foster sustainable development.

I. Introduction

Due to its geographic, demographic, and socio-economic conditions, Bangladesh is particularly susceptible to the adverse impacts of climate change.

According to the 2020 Global Climate Risk Index, Bangladesh stands at the seventh position among countries most affected by extreme weather events in the twenty-year period from 1999 through 2018

(Eckstein, et al. 2019). The country's freshwater, agricultural resources, and coastal infrastructure are particularly vulnerable to the changing temperatures, precipitation, and sea level rise that amplify the impacts of climate change in Bangladesh (USAID 2013; Islam and Nursey-Bray 2017; Mondal et al. 2019). Climate change is also exacerbating socio-economic vulnerabilities by adversely affecting low-income agriculture and aquaculture sectors, which depend on seasonal climate conditions (Mondal, et al. 2019). A recent government report found that 80% of farmers in the country acknowledged changes in climate, with more than half of the respondents reporting that their agricultural land had been adversely affected by floods, droughts, and cyclones in the previous five years (MoFA 2018). In addition to crop production, the fisheries sector is also vulnerable to the effects of climate change—cyclones and storm surges can damage aquaculture infrastructure and increase unemployment (MoFA 2018). Therefore, Bangladesh needs to address these challenges by keeping nature at the core of its climate adaptation response. Nature-based solutions (NbS) can address these complexities and promote sustainable development for the future of the country.

NbS broadly describes nature-oriented actions that address societal issues, such as food and water insecurity, natural disasters, poverty, and public health. NbS emerged as an integrated approach in the early 2000s to sustainably manage natural and modified ecosystems, which contributes to nature conservation and ensures socio-economic benefits to communities (Cohen-Shacham, et al. 2016). Studies have also framed NbS as an umbrella concept that incorporates ecological restoration, ecosystem-based adaptation (EbA), green infrastructure, and integrated coastal zone management (Cohen-Shacham, et al. 2019; Pauleit, et al. 2017). However, studies of NbS — which range from minimal intervention in existing ecosystems to the design and management of new ecosystems — demonstrate the emerging concept is still developing, and the terminology may not be widely used by decision-makers and practitioners (Almenar, et al. 2021; Cohen-Shacham, et al. 2016; Eggermont, et al. 2015; European Commission 2015).

Existing case studies of NbS illustrate the potential of such strategies around the world. Coastal wetlands in the United States protect communities from storm

surge and sea level rise and create economic stimulus by reducing flood insurance (Rezaie, et al. 2020). In Uruguay, coastal ecosystem restoration can reduce storm surge, coastal erosion, and inundation (Carro, et al. 2018). Another study on Burkina Faso indicates that protection of tropical forests can conserve water quality (Zongo, et al. 2017). In India, preserving mangroves provides protection from wind damage, storm surge, and coastal erosion (Badola and Hussain 2005).

Bangladesh, a developing country which is highly dependent on its natural resources for livelihood options, has practiced NbS informally to adapt to challenging climates. For example, the floating agricultural garden practice is well-known in South-Central Bangladesh, where 50% of the region is submerged under water (Irfanullah, et al. 2011). The local farmers apply indigenous knowledge to build “floating gardens” from local materials to grow crops and reduce food crises during the flood seasons (Alam and Chowdhury 2018). Bangladesh has also implemented large-scale coastal afforestation programs to reduce the impacts of storm surge and sea level rise (Rezaie, et al. 2019). The coastal forest areas, particularly the Sundarban Mangrove Forest, also play an instrumental role in carbon sequestration (Kibria 2014). However, even though select nature-based practices are already well-established, the potential of NbS in Bangladesh has not been translated into comprehensive policy action.

National policies in Bangladesh need to support the initiation, execution, and upscaling of NbS to address societal challenges (Cohen-Shacham, et al. 2019). While several national policies emphasize the importance of natural ecosystems for disaster management and climate change, they do not specifically address the implementation and monitoring of NbS (Tasnim, et al. 2020). Instead, the policies refer to a suite of various NbS-related approaches to mitigate climate change risks. In this study, we analyze national (1) development, (2) climate change and disaster management, and (3) environmental, forestry and biodiversity policy documents across three decades to understand the development and current state of NbS and related concepts in national policy discourse. We also present several policy insights and propose recommendations to further incorporate NbS into national policies to address climate change for the future of Bangladesh.

II. Methodology

The study entails a systematic analysis of twenty Bangladeshi national policy documents dated from 1992 to 2020 (Table 1). We focused on long- and short-term national development, climate change, disaster management, and environmental and biodiversity policies to understand the role of NbS in these policies to address climate change risks in the country.

We approached NbS as an umbrella term (Seddon, et al. 2021) and searched for the following keywords to analyze the policies: “nature-based solutions;” “ecosystem;” “ecosystem-based adaptation;” “green infrastructure;” and “ecosystem services.” We also included the keyword “disaster management” to examine whether the aforementioned approaches were considered as tools for addressing climate change and disaster management.

<i>National Sector</i>	<i>Policies</i>
Development	<ul style="list-style-type: none"> ○ Seventh Five Year Plan (2015) ○ Bangladesh Country Investment Plan for Environment, Forest and Climate Change (2017) ○ Bangladesh Delta Plan 2100 (2018) ○ Perspective Plan 2021 – 2041 (2020) ○ Eighth Five Year Plan (2020)
Climate Change and Disaster Management	<ul style="list-style-type: none"> ○ Bangladesh Climate Change Strategy and Action Plan (2009) ○ National Adaptation Program of Action (2009) ○ Climate Change and Gender Action Plan (2013) ○ Intended Nationally Determined Contributions (2015) ○ The National Plan for Disaster Management (2017) ○ Nationally Determined Contributions (2020)
Environment and Biodiversity	<ul style="list-style-type: none"> ○ National Environmental Policy (1992) ○ National Forest Policy (1994) ○ National Environmental Management Action Plan (1995) ○ Environment Conservation Act (1995) ○ Environment Conservation Rule (1997) ○ Revised National Forestry Policy (2016) ○ National Biodiversity Strategy and Action Plan of Bangladesh (2016) ○ Bangladesh Biodiversity Act (2017) ○ Revised National Environment Policy (2018)

Table 1: List of analyzed national policies identified across three sectors

III. NbS in the national policy discourse of Bangladesh

In this section, we present brief reviews of national policies across three sectors of Bangladesh to contextualize NbS in the historic policy discourse of Bangladesh (Table 1). Notably, most of these policies and acts were passed by the Bangladesh National Parliament, making them obligatory under the force of law. However, while citizens and economic agents

can be penalized under these policies, the government is not necessarily held accountable if policies are not implemented or goals are not met.

i. NbS in national development policies

Five long- and short-term national development policies establish the context of NbS in the country’s development sector (Figure1).

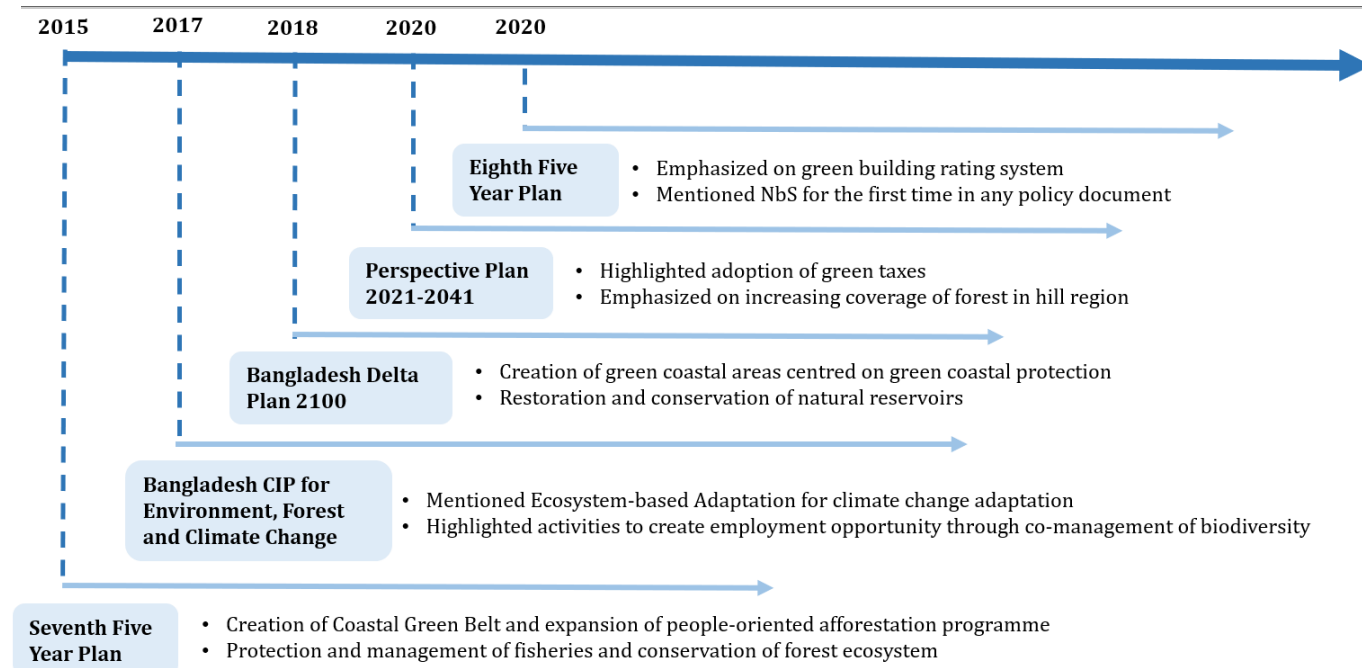


Figure 1: Timeline of national development policies

Seventh Five Year Plan (2015)

The Seventh Five Year Plan (7FYP) was published in 2015 by the General Economics Division of the Bangladesh Planning Commission. It aimed to develop strategies, policies, and institutions to accelerate job creation, reduce poverty, and meet Sustainable Development Goal targets. This document was a sequel to the Sixth Five Year Plan (FY2011-2015) aimed at completing the agenda of social and economic outcomes of the Perspective Plan of Bangladesh. The major targets of this plan focused on income and poverty, macroeconomic development, urban and human resource development, information and communication technologies, water and sanitation, energy and infrastructure, environmental sustainability, gender equality, and social protection (GED 2015).

The plan provided guidance for the government to sustainably use natural resources and maintain food security, and for concerned institutions, stakeholders, and parties to implement them. For example, the plan suggested, while offering limited details, removing trees that are detrimental to the environment to preserve forest ecosystems and protect endangered species of flora and fauna. The plan also highlighted expanding development of the Coastal Green Belt to reduce disaster risk and increase tree coverage along the coastline. In order to enhance biodiversity conservation and improve the

quality of forestry, the plan emphasized afforestation and reforestation activities in the country. The plan also focused on inclusive governance through expansion of a people-oriented afforestation program for poverty alleviation and employment opportunities. Additionally, in order to make cities more sustainable, the plan encouraged measures to “incorporate and introduce Green Building Code in the National Building Code to have energy efficient buildings to address climate change” (GED 2015). The recently updated National Building Code now includes a chapter on “energy efficiency and sustainability” which encourages sustainable construction practices and explains the concept of environmentally-friendly building designs (Bhattacharjee 2021). Protection and management of the fisheries was also among the suggested actions to address food security in the country (GED 2015).

Therefore, the 7FYP addressed multiple factors related to NbS for planning and practices, though there was no direct mention of the term in this crucial document. At present, several of the specified plans have been successful, including poverty alleviation, economic development, significant progress on food security, improved rural infrastructure, and better sanitation facilities (Alam 2019).

Bangladesh Country Investment Plan for Environment, Forest and Climate Change (2017)

The Bangladesh Country Investment Plan (CIP) for Environment, Forest, and Climate Change (EFCC) aimed to increase the contribution of EFCC sectors to national sustainable development through proper investment. The plan included enhanced provision of ecosystem services, thereby reducing poverty, improving environmental and human health benefits, and increasing resilience to climate change (MoEF 2017). The plan highlighted a variety of ecosystem services from nine main sources. For instance, coastal ecosystem services range between food, timber, climate regulation, storm and wave protection, and ecotourism. The EFCC CIP also mentioned EbA, which it defined as the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change (MoEF 2017).

The policy highlighted that the loss of ecosystem services can lead to financial losses (MoEF 2017). The plan set several strategic priority areas for investment, which included sustainable forest management (social forestry, afforestation, reforestation, coastal belt development), biodiversity conservation (conservation of protected areas and endangered species), and sustainable management of wetlands, rivers, and marine ecosystems, among others. These actions would further create employment opportunities for rural communities and allow them to benefit economically from the improved co-management of biodiversity-enriched areas (MoEF 2017).

The strategies outlined in the EFCC CIP for enhancing biodiversity and human well-being (employment generation) through sustainable management and conservation of natural resources aligns with the objectives of NbS. However, the plan did not explicitly use the term NbS; it instead used the term EbA, which is a vital component of the broader NbS umbrella.

Bangladesh Delta Plan 2100 (2018)

Bangladesh Delta Plan (BDP) 2100 is a long-term development plan to address challenges related to climate change in the Bangladesh Delta. The plan highlights the need for climate resilient ecosystem services (GED 2018). The plan focuses on agriculture and nature-based management strategies rather than infrastructure as a short-term adaptation strategy. For the medium-term, the plan suggests

implementing land and water management practices, such as green coastal protection, flood resilient habitats, natural reservoir restoration and conservation (GED 2018). Though the plan does not mention NbS; several elements of NbS, such as nature-based management strategies for adaptation, green coastal protection, and conservation of natural reservoirs, were included.

Perspective Plan 2021-2041 (2020)

The Perspective Plan (PP) 2021-2041, also known as Vision 2041, sought to eliminate extreme poverty and elevate the country's status to an upper-middle-income country by 2031 and high-income country by 2041. Conservation of land productivity and forest resources, and improvement of biodiversity and ecosystem services, were some of the key aspirations of Vision 2041. It also highlighted the adoption of green taxes (carbon taxes) as a highly effective policy for regulating polluters by discouraging the consumption of carbon dioxide-emitting fossil fuels (GED 2020a).

The plan takes steps to increase the forest coverage in hilly regions and protect the environment and biodiversity to reduce poverty. However, there were no definitive guidelines on how conservation of natural resources and improvement of biodiversity can lead to income generation and poverty reduction.

Eighth Five Year Plan (2020)

The Eighth Five Year Plan (8FYP) was published in 2020 to promote prosperity and foster inclusiveness. The plan emphasized the development and management of water resources in the Chittagong Hill Tracts, which include creating green belt and eco-friendly structures for erosion management and restoring and protecting water-related ecosystems (GED 2020b). Priority was also given to the adoption and creation of a "green building rating system" which would allow assessment of buildings against a set of criteria and recognition of their environmental performance (GED 2020b). Importantly, NbS was mentioned explicitly in the 8FYP — the first time in a Bangladeshi policy document. Though the plan did not provide any definition, guidelines, or strategies, it prioritized NbS in the upcoming National Adaptation Plan (NAP) of Bangladesh (GED 2020b).

ii. NbS in climate change and disaster management policies

Six national policies elucidate the context of NbS in natural disasters management and climate change response (Figure2).

Bangladesh Climate Change Strategy and Action Plan (2009)

The Bangladesh Climate Change Strategy and Action Plan (BCCSAP) was published in 2008 and further revised in 2009. This document included programs related to natural resources, such as land and water resources to ensure food security, disaster management, mitigation of greenhouse gas emissions, and low-carbon development. However, the plan did not outline detailed activities to implement these programs. It also included programs concerning research and knowledge management to comprehend the impacts of climate change on ecosystems and biodiversity (MoEF 2009a). Priority was given to expanding social forestry and coastal “greenbelt” afforestation programs to reduce greenhouse gas emissions. The government is in the process of revising the Action Plan and may address

NbS in the updated version, although elements of the concept are already present in the current plan.

National Adaptation Programme of Action (2009)

The National Adaptation Programme of Action (NAPA) was adopted by the Government of Bangladesh in 2005 and further updated in 2009. The updated version of NAPA incorporated findings from previous studies to deal with the adverse impacts of climate change. It also extended adaptation system measures from immediate and emergency to medium- and long-term. It emphasized four security issues of Bangladesh: food; energy; water; and livelihood security. NAPA highlighted the importance of water ecosystems, forest, and biodiversity measurement to monitor and research the impact of climate change (MoEF 2009b). It also mentioned strengthening community-based adaptation programs, such as afforestation programs, and deploying them in every disaster-prone part of the country as a potential adaptation system for disaster management (MoEF 2009b). However, it did not mention the term NbS or any of the related concepts, such as ecosystem services or EbA, that can address the impacts of climate change in the country.

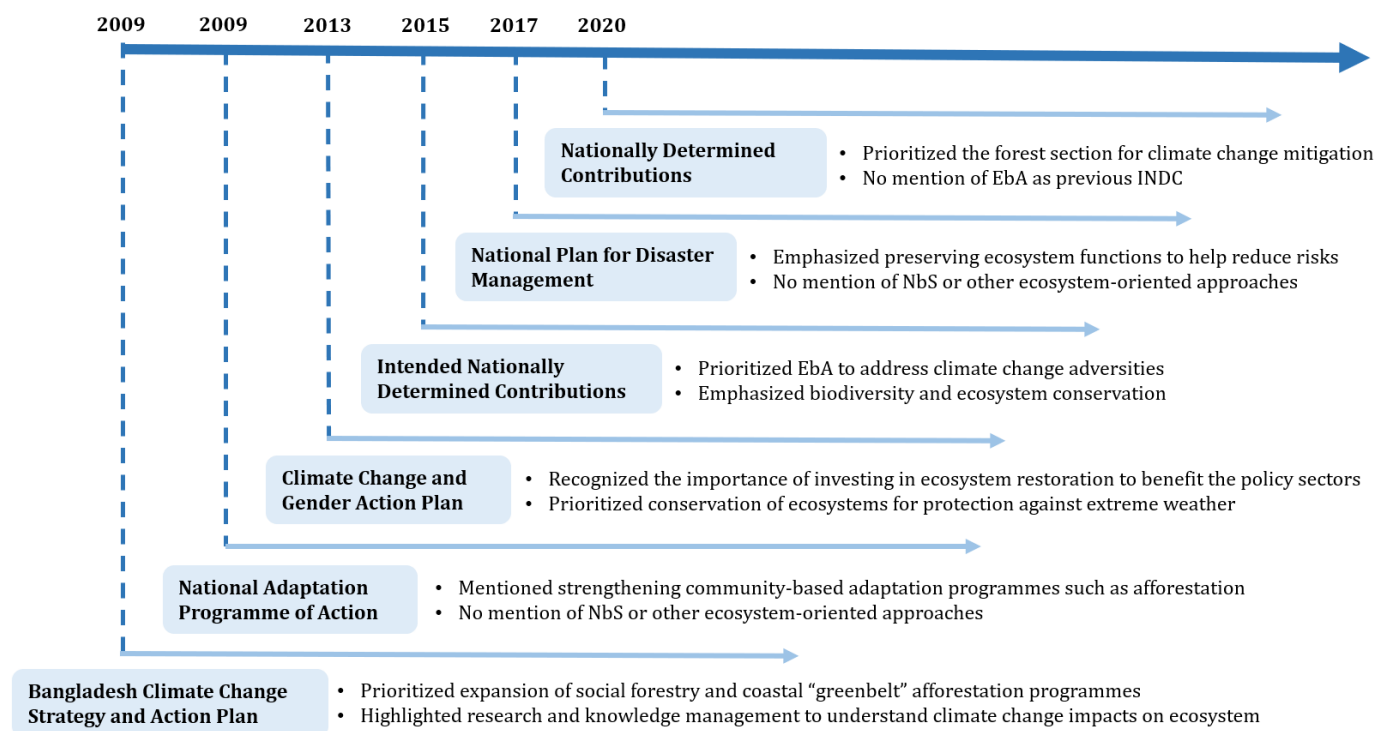


Figure 2: Timeline of climate change and disaster management policies

Climate Change and Gender Action Plan (2013)

The Bangladesh Climate Change and Gender Action Plan (ccGAP) was developed in 2013 to promote gender equality in climate change policies and strategies. The document recognized the impacts of climate change on marine and freshwater ecosystems, which in turn directly impacts employment opportunities (MoEF 2013). Investment in natural capital and conservation of ecosystems to avoid crises and catastrophes or to mitigate their consequences was also prioritized (MoEF 2013). While ccGAP does not mention any NbS terminologies in the document, it did emphasize natural ecosystem conservation.

Intended Nationally Determined Contributions (2015)

The Ministry of Environment and Forests published the Bangladesh Intended Nationally Determined Contributions (INDC) in 2015. The document identified a number of areas to address the adverse effects of climate change, including biodiversity, ecosystem conservation, and EbA (MoEF 2015). The document also provided an estimated cost of \$2.5 million USD for EbA (MoEF 2015). NbS terminology was absent in the document, although EbA and

ecosystem conservation falls under the NbS umbrella (Cohen-Shacham, et al. 2016).

The National Plan for Disaster Management (2017)

The National Plan for Disaster Management (NPDM) 2016-2020 was developed by the Ministry of Disaster Management and Relief in 2017 after the Plan of 2010-2015. The document focused on addressing the emerging risks of urbanization and climate change, and placed importance on disaster risk reduction. The Plan emphasized preserving ecosystems, though there was no mention of NbS (MoDMR 2017).

Nationally Determined Contributions (2020)

The Ministry of Environment, Forest and Climate Change submitted the interim Nationally Determined Contributions (NDC) of Bangladesh in 2020. The forest sector was prioritized for climate change adaptation, where initiatives included increasing forest cover, reducing forest degradation and deforestation, and implementing social forestry (MoEFCC 2020). However, whereas EbA was explicitly prioritized in the INDC 2015, neither EbA nor NbS were directly mentioned in the interim NDC.

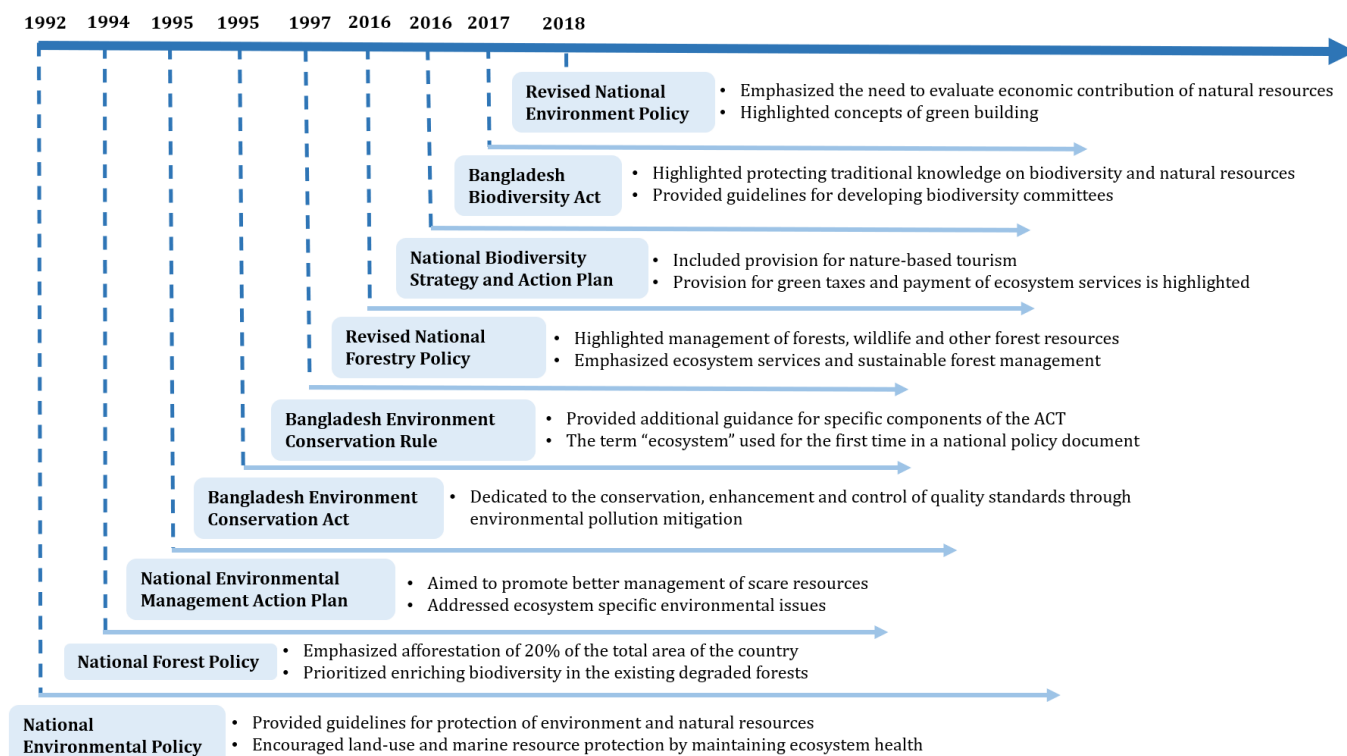


Figure 3: Timeline of national environment and forest policies

iii. NbS in environment and forest policies

Nine national policies, acts, and rules contextualizing NbS relate to environment and forests (Figure 3).

National Environmental Policy (1992)

The main theme of the National Environmental Policy (NEP), enacted in 1992, was to maintain ecological balance and overall development through environmental protection and improvement. It provided multiple guidelines to protect the environment and natural resources across fifteen sectors (including agriculture, industry, health, energy, water development, flood control and irrigation, land, forest, wildlife and biodiversity, fisheries and livestock, food, and coastal and marine environment). Although the policy did not include the concept of NbS, it encouraged land-use and marine resource protection by developing and maintaining ecosystem health. It also considered environmental impacts while planning urbanization and housing (MoEF 1992).

National Forest Policy (1994)

The National Forest Policy (NFP) was enacted in 1994 to initiate a twenty-year Forestry Master Plan. The main objectives of this policy were to: afforest about 20% of the country; enrich biodiversity in the existing degraded forests; and fulfill national responsibilities and commitments relating to global warming (GoB 1994). As of 2019, the forest cover of Bangladesh is about 17% of the total land area of the country (Reza and Hasan 2019). While NbS was not introduced at that point, the policy highlighted afforestation and enriching biodiversity, which can be considered as components of NbS.

National Environmental Management Action Plan (1995)

The National Environmental Management Action Plan (NEMAP) promoted better management of scarce resources to reverse current trends in environmental degradation, and also to raise awareness of the environment (MoEF 1995a). These interventions aligned with the objectives of NbS to sustainably manage natural resources. The plan developed a forecasting mechanism for disasters, community awareness, and disaster management plans to reduce the impact of natural hazards (MoEF 1995a).

Bangladesh Environment Conservation Act (1995) and Rule (1997)

The Bangladesh Environment Conservation Act (ECA) was passed in 1995 and accompanied by the 1997 Rules. The Act was dedicated to the conservation and enhancement of environmental conditions. It provided guidelines to ensure quality standards for the environment by reducing pollution from the various environmental polluting industries and sectors (MoEF 1995b). Moreover, the Environment Conservation Rules adopted in accordance with the 1995 Act provided additional guidance for specific components of the Act (Clemett 2006). The term “ecosystem” was defined in this policy document (MoEF 1995b).

Revised National Forestry Policy (2016)

In 2016, Bangladesh updated the National Forest Policy (1994). The objective was to manage all existing forests, wildlife, and other forest resources to build sustainable management and climate resilience, enrich degraded forest areas, and produce a wide range of goods and services for the ecosystem (MoEF 2016a). The policy planned to cover at least 20% of the country with trees by 2035 to enrich forest areas. It also enhanced ecosystem services and sustainable forest management in order to address the effects of climate change on forest ecosystems (MoEF 2016a). Thus, the policy includes several (forest ecosystem-based) components of NbS.

National Biodiversity Strategy and Action Plan of Bangladesh (2016)

The National Biodiversity Strategy and Action Plan (NBSAP) implemented the three objectives of the international Convention on Biological Diversity (CBD): conservation of biodiversity; sustainable use of natural resources; and fair and equitable sharing of the benefits arising from the utilization of genetic resources. This document included provisions for nature-based tourism as well. Furthermore, it evaluated ecosystem goods and services to integrate into national accounting. Additionally, it included policies for green taxes, payment for ecosystem services, and fines for polluters to protect biodiversity and control pollution (MoEF 2016b).

Bangladesh Biodiversity Act (2017)

Bangladesh is one of the state members of the CBD, and to protect the global and national commitment to biodiversity conservation and implement the NBSAP,

the Ministry of Environment, Forest and Climate Change adopted the Bangladesh Biodiversity Act (BBA) in 2017. It provided clear directives for increasing biodiversity and protecting endangered species. This document further aimed to protect traditional knowledge of biodiversity and natural resources. In addition, it provided guidelines for developing biodiversity committees at the national to local levels (MoEFCC 2017). Even though the Act did not provide directives for NbS, it emphasized the protection and management of natural resources and biodiversity.

Revised National Environment Policy (2018)

The National Environment Policy was adopted in 2018 to protect the environment, control pollution, and conserve biodiversity from the negative impacts of climate change (MoEF 2018). It emphasized evaluating the economic contribution of natural resources and highlighted multiple vital strategies, like polluter fines, payment for ecosystem services, and emission taxes (MoEF 2018). It also stressed the need to ensure equitable accessibility to ecosystem services by local people (MoEF 2018). In addition, this policy highlighted components of NbS, such as green- and eco-building and energy efficient construction for future urbanization (MoEF 2018).

IV. Findings and discussion

i. Distinguishing Nbs concepts in the existing policies of Bangladesh.

Bangladesh's EFCC CIP, ccGAP, INDC, and NBSAP frequently mentioned **EbA** in the policy documents. EbA primarily focuses on climate change adaptation and has a more limited scope than NbS, although it is a component of NbS (Pauleit, et al. 2017). According to Seddon et al. (2020), NbS has the potential to tackle both climate adaptation and mitigation challenges at low cost while delivering multiple additional benefits for people and nature. For example, restoring natural forests in upper catchments can protect communities downstream from flooding, increase carbon sequestration, and protect biodiversity (Seddon, et al. 2020). Thus, EbA focuses on participatory community-based adaptation strategies by emphasizing sustainable management, conservation, and restoration of ecosystems. In contrast, NbS differ from traditional biodiversity conservation and management approaches by specifically aiming to address broad

societal goals such as human well-being, poverty alleviation, and socio-economic development (Seddon, et al. 2020). An example of NbS is planting trees and increasing green spaces in cities to help with urban cooling and flood abatement while also storing carbon, mitigating air pollution, and providing health benefits (Seddon, et al. 2020).

More recently published policies have started to explore the concept of **green infrastructure**. This particular approach falls under the NbS umbrella (Cohen-Shacham, et al. 2019; Eggermont, et al. 2015). Green infrastructure is a planning approach which can provide strategic guidance for integrating NbS in developing green spaces at various scales (Pauleit, et al. 2017). However, the limited appearance of green infrastructure in the policies may indicate a lack of understanding of the concept, which is at the heart of NbS. (Jato-Espino, Sañudo-Fontaneda and Andrés-Valeri 2018).

We also investigated the concept of **ecosystem services**. This term is more frequently used than the other ecological approaches (i.e. EbA and green infrastructure) mentioned in the policies, and refers to benefits people obtain from ecosystems (Pauleit, et al. 2017). Ecosystem services are often valued for providing immediate benefits to human well-being and economy, while NbS emphasizes benefits to people *and* the environment itself, which allows for sustainable solutions that are able to respond to environmental change and hazards in the long term (Eggermont, et al. 2015).

Across the policies, **disaster management** is a major concern, especially in the national development policies and climate change policies. However, in most policies, creating coastal green belts or coastal afforestation is the only initiative presented for disaster management. There are other NbS initiatives that can be tapped for disaster management. For example, green roofs can reduce stormwater runoff by promoting rainfall infiltration on the tops of buildings, and open spaces such as parks and greenways can capture runoff from upstream basins and adjacent areas (World Bank 2018). By mainstreaming NbS in national policy and planning, these multiple benefits of NbS can be exploited for managing and reducing disasters in urban, freshwater, and coastal areas.

NbS are also meant to engage and integrate indigenous peoples and local communities (Seddon, et al. 2021). In PP 2021-2041, the policy emphasized increasing forest coverage in hilly regions without considering the impact on the ethnic communities there. Through the integration of NbS, these issues might be addressed by policies in a more structured and inclusive manner. Moreover, most of the approaches to address the adverse effects of climate change are engineered interventions; in Bangladesh, 291 out of 329 (88%) adaptation projects approved by the Bangladesh Climate Change Trust between 2009 and 2016 involved engineered interventions, while only thirty-eight involved NbS (Seddon, et al. 2020). Although NbS concepts and related terminology have entered the policy discourse of Bangladesh, systematic uptake of the approaches has been lacking. NbS can function as a framework for these approaches and ensure systematic integration into the policies and further effective implementation.

ii. Prevalence of NbS-related terminology and concepts in the policy discourse

The results of the policy review suggest that, throughout the past three decades, several policies in Bangladesh emphasized ecosystem-oriented approaches, such as EbA, green or eco-building, enhancing biodiversity, and conservation of natural resources (Figure 4 and Table A1). The policy documents also emphasized disaster management. However, these concepts have remained disconnected; none of these documents applied EbA or ecosystem services as a potential tool for disaster management. Additionally, among the twenty policies, nineteen of the policies did not explicitly mention or use the term NbS to address societal challenges and climate change in the country; the recent 8FYP was the first policy document to do so, suggesting an emerging awareness of the terminology in the policy discourse (Table A1).

Across the national development policies, the recent documents incorporate ecosystem conservation and improvement, along with emphasizing the importance of EbA and green infrastructure. Bangladesh EFCC CIP (2016-2021) used “EbA” the most among these policies, while BDP 2100 and 7FYP prioritized “ecosystem” conservation and “disaster management,” respectively. The use of these terms is also prevalent in the national climate change and

disaster management policies. EbA was prioritized across two documents (ccGAP and INDC)—these policies mostly focused on conservation of existing ecosystems rather than on restoration.

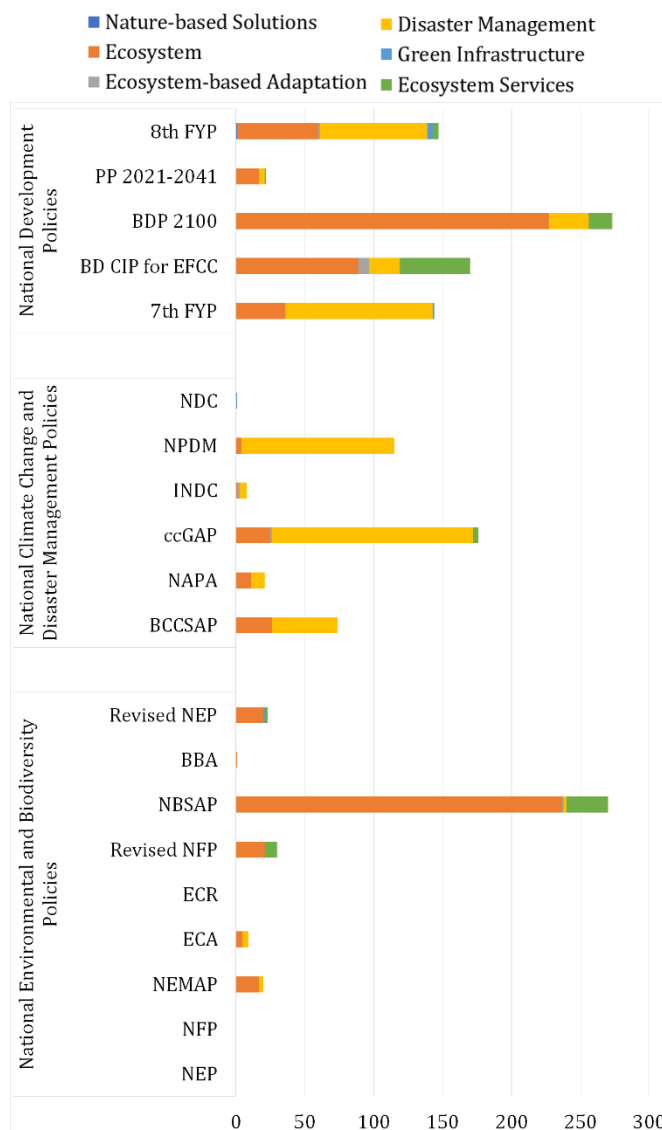


Figure 4: Frequency of nature and ecosystem-oriented keywords in the national policies (arranged in reverse chronological order per sector)

The environment and forest policies focused on the protection, management, and conservation of natural resources and ecosystems, with recent policies tilting more towards the enrichment of ecosystems as well as equitable access and finance of ecosystems.

The term “NbS” appeared in the 8FYP, as it stated that the upcoming NAP would prioritize NbS. However, although NbS appeared for the first time in a Bangladeshi policy document, the plan includes

neither any explanation of the term nor any national guidelines or strategies. It is important that the term is being understood properly to facilitate effective strategies and implementation. Nonetheless, the use of the term in the 8FYP and its prioritization in the NAP can be considered as the first step for mainstreaming NbS.

Among the other policies, none used or applied the term “NbS” to address societal challenges or climate change in Bangladesh; nevertheless, several policies (7FYP, EFCC CIP, and PP 2021-2041) highlighted the importance of conservation, protection, and management of forest ecosystems, resources, and fisheries. Protection, conservation, and management of these ecosystems fall under NbS according to Eggermont et al. (2015). NbS also incorporates the creation of new ecosystems, such as green roofs (Eggermont, et al. 2015). Furthermore, according to the International Union for Conservation of Nature (IUCN) definition of NbS, the concept can be regarded as a tool for addressing societal challenges, such as mitigating climate change and providing socio-economic benefits (IUCN 2020). Integrating NbS in policies, not just its umbrella-enveloped concepts addressing environmental conservation, may have the benefit of addressing social and economic challenges more extensively than simple conservation measures.

iii. Global commitments and upcoming policies in Bangladesh that include NbS

NbS is gaining rapid attention in global climate change discussions. For instance, the United Nations (UN) Climate Action Summit of 2019 included NbS as one of its main tracks; the 25th Conference of the Parties to the UN Framework Convention on Climate Change discussed NbS, and China and New Zealand created a “Nature-based Solution Coalition.” To align and keep up with global knowledge and trends, it is important that policymakers recognize NbS concepts at the national level to realize its potential.

The people and government of Bangladesh have appreciated nature-based actions, which is evident in the policy documents such as BDP 2100, 7FYP, INDC, and BCCSAP. Additionally, the 8FYP prioritized NbS in the NAP of Bangladesh. As an emerging term, policymakers and stakeholders can continue discussing NbS to carry out effective implementation and inclusion of this framework for climate change

adaptation and mitigation in the national policy discourses.

iv. Lack of financial provisions for NbS

Funding for ecosystem and NbS-related actions infrequently occur in the selected national policies. For instance, some policies proposed green taxes and payments for ecosystem services. However, potential investors and donors, financing, and allocation strategies for the ecosystem-oriented approaches are not outlined in these policies. Thus, government investments on these approaches are scattered, and relevant funding is mostly integrated into development or climate change budgets. Subsequently, monitoring and evaluation of how much of these finances flow to NbS and related concepts is difficult to quantify.

There are funding mechanisms for climate change adaptation issues, such as Adaptation Fund, Green Climate Fund, and Bangladesh Climate Change Resilience Fund. Depending on project objectives, the government can acquire financial support through these funds to carry out NbS-related projects. However, to monitor and evaluate financing towards NbS, it is important to establish robust financing mechanisms and reporting systems for NbS-related projects.

v. Realizing the limitations of NbS and this analysis

While promoting the integration of NbS in national policy documents, we need to acknowledge that NbS also entail challenges and limitations. In terms of participation and equity, there is a lack of public understanding of NbS, and the social and cultural elements important for promoting sustainable development (Nelson, et al. 2020). Furthermore, the potential of NbS in providing intended benefits has not been rigorously assessed. The cost-effectiveness of NbS interventions compared to engineered alternatives are also not clear (Seddon, et al. 2020). In addition to evaluating the efficacy of natural solutions for climate change, we need to conduct further research assessing the feasibility and long-term responses of NbS to global warming and sea level rise (Molino, Kenney and Sutton-Grier 2020). There are possibilities of trade-offs arising from climate mitigation policies if they encourage NbS with low biodiversity value, such as afforestation with non-native monocultures. This can result in maladaptation, especially in a rapidly changing world

where biodiversity-based resilience and multi-functional landscapes are key (Seddon, et al. 2020). Moreover, at the governance level, even though there is increasing political will at various scales (local, national, regional, and global), governments may lack the commitment to implement various nature-based initiatives (Nelson, et al. 2020). Hence, the term “solutions” allow NbS to promote the idea of quick and tidy outcomes, but these solutions require ongoing evaluation to learn from past decisions. Thus, realizing the potential of NbS depends on effective consultation with the public and policymakers, and addressing not just the possible benefits, but also the tough road to get there (Nelson, et al. 2020).

Finally, this study analyzed twenty policies to assess the national policy landscape in the context of using to address societal challenges in Bangladesh. While verifying the outputs and practical applications of past policies and plans was beyond the scope of this study, future research can consider primary data collection and stakeholder consultations to investigate the impacts, progress, and outcomes of NbS policies. Moreover, we studied only recent national development policies and climate change and disaster management policies, as the older policies in these sectors generally did not consider ecosystem and nature-oriented concerns; the inclusion of these approaches is relatively recent in these sectors. However, the environment and forest policies have considered nature and ecosystems for decades, so we considered older policies in these sectors.

V. Policy recommendations

Realizing the full potential of NbS requires that national policies rigorously address components focused on climate change adaptation and mitigation. As discussed in Section IV, there are various entry points to integrate NbS and contribute to future sustainable approaches for climate change adaptation in Bangladesh. Based on the analysis, the following issues should be addressed to integrate the holistic indicators of NbS at the national policy level:

i. Adopt NbS across national development, climate change, environmental, and forestry policies: Several national policies have already prioritized natural ecosystems and their conservation in development, climate change, and disaster risk reduction strategies,

along with the latest policy document mentioning NbS for the first time. Thus, NbS and its components can be adopted among these national development policies to ensure the future sustainable development for nature, as well as human well-being, in Bangladesh.

ii. Strengthen inter-ministerial and inter-departmental coordination and cooperation to promote NbS: The government needs to ensure coordination amongst various sectors to ensure a sustainable future. As NbS is an umbrella concept emphasizing multiple sectors (water, disaster, land, soil, infrastructure, etc.), stronger coordination across these various sectors, from the local to national level, is vital to implement NbS.

iii. Provide funding for NbS in national policies: Finance is a vital issue in implementing various interventions of NbS. Bangladesh EFCC CIP and NBSAP highlight several funding mechanisms for environment, forest, and climate change programs. Future policies can develop specific guidelines for funding and investment of NbS. For example, encouraging private-public partnership for financing nature-based interventions, requiring nature-friendly taxes, reducing fees on NbS interventions, or employing incentive schemes or compensation mechanisms can help fund NbS initiatives. Additionally, international funding can be tapped through global climate change negotiation to promote NbS as an effective adaptation strategy. Proper measurement, reporting, and verification systems can also ensure sustainable finance mechanisms to benefit from NbS.

iv. Strengthen monitoring and evaluation mechanism of national policies on NbS: As mentioned in Section IV, the cost-effectiveness of NbS interventions compared to engineered alternatives and their resilience to climate change are still not clear (Seddon, et al. 2020). Thus, it is highly important to formulate specific indicators and mechanisms for monitoring and evaluating NbS, and integrate these across various policies to evaluate the efficacy of NbS.

v. Develop a national platform for NbS with concerned stakeholders: A national platform for NbS can provide common knowledge to share with multiple stakeholders, including policymakers, local communities, experts, and other concerned parties to

discuss various challenges and strategies for proper implementation of NbS. This platform can achieve policy advocacy, research and knowledge management, and capacity building of the concerned stakeholders. A web portal can also be developed to gather available data and information around the NbS interventions in Bangladesh. Hence, this platform can function as a knowledge bridge between policymakers, practitioners, and local community members, as well as to enhance knowledge on NbS.

vi. Ensure inclusive participation of women, youth, and marginalized people as vital actors of NbS implementation: NbS seeks to ensure that policies are inclusive and participatory. As women, youth, and other marginalized groups are often highly vulnerable to climatic threats, they should be considered as important agents for implementing NbS policies. The Bangladesh Biodiversity Act (2017) and National Environment Policy (2018) highlighted the need to ensure the equitable accessibility of the variety of ecosystem services by local people. Therefore, national policies and plans should include the involvement of marginalized communities, youth, and women to facilitate equitable implementation of NbS practices.

VI. Conclusion

Bangladesh is extremely vulnerable to climate change, and the government has already acknowledged the need to adapt to the changing climate at the national policy level. While the country is rapidly developing and prioritizing adaptation strategies by focusing on infrastructure, it needs to acknowledge the role nature plays in its economy, disaster risk reduction, and climate change

adaptations. Ecosystem and nature-oriented approaches have long been practiced in the country, however, the terminology of NbS has only recently attained momentum.

Our findings suggest that earlier national policy documents emphasize protection, conservation, and management of the country's natural ecosystems and included several relevant actions that fall under the umbrella of NbS. However, these concepts and approaches have limitations that NbS can help overcome, which can also address sustainable development, human well-being, and biodiversity. The term was used in the recently published 8FYP, which indicates that the policy sphere of Bangladesh is ready to take on and explore the potential of the concept. Therefore, NbS can be applied as a potential mechanism in upcoming policies in a more structured and inclusive manner to address climate change adaptation and disaster management.

While promoting NbS across the policy discourse in addressing climate change and socio-economic challenges, we must recognize that the concept is still new and consider challenges and limitation of NbS to avoid maladaptation. In light of limitations, consultation with relevant stakeholders, facilitation of inter-ministry coordination, development of national funding and monitoring mechanisms, and pursuit of evidence-based research can enhance effective implementation of NbS in the country. Finally, inclusion of local knowledge and involvement of youth, marginalized people, and women can ensure transparent governance and foster Bangladesh's resilience against climate change.

Appendix: Occurrence of terminologies related to NbS in policy documents of Bangladesh 1992 to 2020

	Policy	Year	NbS	ES	EbA	DM	GI	ESS
National Development Policies								
1.	Seventh Five Year Plan	2015	0	36	0	107	1	0
2.	Bangladesh Country Investment Plan for Environment, Forest and Climate Change	2017	0	89	8	22	0	51
3.	Bangladesh Delta Plan 2100	2018	0	227	0	29	0	17
4.	Perspective Plan 2021-2041	2020	0	17	0	4	0	1
5.	Eighth Five Year Plan	2020	1	59	1	78	4	4
National Climate Change and Disaster Management Policies								
6.	Bangladesh Climate Change Strategy and Action Plan	2009	0	26	0	48	0	0
7.	National Adaptation Programme of Action	2009	0	11	0	10	0	0
8.	Climate Change and Gender Action Plan	2013	0	25	1	146	0	4
9.	Intended Nationally Determined Contributions	2015	0	1	2	5	0	0
10.	National Plan for Disaster Management	2017	0	4	0	111	0	0
11.	Nationally Determined Contributions	2020	0	0	0	0	1	0
National Environment and Biodiversity Policies								
12.	National Environmental Policy	1992	0	0	0	0	0	0
13.	National Forest Policy	1994	0	0	0	0	0	0
14.	National Environmental Management Action Plan	1995	0	17	0	3	0	0
15.	Environment Conservation Act	1995	0	5	0	4	0	0
16.	Environment Conservation Rule	1997	0	0	0	0	0	0
17.	Revised National Forestry Policy	2016	0	21	0	0	0	9
18.	National Biodiversity Strategy and Action Plan of Bangladesh	2016	0	237	1	2	0	30
19.	Bangladesh Biodiversity Act	2017	0	1	0	0	0	0
20.	Revised National Environment Policy	2018	0	20	0	0	1	2
	Recurrence of terminologies highlighted in the policies		1	796	13	569	7	118

Table A1: Tabulated occurrence of terminologies related to NbS in policy documents of Bangladesh from¹

¹Nature-based Solutions (NbS); Ecosystem (ES); Ecosystem-based Adaptation (EbA); Disaster Management (DM); Green Infrastructure (GI); Ecosystem Services (ESS). The bottom row (in grey) represents the total uses of terminologies highlighted in the policies.

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