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Legal and Institutional Frameworks Governing Invasive Plant Species and Biodiversity in Bangladesh

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ABSTRACT

In Bangladesh, invasive plant species (IPS) are the greatest danger to biodiversity loss. Since British colonialism, hundreds of non-native plant species have naturalised in Bangladesh's landscapes. These trends are likely to be perpetuated through economic globalisation. The Global Register of Invasive and Alien Species (GRIIS) develops a confirmed list of Bangladeshi IPS. Bangladesh is committed to achieving the Aichi Convention's target to identifying major IPS and their passageways, administering or eliminating priority species, and managing passageways to halt their naturalisation. However, existing piecemeal and fragmented soft-law and hard-law instruments relevant to environment, forestry, quarantine and biodiversity are not well enough to protect biodiversity. In this regard, the country needs to develop its own comprehensive community-centred IPS governance legislative frameworks to safeguard biodiversity. This systematic review outlines and evaluates existing soft and hard law instruments and identifies their fundamental shortcomings. To achieve these aims, qualitative research methods is adopted with comprehensive analysis and evaluation of national soft and hard law instruments. However, the lack of comprehensive articulation and implementation challenges of both hard-law and soft-law instruments, reveal the inadequacy of national legislative and institutional frameworks. Therefore, it is recommended that there be community-based adaptive IPS legislative frameworks for sustained biodiversity conservation.



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1. Introduction

In Bangladesh, Invasive plant species (IPS) is regarded as the main threat to biodiversity (Afrin et al., 2010, p. 64). In order to govern environment and biodiversity, Bangladesh developed the National Environment Policy 2018, Forest Policy 2016, Agriculture Policy 2018 and the National Biodiversity Strategy and Action Plan 2016; the Bangladesh Environment Conservation (Amendment) Act 2010, Forest Act 1927 and its amendments, Draft Forest Act 2019, Bangladesh Plant Quarantine Act 2011, and Biological Diversity Act 2017.¹ The Convention on Biological Diversity (CBD),² also emphasised that ‘each contracting party shall, as far as possible and as appropriate, prevent the introduction of, control, or eradicate those alien species which threaten ecosystems, habitats, or species’.

The International Union for the Conservation of Nature (Species Survival Commission, Invasive Species Specialist Group [SSC ISSG], 2000) has also issued guidelines for preventing biodiversity loss caused by invasive alien species (IAS), as well as recommended management and/or eradication measures. Bangladesh is a member of both the CBD and IUCN and committed to fulfilling the requirements imposed by the international legal and institutional frameworks. Hundreds of non-native plant species have altered Bangladesh’s landscapes for aesthetic and economic reasons since British colonisation (Afrin et al., 2010). Due to the globalisation of economies and growing trade between nations, these trends are expected to continue. In Bangladesh, alien IPS have been blamed for lower agriculture and forest production and a loss of biological diversity (Afrin et al., 2010). As a member of the CBD and the IUCN, Bangladesh should take measures to mitigate the damage caused by alien IPS. As a signatory to the WTO SPS Measures 1995,³ Bangladesh should support trade liberalisation and substantiate all trade restrictions with scientific justification. The applicability and effectiveness of the ‘CBD and IUCN’ (SSC ISSG, 2000) measures would prevent alien IPS transportation and establishment in Bangladesh; however, economic imperatives introduced by the WTO SPS Measures⁴ through trade liberalisation rules would facilitate plant invasion. According to the Bangladesh National Herbarium (Khan et al., 2001,

¹ The National Environment Policy 2018, Forest Policy 2016, Agriculture Policy 2018 and the National Biodiversity Strategy and Action Plan 2016; the Bangladesh Environment Conservation (Amendment) Act 2010, Forest Act 1927 and its amendments, Draft Forest Act 2019, Bangladesh Plant Quarantine Act 2011, and Biological Diversity Act 2017.

² Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) vol. 1760 United Nations Treaty Series, p. 79, https://treaties.un.org/pages/ViewDetails.aspx?chapter=27&mtdsg_no=XXVII-8&src=TREATY.

³ Marrakesh Agreement Establishing the World Trade Organization (adopted 15 April 1994, entered into force 1 January 1995) vol. 1867 United Nations Treaty Series, p. 3, <https://treaties.un.org/pages/showDetails.aspx?objid=08000002800ade6c>.

⁴ The Marrakesh Agreement Establishing the World Trade Organization.

p. 179), 106 vascular plant species are at risk of extinction to varying degrees due to direct habitat loss and invasion by non-native IPS. Even though alien IPS cause enormous economic and environmental harm to the Bangladesh environment, the country is still behind in this field and there is little scientific or social data and legal frameworks on the subject (Barua et al., 2001, p. 7).

The Global Register of Invasive and Alien Species (GRIIS) recently published a validated and verified list of introduced (alien) and invasive species for Bangladesh (Dutta et al., 2021). As a signatory to the CBD, Bangladesh committed to achieving the Aichi Convention's Target 9 by 2020, meaning that Invasive Alien Species (IAS) and pathways should have been identified and prioritised, priority species controlled or eradicated, and measures put in place to manage pathways to prevent their introduction and establishment (Secretariat of the Convention on Biological Diversity, 2011).⁵ However, although several legislative and institutional mechanisms have been developed for the governance of the environment, forestry, agricultural invasive species (IS) and biodiversity (as mentioned above),⁶ Bangladesh has not yet developed its soft law/non-binding (ie National Invasive Species Strategy and Action Plans (NISSAPs) nor any distinct hard-law/binding legislative and institutional mechanisms for comprehensive and coordinated community-centric IPS governance in forestry sectors to conserve forest biodiversity. Therefore, the development of community-based, shared, and adaptive legislative and institutional mechanisms is essential for Bangladesh's sustainable environmental protection and biodiversity conservation. This systematic review first discusses Bangladesh's problem with IPS, followed by evaluation of the current legislative, and institutional frameworks relevant to the governance of environment, forestry, biodiversity, and quarantine pests. Second, the review also identifies the fundamental shortcomings of the environment and biodiversity related primary policy, legislative and institutional frameworks for the governance of IPS and biodiversity in Bangladesh's agriculture and forestry sectors.

2. Invasive Plant Species Problem and the Need for Comprehensive Legal and Institutional Frameworks in Bangladesh

In Bangladesh, more than 300 exotic and invasives plant species are either naturalised in the wild or cultivated as economic crops (Hossain & Pasha, 2001; see also, Mukul et al., 2020, p. 12). This includes litchi (*Litchi chinensis*), pineapple (*Ananas sativus*), watermelon (*Citrullus lanatus*), coconut (*Cocos nucifera*), guava (*Psidium* sp.), cucurbits (*Cucurbita* spp.), radish (*Raphanus sativus*), potato (*Solanum tuberosum*) and carrot (*Daucus carota*) as economic crops (Hossain, 2003). In addition to economic crops, bitter bush (*Eupatorium odoratum*), mile-a-minute (*Mikania cordata*), lantana (*Lantana camara*), Mexican ageratum (*Ageratum conyzoides*), sensitive plant (*Mimosa pudica*), *Alternanthera*, *Scoparia*, *Heliotropium* spp.

⁵ See also United Nations General Assembly, Invasive Alien Species: Management of Risks Associated with Introduction of Alien Species as Pets, Aquarium and Terrarium Species, and as Live Bait and Live Food, and Related Issues (17 October 2014) United Nations Document UNEP/CBD/COP/DEC/XII/16.

⁶ The National Environment Policy 2018.

Eichhornia, Eleocharis and Monocharia sp and dragon's blood (Croton sp.) were introduced as ornamental plants or as contaminants with food and seed grains (Hossain & Pasha, 2001). To fulfil timber demand, the British also introduced teak (Tectona grandis), rain tree (Samanea saman), Burmese ironwood (Xylocarpus xylocarpa), and broad-leaved mahogany (Swietenia macrophylla) (Hossain & Pasha, 2001). This trend continued, and Australian eucalyptus (Eucalyptus camaldulensis), mangium (Acacia mangium), pines (Pinus oocarpa and P. caribaea) coffee bush (Leucaena leucocephala) and akashmoni (Acacia auriculiformis) were introduced by international development agencies to fulfil local needs (Das, 1982).

Although economic losses due to IPS in the forestry and agricultural sector are devastating, a scientifically reliable estimate of these losses is not available in Bangladesh (Das, 1982). In forest ecosystems, fast-growing exotic Acacia spp., Eucalyptus spp. and Leucaena leucocephala compete with native species for water and nutrients (Hossain & Hoque, 2013; see also, Zabala, 1990). In the inland water bodies, Eichhornia crassipes and Salvinia molesta hinder the navigation system on a massive scale and negatively impact fish production (Afrin et al., 2010, p. 1; see also, Islam et al., 2003, p. 24). Despite IPS providing food, timber, and fuelwood, help in soil nitrogen fixation and possessing therapeutic uses, the environmental damage costs of such species in most cases exceed their benefits (Rahman & Roy, 2014, p. 14; see also, Rahman et al., 2010, p. 159; Mukul et al., 2006, p. 32). The IPS may also hybridise with native species, thus altering genetic diversity and integrity of native species (Vila et al., 2011, p. 708; see also, Wittenberg & Cock, 2001).

As a signatory to the CBD,⁷ biodiversity conservation is a national priority for Bangladesh. Despite the country's lack of a comprehensive assessment method for identifying and developing governance frameworks for governing IPS, a recent GRIIS report discovered 119 introduced plant species in Bangladesh, 37 of which were deemed invasive, while the remaining 82 had no or negligible impact and were cryptogenic or uncertain (Dutta et al., 2021). The National Biodiversity Strategy and Action Plan (NBSAP) 2016 also listed: water hyacinth (Eichhornia crassipes), siam weed (Chromolaena odorata), mikania (Mikania cordata), jungle tulsi (Croton bonplandianum), lantana (Lantana camara), billy goat weed (Ageratum conyzoides), wild kulthi (Cajanus scarabaeoides), jotakansira (Commelina obliqua), bindweed (Convolvulus arvensis), roundleaf bindweed (Evolvulus nummularius), pignut (Hyptis suaveolens), pink morning glory (Ipomoea carnea), water primrose (Ludwigia adscendens), and common sensitive plant (Mimosa pudica) as IPS that are present in the country (Department of Environment, 2016, p. 119). Moreover, the country's extensive borders with India and Myanmar make it extremely susceptible to the introduction of new exotic and invasive plant species. The existing environmental and quarantine legislative and institutional frameworks, along with the enforcement mechanisms of quarantine authorities, inadequately address the challenges of implementing regulations for importing exotic species at entry points. These weaknesses need further attention in developing stand-alone legal and institutional mechanisms to govern IPS for sustainable biodiversity conservation.

⁷ Convention on Biological Diversity.

3. Bangladesh National Government Legislative Frameworks for Governing IPS and Biodiversity

Bangladesh is a democratic republic with a unicameral parliament called Jatiya Sangsad. The head of state is the president, who is indirectly elected by the members of the parliament for a maximum of two five-year terms (Heitzman & Worden, 1988). The 350 members of parliament are directly elected by universal adult voting and include 50 seats reserved for women (Heitzman & Worden, 1988). The president appoints the leader of the majority party as prime minister and head of government (Heitzman & Worden, 1988). On the advice of the prime minister, the president appoints the cabinet (Heitzman & Worden, 1988). Most of the national policy and legal regimes related to environment, forestry and biodiversity pass through the parliament with the advice and technical assistance from relevant government organisations. This section focuses on conducting a comparative analysis of the existing legislative and institutional frameworks relevant to environmental issues, forestry, biodiversity conservation, and quarantine to identify potential flaws in these frameworks to contextualise their linkage with the governance of IPS and biodiversity.

3.1 Bangladesh National Government Policy Frameworks for Governing IPS and Biodiversity

The national IPS and biodiversity policy frameworks embody the various legal standards and guidelines established and practised in Bangladesh. Nevertheless, unlike Acts, Rules and Regulations, the legal standards, guidelines, and policies manifest as more generalised than commitments and hence lack specific actions. Policies are mostly guidelines for the ministries and other government bodies, and they may lay the foundation for future legal developments. The importance of policies in strengthening the environmental regime has been recognised in several international instruments including the World Conservation Strategy (International Union for Conservation of Nature and Natural Resources [IUCN] et al., 1980) and the Brundtland Report (Brundtland, 1987, p. 383) that guide nations for sustainable resource harvesting and uses. There are economic, social, and environmental elements to sustainable development (SD) (Brundtland, 1987). The Agenda 2030⁸ states that the sustainable development goals (SDGs) are indivisible in nature and their interconnectedness and integrated character are critical to ensure economic, social, and environmental development. The New York SDGs Summit 2019⁹ urged countries to integrate the 2030 Agenda into their national planning instruments, policies, strategies, and financial frameworks. The implication of adopting the above legal standards, guidelines and policies has special importance in the Bangladesh policies and legislative arena, where legal development in Bangladesh environmental and agricultural sectors is comparatively slower than developed nations including Australia. Most of the environment, forestry, and

⁸ United Nations General Assembly, Transforming Our World: The 2030 Agenda for Sustainable Development (15 September 2015) United Nations Document A/RES/70/1, <https://www.sustainabledevelopment.un.org>.

⁹ United Nations General Assembly, Political Declaration of the High-Level Political Forum as Sustainable Development (15 October 2019) United Nations Document A/RES/74/4, <https://digitallibrary.un.org/record/3829888>.

biodiversity-related policy instruments of Bangladesh have been formulated in the post-Rio era. Section 18A of the Bangladesh Constitution¹⁰ states that policies are not the sources of judicially enforceable obligations, they are treated as 'binding instruments' in most of the government agencies and, therefore, can greatly influence the shaping of national environmental regimes. This section focuses on analysing the existing policy frameworks pertaining to environment, forestry, biodiversity conservation, and quarantine issues to identify the existing flaws and contextualise their relationship with the governance of IPS and biodiversity.

3.1.1 National Biodiversity Strategy and Action Plan (NBSAP) 2016

Bangladesh has signed and ratified the CBD¹¹ and the NBSAP (Department of Environment, 2016) and has been prepared to fulfil the country's commitment to the CBD and provide a framework for conservation of biodiversity, sustainable use and sharing the benefits of biodiversity to its citizens. A major focus of the plan is to establish cross-sectoral linkages among environmental, social, and economic sectors to conserve biodiversity and to provide a framework for securing the necessary environmental settings to reduce poverty and ensure sustainable development (Planning Commission, 2005; see also, Department of Environment, 2016). Climate change, loss of habitat, deforestation, inappropriate water and agricultural management and natural disasters, issues of land tenure and land users' rights, and institutional capacity constraints are responsible for biodiversity loss in Bangladesh (Department of Environment, 2016). The NBSAP is a participatory approach that works to gain an understanding of the status of biodiversity loss and the significance of biodiversity; national targets and activities, capacity development and resource mobilisation for NBSAP implementation; and coordination, monitoring, and reporting (Department of Environment, 2016). The Aichi Biodiversity Target 9 is focused on identifying and prioritising IAS and their pathways, preventing their introduction and establishment, and controlling or eradicating identified priority species and their pathways through the development of management approaches and legislative and institutional instruments (Secretariat of the Convention on Biological Diversity, 2011). To achieve the Aichi Biodiversity Target 9 set by the CBD, the NBSAP set a target to conduct effective study on the impact of invasive alien species (IAS); develop regulations to control and enhance capacities at port-of-entries to regulate IAS; prevent the extinction of known threatened species; improve and sustain the conservation status of those species that are mostly in declined status; recognise and document traditional knowledge, innovations and practices of local communities or ethnic groups; and develop, adopt, update and implement the NBSAP in an effective and participatory manner (Department of Environment., 2016). The Ministry of Environment, Forest and Climate Change (MoEFCC) coordinates the implementation of the NBSAP. Although strategy considers various threats to biodiversity in Bangladesh, there is no

¹⁰ Constitution of the People's Republic of Bangladesh 1972 (Fifth Amendment) Act 2011, art. 18A, s. 12, <https://www.refworld.org/docid/3ae6b5684.html>.

¹¹ Convention on Biological Diversity.

accurate estimation of the nature and extent of threats that IPS pose to biodiversity loss in Bangladesh.

3.1.2 National Conservation Strategy (NCS) 2016

The main goals of the NCS 2016 (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016) are to provide guidance for future resource use and conservation, maintaining the current rate of resource utilisation and economic development in a sustainable manner. To ensure the effectiveness of the NCS, the Bangladesh Government signed and ratified some multilateral environment agreements (MEAs) including Aichi Biodiversity Target 9 and SDGs, and delegated authority to the Ministry of Environment, Forest, and Climate Change (MoEFCC) to incorporate current perspectives, achievements, and priorities in environmental sectors to ensure SD and conservation of national resources (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016). The MoEFCC established an Expert Committee, and the committee requested the IUCN to develop the NCS (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016). The IUCN created NCS with funding from the Bangladesh Climate Change Trust Fund (BCCT) (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016), and the Bangladesh Forest Department (BFD) manages and implements the NCS for long-term environmental governance (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016). The NCS aims to foster the country's development through the conservation, development, and enhancement of natural resources within the framework of the SDGs by the formulation and implementation of updated policy and laws, regular monitoring and research, and stakeholder consultation in integrating biodiversity issues into local area development projects (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016). The policy instrument also focuses on avoidance of IAS, effective and efficient management of existing protected area (PA) networks, and inclusion of new PAs in the network, updating the lists of endangered species and capacity building at local levels to manage local biodiversity and IPS (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016). However, the NCS still lacks in guiding clearly defined legal and policy frameworks in forestry and agricultural sectors IPS and biodiversity governance. The compliance and monitoring mechanisms within the policy frameworks are extremely fragile, and access to justice and dispute resolution mechanisms across sectors is extremely complex due to a lack of transparency and accountability in the policy frameworks. As discussed above, these inconsistencies have been addressed to a limited extent in the NBSAP by conducting an effective study on the impact of IAS, developing regulations to control and enhance capacities at ports of entry to regulate IAS, preventing the extinction of known threatened species, improving and sustaining the conservation status of species that are mostly in decline, and recognising and documenting local communities' traditional knowledge, innovations, and practices for implementation at national and community levels (Department of Environment, 2016).

3.1.3 National Environment Policy 2018

Environmental challenges attributable to IPS invasion and biodiversity conservation both in the agricultural and environmental sectors create emerging sustainability problems in Bangladesh. In this regard, the National Environment Policy (NEP) 2018 (Ministry of Environment, Forest and Climate Change, 2018) provides SD guidance, especially in the agriculture, forestry, wildlife and biodiversity, and food sectors. To this end, the policy established direct links by prohibiting the intentional introduction of invasive species (IS) (Ministry of Environment, Forest and Climate Change, 2018). Even if IPS are required to be introduced for the country's long-term overall SD target, scientific measures should be conducted in all sectors of the environment through efficient environmental impact assessment (EIA) and strategic environmental assessment (SEA) (Ministry of Environment, Forest and Climate Change, 2018). The policy also integrated a polluter pays principle to claim compensation from polluters, with the emphasis on adopting preventative measures over curative measures to protect the overall environment (Ministry of Environment, Forest and Climate Change, 2018). Although the policy laid the groundwork for amending all laws and regulations related to natural resource governance, environmental pollution, and degradation, environmental degradation due to the adverse effects of alien IPS in the forestry sectors needs to be addressed and policy frameworks need to be developed with clearly developed guidelines and responsibilities, as per the requirements of international conventions and protocols (e.g., CBD and IPPC) and local needs.

3.1.4 Draft Forest Policy 2016

The first British Colonial Forest Policy was developed in 1894 with the goal of reserving forestland and exploiting its resources for revenue generation.¹² The second and third Forest Policies were developed in 1955 and 1962 with the priority of increased financial allocation for enhanced afforestation and reforestation programs, and recognition of non-tangible benefits from forests;¹³ however, both policies focused on revenue generation through exploitation of forest resources. The Government of Sovereign Bangladesh further developed the National Forest Policy in 1979 with the goal of providing greater protection by emphasising forest conservation and developing its rural and industrial economies (Ministry of Environment and Forest, 1979). The policy, however, largely ignored community participation in forest management (Ministry of Environment and Forest, 1979). The first shift from traditional to participatory forest governance was initiated through the development of the National Forest Policy in 1994, which recognised the importance of community participation and adopted SD, poverty alleviation, biodiversity conservation, and enhanced government support for forestry development as important policy commitments (Ministry of Environment and Forest, 1994). The policy explicitly focused on afforestation in degraded forestlands and the designation of forestlands as PAs to conserve forest flora and fauna, aiming to provide 20% of the country's total land area with forest

¹² British Colonial Forest Policy 1894.

¹³ Forest Policy of Pakistan 1955 and 1962.

cover, with at least 10% as PAs by 2015 (Ministry of Environment and Forest, 1994). The policy adopted social forestry activities on vacant private and public land for biodiversity conservation, and made provisions for harvesting forest products for livelihood support of forest-dependent communities by bringing them under a participatory forest management approach (Ministry of Environment and Forest, 1994). However, adoption of a social forestry approach with fast growing alien IPS mostly in all forestry extension projects, in many ways proved to be incompatible with native species, ecological communities and biodiversity conservation (Ministry of Environment and Forest, 1994). Considering the above contradictory issue, the Forest Policy 1994 was revised to form the Draft Forest Policy 2016 with the aim of sustainable forest management (SFM) (Ministry of Environment and Forest, 2016) by complying with relevant provisions of all multilateral environmental treaties and conventions (Ministry of Environment and Forest, 2016, Policy Statement 1.9), ecosystem-based forest management adopting the principles of SFM (Ministry of Environment and Forest, 2016, Policy Statement 2.1), and the introduction of 'Forest Certification' (Ministry of Environment and Forest, 2016, Policy Statement 2.6) as a tool to improve forest management for current and future generations. The policy also emphasised developing and implementing a strategy to contain, control, and mitigate IAS (Ministry of Environment and Forest, 2016, Policy Statement 5.12), improving forestry research facilities to conserve germplasm, and establishing biosafety standards to reduce the impacts of IAS and GMOs (Ministry of Environment and Forest, 2016, Policy Statement 8). Although the DFP 2016 outlined some policy direction to govern IAS and GMOs, no unitary policy instrument, for example, NISSAPs, has yet been developed to fulfil the international commitment to SDG 15.8, Aichi Target 9, and Bangladesh's NBSAP¹⁴ commitments for coordinated IPS and biodiversity governance in agricultural and environmental sectors.

3.1.5 National Land Use Policy 2001

The National Land Use Policy 2001 (NLUP) established guidelines for the protection of agricultural land, waterbodies, and the best possible use of other land (Ministry of Land, 2001). Due to increased population pressure, per capita land availability in Bangladesh is gradually decreasing. An effective and sustainable land use plan would contribute to an increase in per capita income and the country's gross domestic product (GDP) (Islam, 2006). The primary goal of NLUP is to create guidelines for determining appropriate land use types for sustainable food production, rural housing, and urban development (Islam, 2006). It also emphasised environmentally friendly land use to help alleviate poverty and increase employment opportunities for landless households (Islam, 2006). To maintain eco-

¹⁴ The commitment to the Sustainable Development Goals (SDGs): Goal 15.8 states: 'By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species (IAS) on land and water ecosystems, and control or eradicate the priority species.' CBD's Aichi Target 9: 'By 2020, invasive alien species and pathways are identified and prioritised, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.' NBSAP's commitment: 'By 2021, a study on the impact of IAS will be furnished, regulations towards the control of IAS will be developed, and capacities at the ports of entry will be enhanced to regulate IAS.'

environmental balance and human health, forest should cover 25% of total land area (Islam, 2006). As deforestation continues in Bangladesh, there is an increased risk of invasion that can largely be mitigated by an afforestation program on char lands and other neighbouring lands. Land use activities are inextricably linked to sustainable biodiversity, environmental conservation, and the problem of plant invasion (Ministry of Environment and Forest, 2016; see also, Klepeis et al., 2009, p. 392). However, there are no clear policy guidelines articulated in the national land use policy on how sustainable land use would address the plant invasion problem to ensure long-term biodiversity and environmental conservation.

3.1.6 National Seed Policy 1993

The National Seed Policy (NSP) 1993 aims to increase improved seed production in both the public and private sectors so that farmers can quickly and affordably access high-quality seeds (Ministry of Agriculture, 1993). The policy's overall objective is to boost crop yields, farmer productivity, per capita farm income, and export earnings by making high-quality seeds of improved crop varieties widely available to farmers (Ministry of Agriculture, 1993). The specific objectives include: (i) increasing farmer acceptance and use of improved seed varieties through education; and (ii) multiplying and disseminating high-quality seed of improved high-yielding varieties that are resistant or tolerant to disease and pests (Ministry of Agriculture, 1993). To accomplish the above goals, it is necessary to: (i) strengthen the institutional capacity of public and private sector entities involved in the seed industry; (ii) adapt seed technology to the needs of high-input and high-output agriculture; (iii) promote balanced development of the seed sector by providing equitable opportunities to public and private sector entities involved in the seed industry from seed breeding to seed marketing; and (iv) simplify procedures for high-quality seeds imports (Ministry of Agriculture, 1993). The NSP emphasised import of seeds (Ministry of Agriculture, 1993, s. 8), leaving out appropriate plant quarantine measures and eliminating restrictions on seeds importation (Ministry of Agriculture, 1993, s. 8(1)). Adoption of the Bangladesh Plant Quarantine Act (PQA) 2011¹⁵ remediated the above drawbacks. This policy instrument also liberalised seed imports, strengthened quality control and research systems, and maintained seed security. Plant invasions are attributed to trade liberalisation, horticulture, and inadequate quarantine measures in both agriculture and forestry sectors globally (Bright, 1998, p. 294; see also, Le Maitre et al., 2004, p. 112; Schrader & Unger, 2003, p. 364). However, this policy instrument paid little attention to protecting local ecosystems and habitats from unintentionally introduced IPS seeds risks through the liberalisation of seed imports.

3.1.7 National Agriculture Policy 2018

The National Agriculture Policy (NAP) 2018 (Ministry of Agriculture, 2018) was developed for the sustainable protection and conservation of agricultural land and to protect its biodiversity from natural and man-made disasters by adopting an eco-environment-friendly

¹⁵ Plant Quarantine Act 2011.

food security system. The policy instrument emphasised the application of integrated pest management (IPM) to control diseases, pests, and conservation of the environment by limiting chemical fertilisers and agrochemicals (Ministry of Agriculture, 2018). Invasive plant species, also known as weeds, are a leading cause of production loss and environmental damage in Bangladesh's agriculture and forestry sectors. Despite the policy's emphasis on conducting new pest identification research and strengthening effective research on prevention through biological control and use of eco-friendly fertilisers and agrochemicals, cross-border pest and disease transmission should be monitored to ensure long-term invasive pest management outcomes. The policy is entirely focused on agricultural production losses caused by invasive weed and pest infestations, while ignoring the forestry sector.

An analysis of the above policy instruments reveals that most are formulated in a piecemeal, fragmented, and overlapping manner with no comprehensive policy frameworks and guidelines. These limitations are identified in detail later in section 4 of this article.

3.2 Bangladesh National Government Legal Frameworks for Governing IPS and Biodiversity

There are more than 100 pieces of legislation in Bangladesh that address environmental and agricultural concerns. Compared to agricultural IS laws, laws about protecting the environment, forests, and biodiversity are made and put into place in a piecemeal and fragmented way. This section examines the environmental and agricultural sectors' IS and biodiversity conservation regulations to identify their gaps and inconsistencies.

3.2.1 Bangladesh Environment Conservation (Amendment) Act 2010

The Environment Conservation Act (ECA) of 1995, amended as the Bangladesh Environment Conservation (Amendment) Act (ECAA) of 2010,¹⁶ was enacted for the protection of the environment from environmental pollution and the conservation and sustainable use of biological resources. The Act established a Department of Environment (DoE) and developed operational definitions of conservation, environment, ecosystem, and pollution, prescribing punishments for environmental offences.¹⁷ The Act also established a provision to designate ecologically problematic areas as ecologically critical areas (ECA) for in situ conservation in order to protect the area's overall ecology, its natural characteristics, and all forms of life that exist within the ECA.¹⁸ This Act also made provisions to perform environmental impact assessments (EIA), and acquire environmental clearance certificates (ECC) before establishing industries or managing environmental projects.¹⁹ Moreover, the Environment Conservation Court Act 2010²⁰ made provision to establish environment courts

¹⁶ Bangladesh Environment Conservation (Amendment) Act 2010.

¹⁷ Bangladesh Environment Conservation (Amendment) Act 2010.

¹⁸ Bangladesh Environment Conservation (Amendment) Act 2010.

¹⁹ Bangladesh Environment Conservation (Amendment) Act 2010.

²⁰ Environment Conservation Court Act 2010.

in every division of the country with specific terms of reference to deal with environmental offences and ensure the effective operation of Bangladesh's environmental laws. Nevertheless, this Act gives authority to the Joint District Judge to preside over this court²¹ and grants the government the authority to add additional laws for this court to administer.²² This Act establishes two types of courts: the special magistrate court and the environment court. The establishment of an environment court for addressing environmental issues was a milestone for the protection of the environment and biodiversity in Bangladesh.²³ The ECAA defined 'environmental pollution'²⁴ as 'contamination' and 'environment pollutant'²⁵ as 'contaminant' and treated any kind of pollution that was injurious, harmful, or destructive to any sectors of the environment as 'pollution', making provision to pay compensation as a penalty.²⁶ The ECAA further made provisions to protect wetlands and restrict hill cutting to conserve biodiversity.²⁷ However, the ECAA has not recognised the substantive or procedural principles of environmental jurisprudence, e.g., the principle of harm prevention, the precautionary principle, the principle of sustainable development, the principle of prior notification, or the principle of public participation in the decision-making process (Miah, 2022). These are necessary to ensure effective implementation, adequate coordination, capacity building, increased awareness, resource allocation, and enhanced clarity for sustainable environmental governance for biodiversity conservation.

3.2.2 Wildlife (Conservation and Security) Act 2012

The Wildlife (Conservation and Security) Act (WA) 2012²⁸ was enacted to protect the biodiversity, forests, and wildlife of Bangladesh. Under this Act, the government can declare any area a 'sanctuary',²⁹ take measures to protect the livelihood rights of local communities who rely on the sanctuary,³⁰ impose restrictions on the cultivation, cutting down and removal of any plants or animals, and bring in any domestic or foreign invasive animal or

²¹ Environment Conservation Court Act 2010, s. 4.

²² Environment Conservation Court Act 2010, s. 2.

²³ Environment Conservation Court Act 2010.

²⁴ Bangladesh Environment Conservation (Amendment) Act (ECAA) 2010, defined 'environmental pollution' as any contamination or alteration of the physical, chemical or biological properties of air, water, soil, including change of their temperature, taste, odour, density, or any other characteristic, or such discharged soil or any elements of the environment that will be injurious, harmful or destructive to public health or to domestic, commercial, industrial, agricultural, recreational or other useful activity, as well as to air, water, soil, livestock, wild animal, bird, fish, plant or other forms of life.

²⁵ Bangladesh Environment Conservation (Amendment) Act (ECAA) 2010, also defined an 'environment pollutant' as any solid, liquid, and gaseous substance that causes harmful effect to the environment (heat, noise, radiation, smoke etc).

²⁶ Bangladesh Environment Conservation (Amendment) Act 2010.

²⁷ Bangladesh Environment Conservation (Amendment) Act 2010.

²⁸ Wildlife (Conservation and Security) Act 2012.

²⁹ Sanctuary means 'wildlife sanctuary', 'bird sanctuary', 'elephant sanctuary' or 'wetland dependent animal sanctuary or marine protected area'.

³⁰ Wildlife (Conservation and Security) Act 2012.

plant species.³¹ The government may also designate any land or wetland that has 'conservation values'³² as a 'community conservation area'³³ and begin 'co-management'³⁴ upon providing compensation to the affected owner for their land or wetland.³⁵ There are number of ways in which the government can designate any government-owned forest area as a 'safari park', 'eco-park', 'botanical garden', and 'wild animal breeding centre'.³⁶ However, introduction of exotic animals is allowed in the safari park for recreational purposes³⁷ without the requirement to conduct a proper environmental impact assessment (EIA) regarding any risks to the safari park. In addition, the Act made provision to declare 'any tree or kunjaban'³⁸ in any khas land or community land as 'national heritage, memorial tree, sacred tree, kunjaban or wildlife habitat' as these trees and kunjaban are recognised and used as cultural, traditional, religious or memorial purpose and as a habitat of wildlife.³⁹ However, the Act does not clearly specify whether such a tree or kunjaban is a native species or an invasive alien species that dominates the tree stand or kunjaban. Under this Act, no person shall import⁴⁰ or export⁴¹ any wild animals and plants except by custom port of entry and without CITES and quarantine certificate issued by the appropriate authority of the country of import or export.⁴² Violation of the Act may result in a minimum sentence of two years in prison and a fine of Bangladeshi taka one hundred thousand or both; if the same offence is committed again, the sentence will be increased to five years in prison and a fine of Bangladeshi taka four hundred thousand.⁴³

Although WA 2012 was enacted for the conservation and protection of biodiversity, forests, and wildlife with a small tangential prohibition of the introduction of invasive animals and plants, a comprehensive mechanism to protect the forest environment from the detrimental effects of IPS was not articulated in this legislation. The Act introduced provisions to declare a sanctuary, prohibiting the harvest, destruction, or collection of any plant or the introduction of any alien invasive animal or plant species inside the sanctuary.⁴⁴ However, there was no clear directive introduced in the Act on how to identify and govern IS already naturalised in these declared sanctuaries, national parks, and forest protected areas. The Act requires further clarification and future amendments through the adoption of

³¹ Wildlife (Conservation and Security) Act 2012, s. 14.

³² Conservation values mean protection of traditional or cultural value or conservation of any animal or plant for sustainable development in such land or wetland.

³³ Wildlife (Conservation and Security) Act 2012, s. 18.

³⁴ Co-management is the process of management in which government shares power with resource users, with each given specific rights and responsibilities relating to information and decision making on participatory basis.

³⁵ Wildlife (Conservation and Security) Act 2012.

³⁶ Wildlife (Conservation and Security) Act 2012, s. 19.

³⁷ Wildlife (Conservation and Security) Act 2012, ss. 13–16.

³⁸ An individual tree or small patch of tree stand.

³⁹ Wildlife (Conservation and Security) Act 2012, s. 23.

⁴⁰ Wildlife (Conservation and Security) Act 2012, s. 28.

⁴¹ Wildlife (Conservation and Security) Act 2012, s. 29.

⁴² Wildlife (Conservation and Security) Act 2012, s. 35.

⁴³ Wildlife (Conservation and Security) Act 2012.

⁴⁴ Wildlife (Conservation and Security) Act 2012.

clear procedures and the appropriate legal mechanisms to achieve sustainable IS and biodiversity governance in forest-protected areas.

3.2.3 Forest Act 1927 and Draft Forest Act 2019

The Forest Act (FA) 1927⁴⁵ has evolved to empower the Forest Department to declare any area of forest as 'reserve forest' for in situ conservation of biological diversity.

With the introduction and expansion of 'community forestry',⁴⁶ the government tried to encourage community-based co-management on reserved forests involving forest-dependent community people; however, the government failed to establish a stringent regulatory regime for the 'protected areas'⁴⁷ and recognise the indigenous practices and techniques of forest conservation through sustainable methods of 'jhum cultivation'.⁴⁸ Declaration of 'protected areas' in forestlands will eventually affect 'jhum cultivation' and extraction of other resources from forest areas by forest-dependent community people. The Act was further amended in an effort to engage local community participation in its governance system;⁴⁹ however, it failed to include the formation and implementation of conservation guidelines to halt overexploitation of forest resources from forest areas. To address the above drawbacks, the Social Forestry Rules (SFR)⁵⁰ were adopted to include different agencies and beneficiaries to effect SFM; however, the SFR neglects IPS governance in its governance activities engaging community people. Finally, Bangladesh formulated the Draft Forest Act (DFA) 2019⁵¹ with some new inclusions adopted to separate village and social forestry activities, specifying different agencies and beneficiaries with their roles and benefit sharing mechanisms⁵² to strengthen community engagement in SFM. Although this Act is considered one of the most important legislative instruments for biodiversity conservation and forest protection in Bangladesh, it once again disregarded IPS governance; thereby, no subsequent legislative and institutional mechanisms have yet been developed to govern IPS in forestry sectors.

⁴⁵ Forest Act 1927.

⁴⁶ Community forestry is a community-based forestry activity with the active participation of local people in the planning, implementing, establishing, managing, and harvesting of forest crops, these being people who receive a major proportion of the socio-economic and ecological benefits from the forest.

⁴⁷ A protected area is a particular geographical space recognised, dedicated, and managed through legal means to achieve the long-term conservation goals.

⁴⁸ Jhum cultivation is a traditional farming method where natural forests are cleared of trees and vegetation through burning and slashing and the land used to cultivate cash crops for a limited number of years. It is also known as shifting cultivation or slash and burn cultivation and is the oldest method of cultivation still being practiced in the north-eastern hilly regions of India and hilly areas of Bangladesh.

⁴⁹ Forest Act 1927, amended in 2000.

⁵⁰ Forest Act 1927, amended as Social Forestry Rules 2010.

⁵¹ Draft Forest Act 2019.

⁵² Draft Forest Act 2019.

3.2.4 Plant Quarantine Act 2011

The Plant Quarantine Act 2011 (PQA)⁵³ was enacted to control the movement of plants and plant products, stop the introduction and spread of foreign insects and diseases, and deal with all phytosanitary issues. The Act also deals with the import and export of plants and plant products in Bangladesh's agriculture sector.⁵⁴ The Act labelled invasive alien species (IAS) and weeds as 'pests',⁵⁵ and any party wanting to import or export pests must go through the risk assessment process imposed by the National Plant Quarantine Authority (NPQA).⁵⁶ Based on the risk assessment outcome, the authority may or may not issue a phytosanitary certificate as per international agreements.⁵⁷ The authority also has the power and functions to declare any infected area a 'controlled area'⁵⁸ and must conduct post-entry quarantine, pest risk analysis and pest risk management for plants or plant products in the controlled area as part of phytosanitary measures.⁵⁹ Importation of prohibited and restricted lists of plants or plant products, pests and beneficial organisms must be regularly reviewed to update and harmonise phytosanitary legislation in Bangladesh.⁶⁰ To keep up to date with the latest advances in plant protection and quarantine-related regulations, the country needs to exchange technical information, opinions and reports with all international, regional and national plant protection organisations.⁶¹ Integrated pest management (IPM) techniques must be adopted for the governance of introduced invasive pests.⁶² As a party of the International Plant Protection Convention (IPPC), Bangladesh must comply with all international agreements, protocols and conventions related to phytosanitary issues to conserve plant biodiversity.⁶³ Although the Plant Quarantine Act prohibited or restricted the import and export of plants or plant products⁶⁴ to reduce the risk of introducing pest plants and plant products under the Imports and Exports (Control) Act 1950,⁶⁵ customs officers imposed restrictions on the import and export of plants, plant products, and packaging materials under the Customs Act 1969.⁶⁶ This indicates that the Plant Quarantine Act, by

⁵³ Plant Quarantine Act 2011.

⁵⁴ Plant Quarantine Act 2011.

⁵⁵ 'Pests' are any kind of plant or animal, strain or biotype, or any pathogenic agent other than beneficial organisms that can harm plants or plant products or beneficial organisms directly or indirectly. They also include living modified organisms (LMO), alien invasive species, and weeds. See also the Plant Quarantine Act 2011, s. 2(9).

⁵⁶ The Director of the Plant Protection Wing of the Department of Agricultural Extension will serve as the National Plant Quarantine Authority and will have full authority. Each officer and employee of the Plant Protection Wing of the Department of Agricultural Extension will be eligible to serve on the Authority.

⁵⁷ Plant Quarantine Act 2011, s. 4.

⁵⁸ Plant Quarantine Act 2011.

⁵⁹ Plant Quarantine Act 2011.

⁶⁰ Plant Quarantine Act 2011.

⁶¹ Plant Quarantine Act 2011.

⁶² Plant Quarantine Act 2011.

⁶³ Plant Quarantine Act 2011.

⁶⁴ Plant Quarantine Act 2011, s. 6.

⁶⁵ Imports and Exports (Control) Act 1950.

⁶⁶ Customs Act 1969.

itself, is incapable of carrying out its legislative mandates without interference from the Customs Act 1969.

Additionally, the Act established regulations for all plants or plant products that are confined or confiscated under the custody of the plant quarantine officer for the purpose of quarantine.⁶⁷ Moreover, the Act imposed an import prohibition,⁶⁸ requiring that no person or organisation can import any plant or plant product, beneficial organism, soil, or packing material without obtaining an import permit.⁶⁹ However, the authority may prescribe for the importation of plants or plant products with the government's prior approval.⁷⁰ With the approval of the government, the authority may also exempt certain plants and plant products from import conditions.⁷¹ Furthermore, the Act provided for the issuance of import permits and certificates⁷² for the entry of any plants or plant products, beneficial organisms, or packing materials into Bangladesh;⁷³ however, imported materials must enter through a designated point of entry, and the importer must present the import permit and phytosanitary certificate issued by the exporting country's National Plant Protection Authority for examination by Bangladesh's plant quarantine officer.⁷⁴ On the import permit, a description of the type of treatment or post-entry quarantine measures that must be applied to the imported plants or plant products must be included for the purpose of ascertaining phytosanitary measures prior to or following importation of plants or plant products.⁷⁵ The Act also made it illegal to export plants or plant products⁷⁶ without a phytosanitary certificate from the Bangladesh Quarantine Authority.⁷⁷ However, with the government's permission, the authority can set out the steps for exporting plants or plant products.⁷⁸ With government approval, the authority can exempt certain plants or plant products from export conditions.⁷⁹ However, there are no rules for such approval or exemption of imports and exports to require the post-entry and exit quarantine, pest risk analysis, and pest risk management actions needed to reduce or eliminate risk factors relevant to pest plants or plant products.

The Act is also primarily concerned with pest control or eradication.⁸⁰ The Quarantine Authority may restrict or prohibit the entry, introduction, sale, cultivation, multiplication, or transportation of any plant or plant product, pest, genetically modified organism, living modified organism, alien invasive species, beneficial organism, germplasm, packing

⁶⁷ Plant Quarantine Act 2011, s. 7.

⁶⁸ Plant Quarantine Act 2011, s. 9.

⁶⁹ Plant Quarantine Act 2011, s. 9(1).

⁷⁰ Plant Quarantine Act 2011, s. 9(2).

⁷¹ Plant Quarantine Act 2011, s. 9(3).

⁷² Plant Quarantine Act 2011, s. 10.

⁷³ Plant Quarantine Act 2011, s. 10(1).

⁷⁴ Plant Quarantine Act 2011, s. 10(2).

⁷⁵ Plant Quarantine Act 2011, s. 10(3).

⁷⁶ Plant Quarantine Act 2011, s. 18.

⁷⁷ Plant Quarantine Act 2011, s. 18(1).

⁷⁸ Plant Quarantine Act 2011, s. 18(2).

⁷⁹ Plant Quarantine Act 2011, s. 18(3).

⁸⁰ Plant Quarantine Act 2011, s. 19.

material, or any similar material capable of harbouring and spreading pests with prior approval from the government and by notification in the official gazette.⁸¹ In addition, the Act is primarily concerned with the declaration of quarantine pests.⁸² If any pest is present, or is likely to be present, or is a threat to crop production or trade in plants or plant products, beneficial organisms, or the natural environment, and is deemed necessary for confinement or eradication in Bangladesh, the authority may declare such pest as a quarantine pest by notification in the official gazette.⁸³ If any land or premises owner discovers a pest that is identified or suspected of being a quarantine pest, that person must notify the nearest plant quarantine officer.⁸⁴ However, while the Act has been consistently used to control harmful pests and diseases in the agricultural sectors, pest and diseases control has been left unattended in the forestry sector. This affects sustainable development outcomes in the Bangladesh environmental sector, as sustainable forestry and biodiversity conservation is hampered by invasive pest and disease infestation in the absence of comprehensive invasive plant biosecurity legal frameworks to govern invasive pest species in the forestry sector.

3.2.5 Biological Diversity Act 2017

Bangladesh, as a party to the Convention on Biological Diversity (CBD)⁸⁵ and the Cartagena Protocol,⁸⁶ and as a signatory to the Nagoya Protocol,⁸⁷ enacted the Biological Diversity Act (BDA) 2017⁸⁸ as a domestic law to conserve biodiversity at the national level. The general goal of the BDA is to ensure the sustainable use of biodiversity and its components, the equitable distribution of benefits derived from the use of biological resources, and the development of relevant laws related to traditional knowledge (TK) and other matters covered by the Act.⁸⁹ The specific goals are to: (i) protect and improve the environment and biodiversity of the country;⁹⁰ (ii) provide for the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of biological resources, knowledge, and matters related to CBD;⁹¹ and (iii) enact

⁸¹ Plant Quarantine Act 2011, s. 19.

⁸² Plant Quarantine Act 2011, s. 20.

⁸³ Plant Quarantine Act 2011, s. 20(1).

⁸⁴ Plant Quarantine Act 2011, s. 20(2).

⁸⁵ Convention on Biological Diversity. Bangladesh ratified the Convention on 03 May 1994.

⁸⁶ Cartagena Protocol on Biosafety to the Convention on Biological Diversity (adopted 29 January 2000, entered into force 11 September 2003) vol. 2226 United Nations Treaty Series, p. 208, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-8-a&chapter=27.

⁸⁷ The Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity (adopted 29 October 2010, entered into force 12 October 2014) vol. 3008 United Nations Treaty Series, p. 3, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-8-b&chapter=27. Bangladesh has not yet ratified it.

⁸⁸ Biological Diversity Act 2017.

⁸⁹ Biological Diversity Act 2017, the Preamble.

⁹⁰ Constitution of the People's Republic of Bangladesh 1972 (Fifth Amendment) Act 2011, art. 18A, s. 12, <https://www.refworld.org/docid/3ae6b5684.html>.

⁹¹ Constitution of the People's Republic of Bangladesh 1972 (Fifth Amendment) Act 2011, art. 18A, s. 12.

necessary biological diversity related laws to protect the country's enriched biological resources and biodiversity, while engaging communities with their traditional knowledges and practices.⁹²

Initially, the Act defined 'biodiversity'⁹³ as 'the diversity that exists in the living world and is part of the environment, as well as existing species diversity, genetic diversity, and ecosystem diversity in inland, aquatic, or marine environments,' and 'biological resources'⁹⁴ as 'genetic resources derived from plants, animals, and microorganisms or parts thereof, as well as their genetic material and by-products (excluding value-added products) or any other biotic component of ecosystems with actual or potential use or value for humanity, but excludes human genetic materials'. Under this Act, to ensure fair and equitable benefit sharing to all claimants, the National Committee on Biodiversity (NCB) would: (i) negotiate terms of benefit sharing according to the principles of prior-informed consent (PIC)⁹⁵ and mutually agreed terms (MAT);⁹⁶ (ii) grant ownership or joint-ownership of intellectual property rights (IPRs); (iii) transfer technology; (iv) install plants in a suitable location; and (v) engage Bangladeshi scientists or their organisations in research and development; and (vi) pay monetary compensation and non-monetary benefits.⁹⁷ Although the Act identified the above six methods with the aim of ensuring fair and equitable benefit sharing among stakeholders, only the first method met the requirements of prior informed concept and mutually agreed terms. However, any domestic access and benefit sharing (ABS) system must be based on prior informed concept and mutually agreed terms as per CBD or Nagoya Protocol standards. The Act also granted joint ownership of intellectual property rights (IPRs) to the National Committee on Biodiversity (NCB). However, there was no clear indication of how, without legal rights, this partnership could own, claim, or enforce the IPRs. Moreover, the Act gives sole control to NCB bureaucrats over biological resources and traditional knowledge, ignoring any collective and individual interests of indigenous and local communities that would eventually hamper the achievement of sustainable biodiversity conservation outcomes. It is clear that the Act needs to be amended to provide more clarity on PIC and MAT requirements and develop sustainable benefit sharing mechanisms with a functional domestic ABS system, engaging indigenous and local communities. In addition, the National Biodiversity Strategy and Action Plan (NBSAP) (Department of Environment, 2016) is the guiding principle for the formulation and amendment of the Biological Diversity Act for the conservation, development, and sustainable use of biodiversity in Bangladesh; however, the Biological Diversity Act ignored one of most important components of the NBSAP on the adoption of national measures and

⁹² Biological Diversity Act 2017.

⁹³ Biological Diversity Act 2017, s. 2(11).

⁹⁴ Biological Diversity Act 2017, s. 2(13).

⁹⁵ Prior informed consent signifies that, in accordance with national law, permission from the competent national authority or the authorities of the provider country must be obtained prior to accessing genetic resources.

⁹⁶ The concept of mutually agreed terms dictates that access to genetic resources and the sharing of resulting benefits must be governed by a contractual agreement between the parties (the contracting country, as represented by its competent authority, and the party using genetic resources).

⁹⁷ Biological Diversity Act 2017, s. 30(1).

standards to deal with invasive alien species. By aligning with NBSAP (Department of Environment, 2016), any amendments to the Biological Diversity Act could include the identification and development of lists of nationally problematic invasive species; the requirement for socio-economic and ecological impact assessment to native species, ecosystems, and ecological communities; identification of drivers and pathways of invasion; and development of governance strategies and plans. The above activities could be executed through the development of legislative mechanisms, capacity, and awareness building, forming institutions and true community engagement. The Biological Diversity Act could also declare any place or area as a biodiversity heritage site (BHS), in consultation with local communities and local government bodies and in coordination with concerned ministries or departments,⁹⁸ compensating or rehabilitating any person or institution economically affected by such declaration.⁹⁹ Moreover, the government could frame directives and allocate funds from the Bangladesh Climate Change Resilience Fund (BCCRF)¹⁰⁰ for the sustainable management and conservation of all biodiversity heritage sites (Government of the People's Republic of Bangladesh, 2010); it could declare them as heritage sites through the declaration of PAs and govern them by adopting community-based shared governance that would eventually mitigate the plant invasion problem.

3.2.6 Biosafety Rules 2012

The Bangladesh Biosafety Rules 2012 (BSR)¹⁰¹ were enacted to regulate the import and export, as well as transboundary movement, research, development, and production of genetically modified organisms in Bangladesh. The Environment Conservation (Amendment) Act 2010¹⁰² form the foundation stone of the BSR, which defines a variety of terms, including 'department', 'Act', 'committee', 'GMO', 'guidelines', 'biotechnology', 'pollution', 'environment', and 'director general', in order to clearly articulate the Rules to the public, experts, and academia.¹⁰³ In addition, the rules imposed import and export

⁹⁸ Biological Diversity Act 2017, s. 32.

⁹⁹ Biological Diversity Act 2017, s. 32.

¹⁰⁰ Bangladesh is the pioneer country among the least developed countries (LDC) that create domestic funding mechanisms to combat climate change.

¹⁰¹ Biosafety Rules 2012.

¹⁰² Bangladesh Environment Conservation (Amendment) Act 2010.

¹⁰³ The term 'department' refers to the Department of Environment established under Section 3 of the Act; the term 'Act' refers to the Environment Conservation (Amendment) Act 2010. 'Committee' refers to the National Committee on Biosafety (NCB), the Biosafety Core Committee (BCC), the Institutional Biosafety Committee (IBC), and the Field Level Biosafety Committee (FBC); 'genetically modified organism (GMO)' refers to any creature created using biotechnology; 'genetically modified products' (GMP) refers to a product or products derived from genetically modified organisms. 'Guidelines' refers to Bangladesh's Biosafety Guidelines. 'Biotechnology' refers to a technology that is used to implant new characteristics, gene carriers, or genes into an organism (plants, animals, or microorganisms) from the same organism or its wild variety, or a completely different organism, to create an organism with new genetically modified characteristics. 'Pollution' refers to the contamination or alteration of the physical, chemical, or biological properties of air, water, or soil, including changes in their temperature, taste, odour, density, or any other characteristic, or to any other activity that, by discharging any liquid, gaseous, solid, radioactive, or other substance into the air, water, or soil, or any component of the environment, destroys or causes injury or harm to public health or to domestic,

restrictions to purchase, sell, or commercially exploit any genetically modified organism or its products without obtaining permission from the Ministry of Environment and Forests.¹⁰⁴ This restriction is, however, waived in cases involving the conduct of research or the undertaking and implementing of projects involving genetically modified organisms or their products.¹⁰⁵ Permission from the departments of agriculture and commerce is required for commercialisation of any research results.¹⁰⁶ The rules also reaffirmed the Ministry of Environment and Forestry's obligation to follow the Bangladesh Environmental Conservation (Amendment) Act 2010, and the Act's rules and guidelines when approving the import, export, or other commercial uses of GMOs.¹⁰⁷ If any inconsistency or incoherence occurs during the implementation of any part of the rules regulating the detrimental and adverse effects of GMOs and their products on the environment, the applicable Act will take precedence.¹⁰⁸ The rules also required labelling of any container or cover used to transport GMOs or their products.¹⁰⁹ The rules also contain provisions to seek assistance and support from any ministry, organisation, or directorate in any emergency responses involving any type of environmental, biodiversity, or human health-related pollution risk, or any type of accident or probability of accident caused by genetically modified organisms or their products.¹¹⁰ In this regard, the rules established an obligation to the relevant ministry, division, organisation, or directorate to provide assistance when requested by the committee or the Director General.¹¹¹ The rules, however, made no explicit provision for how the aforementioned inter-institutional coordination would be accomplished when enforcing the rules at the field level. This lack of inter-institutional coordination is a clear indication of Bangladesh's fragmented and piecemeal approach to legal development and enforcement ingenetically modified organisms. Any negligence in research or project implementation could result in any GMO-derived plant or animal products escaping the research lab or project area and being exposed to human settlements and the natural environment, which could pose an invasion threat to human health and the environment.

An analysis of the above legal instruments reveals that most are formulated in a piecemeal, fragmented, and overlapping manner with minimal or no coordination. The limitations are detailed in Section 4 of this article.

commercial, or industrial operations. 'Environment' refers to the interdependence of water, air, soil, and physical property, as well as their interaction with humans, other animals, plants, and microorganisms; and 'director general' refers to the Director General of the Department of Environment.

¹⁰⁴ Biosafety Rules 2012, rule 3.

¹⁰⁵ Biosafety Rules 2012.

¹⁰⁶ Biosafety Rules 2012.

¹⁰⁷ Biosafety Rules 2012.

¹⁰⁸ Biosafety Rules 2012, rule 4.

¹⁰⁹ Biosafety Rules 2012, rule 5.

¹¹⁰ Biosafety Rules 2012.

¹¹¹ Biosafety Rules 2012.

3.3 Bangladesh National Institutional Frameworks for Governing Invasive Plant Species and Biodiversity

As a party to the CBD¹¹² and the IPPC,¹¹³ Bangladesh is required to take a common and effective action to stop the introduction, control, or eradication of alien species that threaten ecosystems, habitats, or species, as well as the spread and introduction of pests of plants and plant products. This would be done by preventing the accidental or intentional introduction of IAS, early detection, rapid response, and eradication of new invasions, and control and mitigation of species. To meet the international obligations as well as domestic needs, Bangladesh developed a number of legislative instruments (discussed in section 3.1 and 3.2 of this article), to govern IPS and biodiversity through a variety of institutions. In Bangladesh, IS and biodiversity conservation issues are primarily dealt with by Ministry of Agriculture (MoA) and the Ministry of Environment, Forests and Climate Change (MoEFCC). In agriculture, various national authorities and institutions are involved in the development and enforcement of agricultural aspects of IPS and biodiversity legislative instruments; however, existing national authorities and institutions in the environment and forestry sectors are less engaged in the development and enforcement of environmental aspects of IPS compared to biodiversity legislative instruments. The main goal of this section is to discuss the operational architecture of these institutions and departments, as well as critically analyse and evaluate the institutional challenges they encounter in governing IPS and biodiversity in the agricultural and environmental sectors.

3.3.1 Ministry of Environment, Forest and Climate Change

The Ministry of Environment, Forest and Climate Change (MoEFCC)¹¹⁴ fulfils CBD's¹¹⁵ obligations by delegating authority to the Department of Environment (DoE)¹¹⁶ to enforce the Biological Diversity Act 2017¹¹⁷ and the Bangladesh Environment Conservation (Amendment) Act 2010¹¹⁸ to protect the environment and conserve biodiversity. Likewise, the Forest Department (FD)¹¹⁹ is charged with enforcing the Biosafety Rules 2012,¹²⁰ the

¹¹² Convention on Biological Diversity.

¹¹³ International Plant Protection Convention (adopted 6 December 1951, entered into force 3 April 1952) vol. 150 United Nations Treaty Series, p. 67, <https://www.fao.org/treaties/results/details/en/c/TRE-000013>.

¹¹⁴ The Ministry of Environment, Forest and Climate Change was established to ensure a sustainable environment for current and future generations of the country by conserving its ecosystem and environment, reducing environmental pollution, adapting to and mitigating the effects of climate change, and improving and sustainably managing forest and ocean resources.

¹¹⁵ Convention on Biological Diversity was held in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.

¹¹⁶ The Government of Bangladesh established the Department of Environment in 1989 to protect the environment holistically, with a particular emphasis on the introduction of regulatory approval for factories and industries, pollution regulation, and the imposition of fines on polluting industries. The department is based in Dhaka, Bangladesh, is administered by the Ministry of Environment, Forest and Climate Change, and headed by a Director General.

¹¹⁷ Biological Diversity Act 2017.

¹¹⁸ Bangladesh Environment Conservation (Amendment) Act 2010.

Forest Act 1927,¹²¹ and the Wildlife (Conservation and Security) Act 2012¹²² to conserve indigenous forests, flora and fauna from all threats including IS. The FD is also responsible for supervising the research and development activities of the Bangladesh Forest Industries Development Corporation (BFIDC),¹²³ the Bangladesh Forest Research Institute (BFRI),¹²⁴ the Bangladesh National Herbarium (BNH),¹²⁵ the Bangladesh Climate Change Trust (BCCT),¹²⁶ and the Bangladesh Rubber Board (BRB).¹²⁷ The FD also coordinates other institutions' research and development activities. However, most of the CBD's obligations in governing IPS and biodiversity in the forest and environment sectors have yet to be fulfilled due to poor enforcement of existing laws, corruption and lack of political commitment, limited human and financial resources, limited institutional capacity and awareness-building at all levels, interdepartmental coordination problems, lack of alternative income generating activities of forest dependent people, and poor community participation and policy support (Foster-Turley et al., 2016) at the implementation level.

¹¹⁹ In 1870, during the British Raj era, the Forest Department was established to protect natural forests. The department began a social forestry program in the 1980s and is now responsible for the protection and maintenance of forests and wildlife on an overall basis. It is based in the Bangladeshi capital of Dhaka.

¹²⁰ Biosafety Rules 2012.

¹²¹ Forest Act 1927.

¹²² Wildlife (Conservation and Security) Act 2012.

¹²³ The Bangladesh Forest Industries Development Corporation was founded in 1960 as a state-owned enterprise with the objective of developing timber-related activities in the Chittagong Hill Tracts. It has evolved into a semi-autonomous agency within the Ministry of Environment, Forest and Climate Change with 16 enterprises – two timber extraction units, 11 wood-based industrial units, and three board-manufacturing plants. Numerous others are inoperable or unprofitable. Additionally, it owns 11,700 hectares of rubber plantations spread across 12 estates, with more than 5,000 hectares producing rubber. BFIDC employs approximately 4,000 individuals.

¹²⁴ The BFRI is responsible for all facets of forestry research, including silviculture, forest management and protection, the development of forest products, environmental conservation, and agroforestry. A director leads the institute, assisted by two chief research officers and officers in charge of research divisions.

¹²⁵ Bangladesh National Herbarium is a plant taxonomic research organisation and a museum of dried plant species dedicated to the exploration, collection, identification, preservation, and publication of plants in the country.

¹²⁶ Bangladesh Climate Change Trust was established in 2010 in accordance with the Climate Change Trust Act. It reports to the Ministry of Environment, Forest and Climate Change and uses its allocated funds to address climate change-related issues in collaboration with other government ministries, non-governmental organisations, and the private sector. Bangladesh's government has contributed \$400 million to the fund to date.

¹²⁷ Bangladesh Rubber Board was established in 2013 to regulate the rubber industry in Bangladesh. It is a self-governing body of the government charged with developing and implementing strategies for the natural rubber sector. Additionally, it aims to provide scientific, technical, artisanal, and financial assistance to private entrepreneurs to foster the development of sustainable rubber cultivation, extension, and associated industries.

3.3.2 Ministry of Agriculture

The Ministry of Agriculture (MoA)¹²⁸ is tasked with enforcing IPPC¹²⁹ obligations through the Department of Agricultural Extension (DAE) (Department of Agricultural Extension, Ministry of Agriculture, Government of the People’s Republic of Bangladesh, n.d.), providing training to farmers to use pesticides wisely by reducing chemical pesticide use, encouraging biopesticide use, and promoting IPM practices. The DAE conducts pest risk assessments on imported goods at quarantine stations located across the country to check on imported goods’ quarantine pest risks; and if a pest is found to be at risk, the product is refused entry (Constantine et al., 2022). For example, when the American cotton bollworm (*Helicoverpa zea*) was found in imported cotton from the US, the DAE began fumigation control to get rid of it (Constantine et al., 2022). The National Plant Protection Organization (NPPO)¹³⁰ works under the DAE, and consists of two organisations, the Plant Quarantine Wing (PQW) and the Plant Protection Wing (PPW), to implement all obligations of the PQA 2011¹³¹ to protect agricultural crops’ biodiversity from IS.

The PQW fulfils the WTO’s obligation to sustain international trade, abide by its rules, and implement international phytosanitary standards (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People’s Republic of Bangladesh, n.d.). It enforces policy and regulates import and export activities to prevent quarantine pests from entering the country with imported plants, plant products, beneficial organisms, and packing materials (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People’s Republic of Bangladesh, n.d.). It also incorporates new plant quarantine rules and policies; promotes plant quarantine activities at checkpoints and entry points; issues import permits and phytosanitary certificates for agricultural products, and release orders for plant commodities; and records and intercepts pests and diseases (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People’s Republic of Bangladesh, n.d.). The PQW has modernised plant quarantine laboratories and created an e-phytosanitary certification system to help Bangladesh meet international standards (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People’s Republic of Bangladesh, n.d.). It also screens and diagnoses imported products at its laboratories, and at its nationwide quarantine stations (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People’s Republic of Bangladesh, n.d.). Different

¹²⁸ The Ministry of Agriculture’s primary objective is to develop a self-sufficient and sustainable agricultural system in Bangladesh by increasing agricultural productivity and modernising agriculture marketing through the adoption, invention, and transfer of new technologies.

¹²⁹ The International Plant Protection Convention was signed in 1951 in Rome, Italy, and entered into force on 3 April 1952. Its purpose was to foster international cooperation in protecting global plant resources from the spread and introduction of plant pests, to ensure food security, biodiversity, and sustainable trade. It was last revised in 1997.

¹³⁰ The National Plant Protection Organization oversees implementation of the International Standards for Phytosanitary Measures and regulations regarding quarantine in Bangladesh.

¹³¹ Plant Quarantine Act 201115.

stakeholders involved at different levels of the plant quarantine system lack adequate knowledge about the plant quarantine regulation, which makes the job of the PQW much harder (Constantine et al., 2022). For example, due to a lack of knowledge or direct links with a quarantine system or supervised production system in the export supply chain, traditional exporters pack their goods in bamboo baskets and old paper cartons, and there is no way to track them (Constantine et al., 2022).

The PPW registers and renews chemical pesticide and public health product licences and certificates (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, n.d.). It also advises and organises farmers, delivers training on capacity-building and conducts pest censuses to identify new invasive pests (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, n.d.). Its field officers provide technical advice to help farmers manage pests quickly through the promotion of a range of pest and IAS control methods, including IPM (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, n.d.). The PPW collects materials and delivers technologies nationwide with the help of research organisations and extension staff in each district (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, n.d.). It conducts an awareness-raising program through a workshop or information campaign for relevant stakeholders, including environmentalists, field officers, and farmers, to inform them of any incidence of IAS (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, n.d.). Field officers conduct surveillance in areas under their jurisdiction and report any pest incidence immediately to a higher-level officer (Plant Quarantine Wing of the Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, n.d.). The PPW collaborates with other departments and organisations to control new pest invasions; for example, it collaborated with the Bangladesh Agricultural Research Institute (BARI) to control fall armyworm (*Spodoptera frugiper*) (FAW) in maize fields (Constantine et al., 2022). In this instance the Bangladesh Agricultural Research Council (BARC), BARI, the Bangladesh Wheat and Maize Research Institute (BWMRI), Bangladesh Rice Research Institute (BRRI), and other organisations took strong action; the MoA and DAE quickly formed a national task force (NTF) (Constantine et al., 2022) and conducted regional workshops at district level to discuss management and control options and to develop a monitoring system to inform district and national officials (Constantine et al., 2022). Field level control activities were initiated by BARI using traps for monitoring and trials of various pest control methods (Constantine et al., 2022). The DAE, via partners, provided pheromone traps and training for extension agents and farmers to monitor (Constantine et al., 2022). The NTF continued to meet on a monthly basis, and this integrated FAW control strategy reduced the pests the following year (Constantine et al., 2022). Through international, national, non-governmental, and private organisations, the PPW collaborated with NGOs, the private sector, and farming groups to govern this

emergency IS in the Bangladesh agriculture sector (Constantine et al., 2022), i.e., the US Agency for International Development (USAID), and International Maize and Wheat Improvement Centre (IMWIC) (as international organisations), BWMRI, BARI, BRRI and the Agricultural Information Service (AIS) (as Bangladesh government organisations under the MoA), and the Arannayk Foundation, Ispahani Agro Ltd and Syngenta Bangladesh Ltd (as Bangladesh national NGOs) were all actively involved in governing FAW (Constantine et al., 2022). This demonstrates that the Department of Agricultural Extension's PPW has carried out interagency collaboration and coordination effectively and efficiently in a time of emergency; however, it remains to be seen if the emergency response is not required to manage an IAS threat on a regular basis, how effectively and efficiently PPW would coordinate the task.

From the above analysis of both the environmental and agricultural institutional architecture, the agricultural sector demonstrates commendable strength in governing IS and biodiversity compared to the environmental sectors. This is demonstrated by the fact that all relevant environmental sectoral regulations have little direct or indirect connection with comprehensive IPS and biodiversity governance, while the relevant agricultural sectoral regulations have a strong connection with pre-border and border quarantine and the adoption of onshore control. There is no or little cooperation and coordination between the two sectors, i.e., the environmental and agricultural sectors and they govern IAS and biodiversity independently. The current systems in place are ineffective and inefficient due to a lack of comprehensive assessment, and uncoordinated frameworks for identifying and managing IPS and biodiversity issues. These institutional impediments demand an independent cross-sectoral statutory coordinating body with fewer coordinated and collaborative sectoral institutional set-ups.

4. Gaps and Inconsistencies of Bangladesh Invasive Species and Biodiversity Governance Legislative and Institutional Frameworks

IAS in environmental sectors have not yet been prioritised on the national agenda of Bangladesh, even though they cause significant economic loss and damage to its ecosystems and rich biological heritage. While some legislative and institutional instruments have been developed to protect the environment and biodiversity in the agriculture and environmental sectors, the environmental sector instruments are mostly overlapping, piecemeal and fragmented. While agricultural sector instruments are comparatively commendable, they are not without problems; there are prevalent implementation challenges due to a lack of comprehensive assessment mechanisms and coordinated frameworks for identifying and managing IPS and biodiversity issues at the national level and implementation at the local level. These legislative and institutional impediments demand an independent cross-sectoral statutory coordinating body with unitary coordinated and collaborative cross-sectoral legislative and institutional frameworks, which would spearhead the development and implementation of such legislative and institutional instruments. Bangladesh also requires international cooperation in developing, sharing, linking, and integrating IAS databases and

information systems, as well as research support and capacity building for effective IAS and biodiversity governance. A thorough examination of existing policies and regulations revealed that the NBSAP 2016 (Department of Environment, 2016), DFP 2016 (Ministry of Environment and Forest, 1994), NAP 2018 (Ministry of Agriculture, 2018), Wildlife (Conservation and Security) Act 2012,¹³² and BSR 2012¹³³ outline only a few statements regarding entry prohibitions for IS and GMO management. Although the PQA 2011¹³⁴ is reasonably comprehensive, it is primarily focused on IS management in agricultural sectors, ignoring environmental sectors. Although the NLUP 2001 (Ministry of Land, 2001), the NSP 1993 (Ministry of Agriculture, 1993), the ECAA 2010,¹³⁵ the FA 1927 and its amendments,¹³⁶ the DFA 2019¹³⁷ and the BDA 2017¹³⁸ have very limited roles in governing IS (with no relative statements or guidelines), the NCS 2016 (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016) and the NEP 2018 (Ministry of Environment, Forest and Climate Change, 2018) articulated some policy guidelines with a few statements and references to govern IS and biodiversity. Thus, there is no collaboration or coordination between the MoA and the MoEFCC, and no unitary and comprehensive legislative and institutional mechanisms have yet been developed under a unitary coordination body for governing IS and biodiversity in Bangladesh.

A comparison of the NBSAP 2016 with the DFP 2016 and the NAP 2018 reveals that these three policy instruments address IS issues in a piecemeal, fragmented, and overlapping manner. In particular, the NBSAP focuses on ensuring sustainable IS and biodiversity governance by conducting effective studies on the impact of IAS; developing regulations to control and enhance capacities at the ports-of-entry to regulate IAS; preventing the extinction of known threatened species; improving and sustaining the conservation status of those species that are mostly in decline; recognising and documenting traditional knowledge (TK), innovations, and practices of local communities or ethnic groups; and developing, adopting, updating, and implementing relevant legislative instruments in an effective and participatory manner (Department of Environment, 2016). The DFP 2016 was formulated with the aim of SFM by complying with the relevant provisions of all multilateral environmental treaties and conventions; managing forests adopting the SFM principles; introducing a forest certification tool to improve forest management; developing and implementing strategies to contain, control, and mitigate IAS; upgrading forestry research facilities to conserve germplasm; and establishing biosafety standards to minimise the impacts of IAS and GMOs (Ministry of Environment and Forest, 2016). The NAP 2018 prioritised agricultural pest management, establishing pest surveillance and monitoring systems, adopting IPM and conserving the environment by using biopesticides and biological control agents to control pests (Ministry of Agriculture,

¹³² Wildlife (Conservation and Security) Act 2012.

¹³³ Biosafety Rules 2012.

¹³⁴ Plant Quarantine Act 2011.

¹³⁵ Bangladesh Environment Conservation (Amendment) Act 2010.

¹³⁶ Forest Act 1927, its amendments in 2000 and 2010.

¹³⁷ Draft Forest Act 2019.

¹³⁸ Biological Diversity Act 2017.

2018). Despite IPM being accorded a high priority in the agricultural sector, it is poorly implemented in the field, and farmer awareness of biological control is limited, as evidenced by the case of biopesticides being used to control FAW, as well as the lack of evident promotional activities for biological control (Constantine et al., 2022). Even though farmers ask for private local service providers' advice when buying pest control products, they don't promote or sell biological pest control products (Constantine et al., 2022). In the environmental sectors, IPM is not popular and there is no evidence of introduction of biological control agents to control IPS in the agriculture or environmental sectors.

A comparison of the NCS 2016 (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016) and the NEP 2018 (Ministry of Environment, Forest and Climate Change, 2018) revealed that both focused on IS and biodiversity governance with their efforts in outlining some policy guidelines. The NCS focused on formulating and implementing updated legislative instruments; regular monitoring and research; stakeholder consultation in integrating biodiversity conservation activities into local area development agendas; national capacity building for scientific management, development, and protection of biodiversity; the formalisation of community participation in protected area governance; benefit sharing; and the avoidance of IAS in conservation planning (Ministry of Environment and Forest & International Union for Conservation of Nature, 2016). The NEP 2018 initiated IAS governance by prohibiting the deliberate introduction of IAS and emphasised taking scientific measures by implementing EIA and SEA, if species introduction was required for the country's long-term SDGs (Ministry of Environment, Forest and Climate Change, 2018). The NEP also incorporated the polluter pays principle to claim compensation from polluters and emphasised adoption of preventative measures over corrective measures to protect the environment (Ministry of Environment, Forest and Climate Change, 2018). Although the NCS and the NEP explicitly address IAS and biodiversity governance issues by adopting the above statements, their coordinated efforts to conserve the natural resources of Bangladesh through the formulation of regulations have yet to make significant effects.

A comparison of the NLUP 2001 (Ministry of Land, 2001) and the NSP 1993 (Ministry of Agriculture, 2018) revealed that both policy frameworks addressed sectoral aspects of SD; they focused on maximising food production while discarding the incidence of IS problems due to unsustainable land use and inappropriate seed import and handling. In most cases, unsustainable land use practices are detrimental to long-term biodiversity and environmental conservation outcomes and result in plant invasion problems (Klepeis et al., 2009, p. 392). The NLUP contains no explicit guidelines regarding environmental degradation and declining biodiversity caused by land use related plant invasions. The NSP did liberalise the import of seeds and seed processing machinery from other countries to ensure seed security (Ministry of Agriculture, 1993); however, trade liberalisation, horticultural business, insufficient quarantine measures (Mukul et al., 2021), and seed importation processes may be major causes of plant invasion in Bangladesh. This policy has not placed a high value on preserving indigenous or local seeds and crop diversity to protect local ecosystems and habitats. Instead, it has placed a high value on seed imports, allowing

accidental introduction of IS seeds as ‘contaminants’ that would eventually harm the overall environment.

The Bangladesh Constitution outlines the provisions for governing the environment and biodiversity sustainably, with a particular emphasis on preserving and safeguarding natural resources, biodiversity, wetlands, forest, and wildlife.¹³⁹ However, the major environment, forestry, and biodiversity related regulations, including the ECAA 2010,¹⁴⁰ the FA 1927 and its subsequent Amendments,¹⁴¹ the DFA 2019,¹⁴² and BDA 2017,¹⁴³ includes no sections or sub-sections relating to governance of IAS for forest biodiversity conservation. The Bangladesh ECAA regards contamination or alteration of environment as ‘environmental pollution’; however, it does not regard IPS as harmful contaminants to the environment. The International Environmental Law Principles and NEP 2018 introduced a polluter pays principle for any types of pollution caused by any organism, person and/or organisation; however, there is no provision included in the Bangladesh ECAA 2010 for the biological pollution caused by IPS. The FA 1927 and its subsequent amendments included community participation in social forestry activities and introduced different agencies and benefit-sharing mechanisms for SFM. However, the introduction of IPS into plantation forestry has been reported to have adverse effects on native biota, human health, and native animals that ultimately affect forest sustainability (Hossain & Hoque, 2013). The DFA 2019 has been considered an important Act for native forest protection and biodiversity conservation. To ensure SFM, the Act develops provisions to separate village forestry from social forestry, delegate roles individually both to village forestry and social forestry participants and develop benefit sharing mechanisms across different agencies and beneficiaries involved in forestry activities. However, the Act neither includes any statement for the protection of forests from IAS nor directs towards developing a unitary and comprehensive IPS and biodiversity governance instrument.

A comparison of the WA 2012¹⁴⁴ and the BSR 2012¹⁴⁵ demonstrates that both Acts address IS issues in a piecemeal, fragmented and overlapping manner. The WA 2012 is primarily concerned with sanctuary declarations by prohibiting harvesting, destruction, or collection of any plant and the introduction of any IS into the sanctuary without an import permit, or export to overseas without a CITES certificate.¹⁴⁶ The Act also made provisions for the designation of ‘community conservation areas’ and the adoption of ‘co-management’ of those areas through a participatory approach;¹⁴⁷ however, there is no mention in this Act as to what procedure should be followed or how community participation would be strengthened and ensured to implement such a legal mechanism, despite the fact that

¹³⁹ Constitution of the People’s Republic of Bangladesh 1972.

¹⁴⁰ Bangladesh Environment Conservation (Amendment) Act 2010.

¹⁴¹ Forest Act 1927, its Amendments in 2000 and 2010.

¹⁴² Draft Forest Act 2019.

¹⁴³ Biological Diversity Act 2017.

¹⁴⁴ Wildlife (Conservation and Security) Act 2012.

¹⁴⁵ Biosafety Rules 2012.

¹⁴⁶ Wildlife (Conservation and Security) Act 2012.

¹⁴⁷ Wildlife (Conservation and Security) Act 2012.

community participation is a critical component in achieving sustainable IS governance outcomes at national and community levels. Meanwhile, the BSR 2012 regulates the research, development and production, and import and export of GMOs;¹⁴⁸ however, the Rules does not detail precautionary procedures for handling GMOs, yet carelessness in handling GMOs could accidentally release alien organisms into the country's native genetic pool. The BSR only concerns itself with the forestry sectors, ignoring biosafety in agricultural sectors. This demonstrates that there has been no collaboration or coordination identified between the MoA and MoEFCC in formulating the BSR. In addition, the Rules lacked clear guidelines for combining research, development, and production with the import and export of IAS and GMO, even within departments, i.e., the Forest Department and the Department of Environment, which work under the supervision of the Ministry of Environment, Forest, and Climate Change. These also illustrate the prevalent inter-departmental coordination and collaboration problems. A comparison of the BDA 2017¹⁴⁹ and the PQA 2011¹⁵⁰ demonstrated that BDA 2017 focused on sustainable biodiversity governance in the forestry sector and PQA 2011 focused on governing IAS in the agricultural sector. The BDA 2017 introduced an access and benefit sharing (ABS) mechanism, prepared nation-wide biodiversity registers, documented biodiversity-related traditional knowledge (TK), developed provisions for a community-based biological resource management approach and specialised funding mechanism, and alternative livelihood creation for affected people.¹⁵¹ The Act has thus far not developed any provision for native plant varieties protection, except for the inclusion of a simple reference to encourage people in the conservation of landraces and cultivars. The Act mainly focuses on biodiversity conservation issues in the forestry sector, avoiding IPS governance as part of the overall biodiversity governance of Bangladesh. The Plant Quarantine Act 2011 (PQA 2011), on the contrary, regulates the export and import of plants, microorganisms, and soil by increasing the government's authority to prevent the introduction of IS into the country's agricultural sector.¹⁵² The Act states that growing, transporting, or selling illegal plants or products made from them can be punishable by both imprisonment and a fine;¹⁵³ however, this directive is largely not followed, limiting the effectiveness of IS prevention, detection, and control. In this legislative instrument, environmental weeds receive no attention in comparison to agricultural crop pests. Although there is some collaboration between research institutions and agricultural extension departments on IAS governance, there is always room for improvement in on-ground control. For instance, rapid collaboration occurred as an emergency response during the formation of the NTF for FAW and wheat blast control (Constantine et al., 2022). In terms of overall IAS governance, it is also clear that the agriculture and environment sectors work on their own, with little or no communication.

¹⁴⁸ Biosafety Rules 2012.

¹⁴⁹ Biological Diversity Act 2017.

¹⁵⁰ Plant Quarantine Act 2011.

¹⁵¹ Biological Diversity Act 2017.

¹⁵² Plant Quarantine Act 2011.

¹⁵³ Plant Quarantine Act 2011.

Current lists of IS already present in both the agricultural and environmental sectors of the country are insufficient, necessitating additional research on IAS. A comprehensive list will aid better planning for strong preventative measures to be implemented at national borders and for onshore control (Constantine et al., 2022). Despite IPM being accorded a high priority in the agricultural sector, it is poorly implemented in the field, and farmer awareness of biological control is limited, as evidenced by the use of biopesticides to control FAW, as well as the lack of evident promotional activities for biological control (Constantine et al., 2022). Even though farmers ask for private local service providers' advice when buying pest control products, the providers don't promote or sell biological pest control products (Constantine et al., 2022). In environmental sectors, IPM is not popular and there is no evidence of introduction of biological control agents to control IPS. Bangladesh imports a substantial amount of food to meet the country's growing food security needs; therefore, it is imperative to be vigilant for the emergence of new IAS (Constantine et al., 2022). Existing phytosanitary measures put in place by the Plant Quarantine Wing (PQW) in the agricultural sectors should be enhanced to ensure effective interception of IAS and prevent their entry into the country (Constantine et al., 2022). In addition, screening and systemic tests should be conducted prior to the release of any species into the environment. The PQW has acknowledged that quarantine activities were insufficient in the FAW and wheat blast invasion incidents: action was taken only after the arrival of these pests, and preventative measures should have precluded any need for action (Constantine et al., 2022). This was also reflected in the reactive formation of NTFs in response to emergencies instead of adopting day-to-day management practices as a proactive approach. Personnel and physical resources should also be developed to build capacity. Due to lack of staff, for instance, there are gaps in records and no IAS database in the country (Constantine et al., 2022). Additionally, staff shortages present obstacles to opportunities for greater collaboration between organisations (Constantine et al., 2022). Greater access to diagnostic laboratories with highly trained technical personnel would enable rapid analysis and identification of potential IAS, as well as improve quality control (Constantine et al., 2022). Inconsistencies were also reported because of high staff turnover at the government level (Constantine et al., 2022).

It is concluded that the above legislative and institutional gaps demand the development of a more proactive approach to IAS and biodiversity governance, including an increase in surveillance activities and the effective application of existing rules and regulations on the ground. There is also a need for all relevant stakeholders within the system, including government departments, NGOs, and private sector organisations, to play a more proactive role in promoting IAS awareness at the local level. Community stakeholders including farmers and land managers may not be receptive to or willing to adopt new technologies, or if they do so, they may lack the knowledge necessary to do so effectively. Access to and availability of alternative products should be improved; for instance, pheromone traps were recommended for FAW but were unavailable.

5. Conclusion and Recommendations

Bangladesh has legislative and institutional frameworks in place to govern the environmental and agricultural sectors including forest and agricultural crops and the overall biodiversity of the country. Critical analysis and evaluation of these legislative and institutional frameworks show that they do not work well enough at any level to build a sustainable Bangladesh. Most people of the country are not aware of any requirements to meet national goals, and threats are growing because of gaps in environmental, biodiversity and quarantine regulations at pre-border, border and onshore levels, along with insufficient resource allocation, prioritisation of private goods, institutional limitations, and information gaps (DeJose, 2011). Threats to biodiversity posed by IAS, along with ineffective legislative and institutional barriers and flaws, create significant problems on how the country's biological resources will be safeguarded. Bangladesh urgently requires an economically, socially, and ecologically sound, institutionally coordinated, and collaborative unitary approach to biosecurity and biodiversity governance instruments, facilitated by cross-sectoral and inter-departmental collaboration. For these different departments and institutions to work together as a team, it is important to set up a coordinating body that will act as a hub for effective governance of IPS and biodiversity, supported by an appropriate policy, sufficient coordination, huge awareness and capacity development, efficient resources, and evidence-based measurement of economic and environmental costs of IPS. This would require the building of legislative and institutional capacity, fostering community participation, and comprehensive reform of existing quarantine and biodiversity governance regulations. The institution would be an ideal vehicle for developing new policy and legislative frameworks to adopt diverse adaptive approaches to IPS and biodiversity governance. The central government should attempt to fill these gaps based on pre-existing and identified gaps in the systems. The Bangladesh government could use its legislative authority to create a set of instruments delegating responsibility to a coordinating body that worked in tandem with the MoA and the MoEFCC. There are three possible governance models from which Bangladesh could choose: either a unified legislative framework; or a coordinating body with legislative authority; and/or a coordinating body with the authority to harmonise measures but without the legal authority to impose harmonisation (Shane et al., 2000). Each model is based on a different level of central control and would be complemented by coordinating mechanisms. The proposed Bangladesh comprehensive IPS and biodiversity governance frameworks should be adopted by the central government and directed towards the local level to govern IPS and biodiversity by engaging community stakeholders.

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