

A Framework on Biodiversity Conservation Related Policy Analysis

Md Rahimullah Miah^{1,*}, Md Mehedi Hasan², Jorin Tasnim Parisha³, Alexander Kiew Sayok⁴

¹Department of IT in Health, North East Medical College and Hospital, Affiliated with Sylhet Medical University, (SMU), Sylhet, Bangladesh. and PhD Awardee from the IBEC, UNIMAS, Sarawak, Malaysia

²Department of Law, Green University of Bangladesh, Dhaka, Bangladesh

³Government Satis Chandra Girls' High School, Sunamganj Sadar, Sunamganj, Bangladesh

Abstract Biodiversity is inextricably linked to humanity, which requires adequate policy instruments to properly conserve it. But some biodiversity criminals are misusing wireless sensor technology in a specific Global Positioning System location to cause global damage through destabilizing environment and climate crisis. All countries of the world are facing unexpected losses due to misuse of advanced wireless sensor devices. The study shows that dynamic policy, secure wireless sensor technology and co-management system inspire to conserve biodiversity. The study shows that a proportion of the achievement of the Framework for Action 2030 global biodiversity targets can be attributed to specific populations, tribes and protected areas. And another proportion may be controlled by particularly effective area-based conservation measures based on economic values, visitor motivation and scientific research priorities. By compensating for this unpredictable biodiversity, reforming current integrated policies to build a peaceful world will have a particular impact on meeting the Sustainable Development Goals. Research also shows that the active participation of UN states and the use of secure wireless sensor technology can actively contribute to the conservation of global biodiversity. Each country needs to have an existing and well-organized ecosystem with National Biodiversity Strategy and Action Plan (NBSAP), world-leading communication systems, science-based approaches to protection and management, and well-connected systems of ecologically representative and protected areas. Otherwise, everyone living on Earth will suffer severely and future generations will find it difficult to survive.

Keywords Biodiversity, Policy Analysis, Framework, Effectiveness, NBSAP

1. Introduction

Bangladesh is one of the most vulnerable countries facing the effects of environmental degradation (Orts, 1995) due to misuse of wireless sensor technology including sensor tracking, collapse, blocking, virtualizing, poisoning and digital killing (Miah et al., 2022a,b). In addition to outdated policy instruments, lack of management strategies and fragmented political commitment also contribute to biodiversity loss (Miah et al., 2022a-e). Environmental policy instrument is connected with socio-economic factors with environmental considerations at the heart of decision-making on environmental issues among others includes biodiversity, climate change and ecosystem decline. Biodiversity is the core arena of these environmental issues. The current age of technological development is one of mass communication and luxury living, while a class of climate criminals are leading to alarming conditions of

widespread environmental damage as a result of their alarming activities in unsafe wireless technology. On the other hand, administration and policy makers are still apathetic due to lack of advanced sensor technology knowledge. Environmental policy analysis framework is a set of actions to develop the task with relevant indicators to help the National Park management – as a case study teams in evaluating the performance of existing policy instruments, institutional and governance arrangements for ensuring the sustainability of National Park's flora and faunal protection systems as well as the establishment of ecosystem services. Generally, environmental related tools for conserving of biodiversity did not exist innovative isolation from earlier legislative and institutional environment that surrounds them, but are part of a wider 'National Park policy integration.

2. Materials and Methods

2.1. Site Selection

The study was undertaken at Lawachara National Park (LNP) at Kamalganj sub-district in Moulvibazar of Sylhet division, Bangladesh coordinates with 24°32'12"N

* Corresponding author:

drmmiah@yahoo.com (Md Rahimullah Miah)

Received: Dec. 5, 2022; Accepted: Dec. 29, 2022; Published: Jan. 13, 2023

Published online at <http://journal.sapub.org/ajee>

91°47'03"E (NSP, 2005) as the forest conservation case study site. The study also followed the methods for data collection from the following URLs:

URL: <https://ir.unimas.my/id/eprint/24535/>
 URL: <https://ccsenet.org/journal/index.php/jpl/article/view/0/47787>
 URL: <http://article.sapub.org/10.5923.j.bioinformatics.20211101.01.html>
 URL: <http://article.sapub.org/10.5923.j.ajbe.20201001.03.html>
 URL: <http://article.sapub.org/10.5923.j.fs.20211101.01.html>
 URL: <https://ojs.bilpublishing.com/index.php/jer/article/view/2826/2632>
 URL: <http://article.sapub.org/10.5923.j.diabetes.20200902.02.html>
 URL: <http://article.sapub.org/10.5923.j.ijvmb.20211001.03.html>
 URL: <http://article.sapub.org/10.5923.j.scit.20211101.02.html>
 URL: <http://article.sapub.org/10.5923.j.geo.20211101.02.html>
 URL: <http://article.sapub.org/10.5923.j.ijas.20211102.02.html>
 URL: <http://article.sapub.org/10.5923.j.env.20211102.01.html>
 URL: <https://ccsenet.org/journal/index.php/gjhs/article/view/0/46717>
 URL: <http://article.sapub.org/10.5923.j.ijim.20221101.01.html>

2.2. Data Collection and Organizing

At first, all the general information regarding the policy assessment, building a framework and implantation as a biodiversity conservation instruments towards Lawachara National Park. and informatics including biodiversity conservation systems in the Lawachara National Park and their diversity, status, and distribution are collected and tabulated in an organized manner. Besides, Global Development Plan (GDP), National Biodiversity Strategy and Action Plan (NBSAP), Clearing House Mechanism (CHM) and protected areas status of State Parties in South East Asian, After the data had been collected, they were checked properly for accuracy, by using the crosschecking method for data compilation.

2.3. Data Analysis, Presentation and Interpretation

All general information regarding the occurrence of biodiversity and national parks including legal systems in the protected area and their diversity, status and distribution were checked for accuracy from the different sources and sources of information were also verified. Information regarding the initiatives of the authority towards the conservation of biodiversity was collected through relevant secondary information and field survey. Then the information was included in the preparation of data master sheet and incorporated into convenient forms used in the result and discussion section. The data were compiled and analysed for presentation and interpretation using suitable data analysis software like MS Office Suite 2021, SPSS ver.27 and R programming version 5.4 for suitable interpretation.

3. Results and Discussion

3.1. Effectiveness of Protected Areas in South East Asian

The implementation and effectiveness of National Parks

are influenced by diverse social, economic, political and technological factors (Maciel *et al.*, 2008). National Parks (NPs) are instrumental in supporting biodiversity conservation as well as providing many benefits.

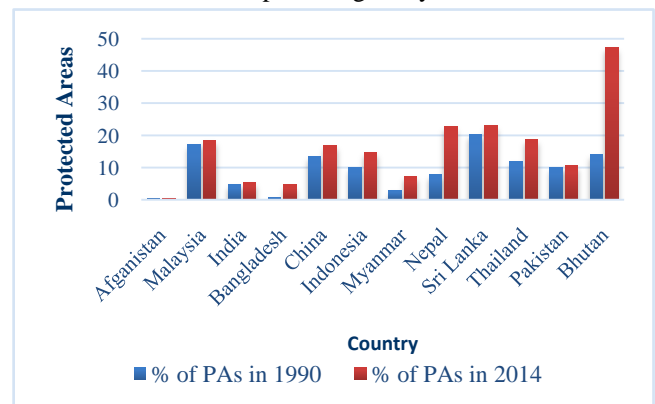


Figure 1. Protected areas of State Parties in Southeast Asia between 1990 and 2014 (Source: Juffe, *et al.*, 2014)

Asia is the most populous region in the world, with a substantial number of global biodiversity hotspots (Myers *et al.*, 2000) and several megadiverse countries, like Malaysia, with rich cultural and natural heritages (NPS, 2016). In this region, the natural heritage with protected areas is under threat with high tendency to losses of biodiversity is continued (Mulongoy and Chape, 2004). This study tries to relook at the key factors that strengthen the policy towards conserving biodiversity at National Parks (NPs) of Bangladesh and Sarawak, Malaysia. There is comparative analysis on the quantity of protected areas in Asia to compare with 1990 and 2014, as shown in Figure 1. The study suggests for learning and taking decision from each other country on increase on protected areas (Juffe, *et al.*, 2014) individually. Different parameters on protected areas of Bangladesh are mentioned with terrestrial and marine in Table 1. However, National Park is a type of environmental conservation tool in national and global

supporting biodiversity conservation (Balmford *et al.*, 1995) and providing various benefits. These parks include the peak portion (about 23%) of the entire global region protected (Chape *et al.*, 2003; Muhumuza and Kevin, 2013). In terms of coverage, the terrestrial national park areas have augmented to continue (UNEP-WCMC, 2017; UNEP-WCMC, 2016), which documented in Figure 1. These Parks (NPs) are also good instruments for biodiversity conservation in Bangladesh.

Table 1. Different parameters on Protected Areas Country Profile for Bangladesh

Parameters	Terrestrial	Marine
Protected Areas	49 protected areas	2 marine areas
Total Land Area	140160.2 km ²	84563.20 km ²
Land Area Protected	6456.00 km ²	4530.00 km ²
Area coverage in percent (UNEP-WCMC, 2016).	4.60%	5.40%
Protected Area Management Effectiveness (PAME)	PAME Score 39.30% (Coad, <i>et al.</i> , 2015).	

(Source: WDPA, 2017)

Sectoral's contribution enhances to sectoral policy integration for conservation of biodiversity including Lawachara National Park biodiversity. For example, the GDP of Forestry and Agriculture sector is 13.66 during the period of 2012–2013, meanwhile the stated GDP is 10.05 in

the same years. However, forestry and agriculture sector enhance the conservation instruments for national park biodiversity protection, particularly safeguard of Lawachara National Park biodiversity. The research also compared with the GDP of Asian countries. In Bangladesh, the GDP was 6.1 in the year 2013 but in 2016 it was 6.7 (GEP, 2016), which as shown in Figure 2. The National GDP reflects on the contribution of local and national community's well-beings. Sustainable biodiversity conservation depends on community's well-being to uplift the socio-economic status.

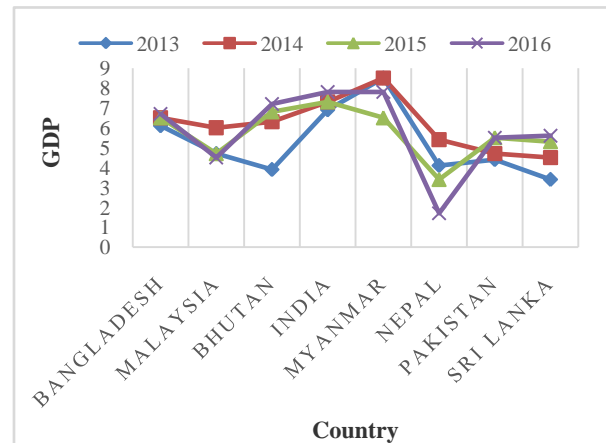


Figure 2. Gross Domestic Product of Asian Countries (Source: GEP, 2016)

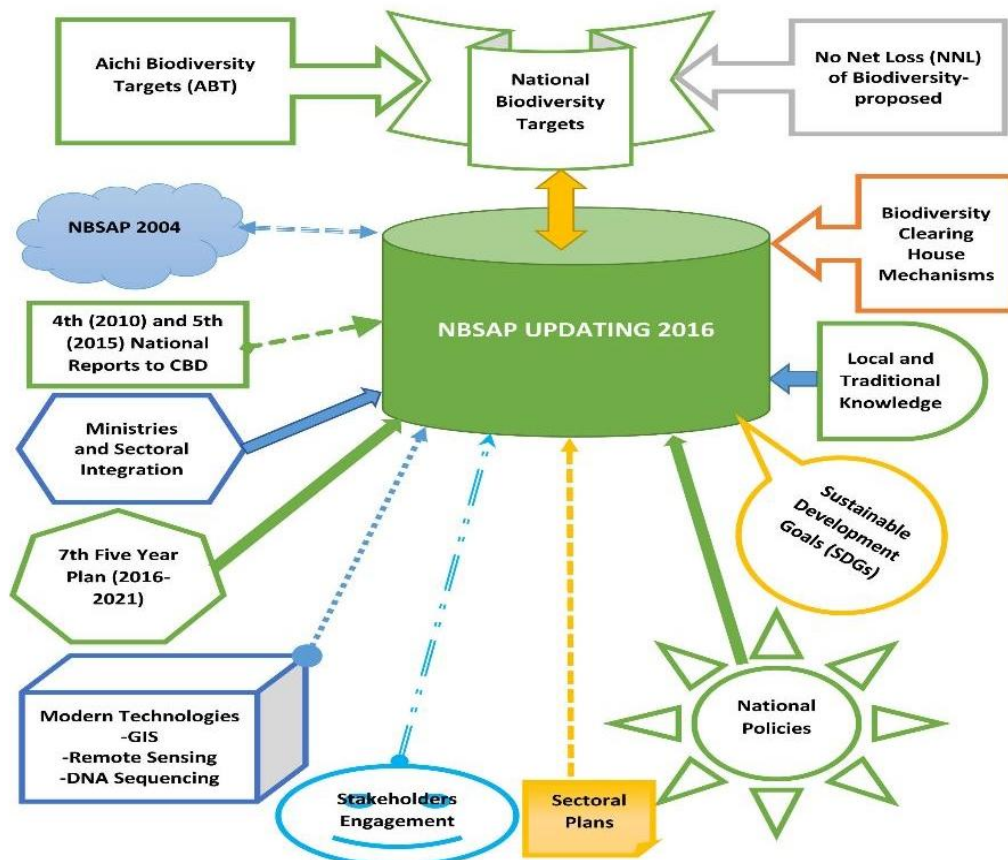


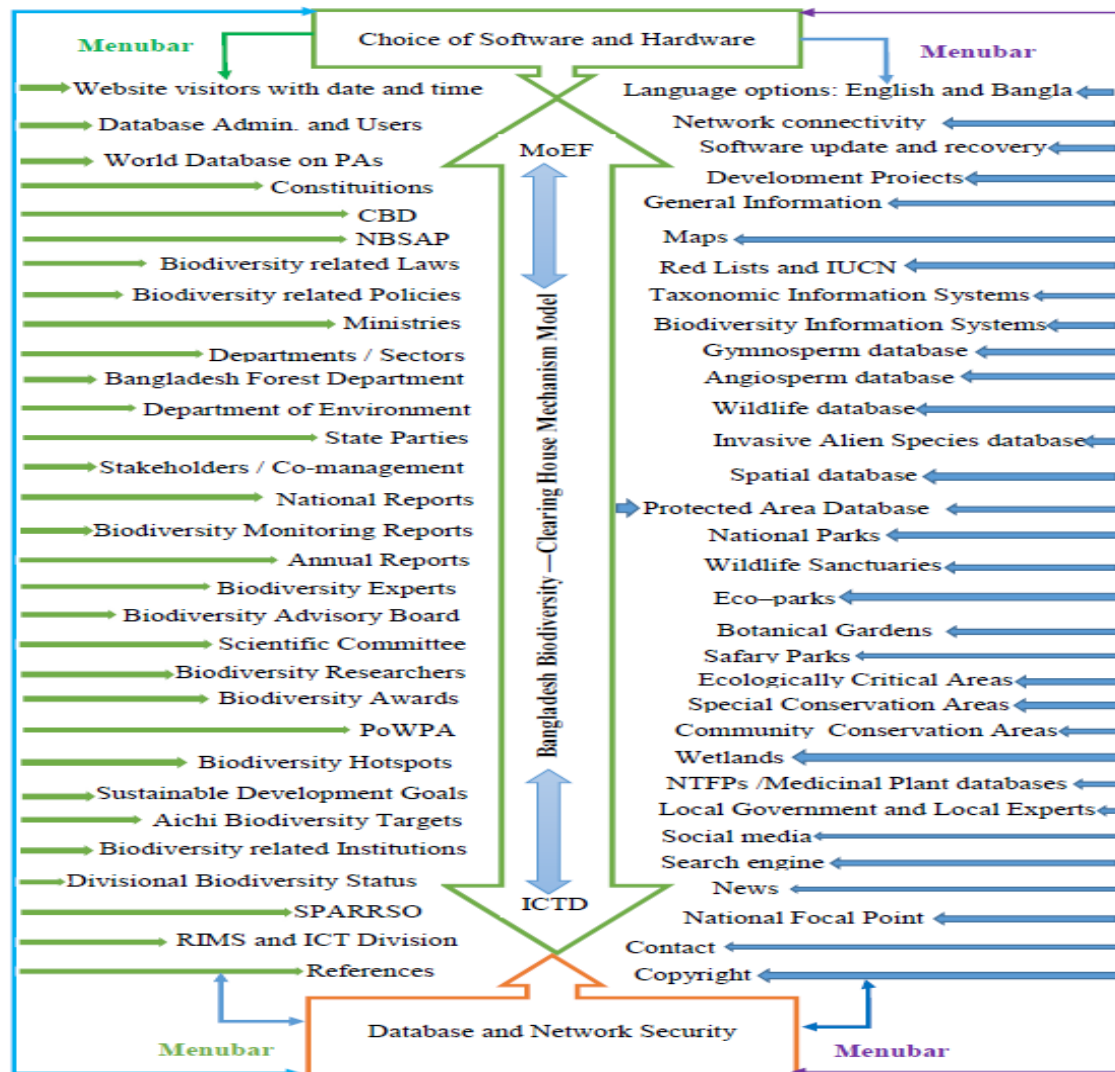
Figure 3. Input updating NBSAP of Bangladesh

3.2. Outcomes of Results for Updating NBSAP of Bangladesh

Update NBSAP is the basic instrument for implementing at national level for the purpose of state biodiversity conservation. It has been updated in order to fulfil the commitment of Bangladesh towards implementing the specific objectives indicating (a) national biodiversity conservation, (b) effective and justifiable use, and (c) reasonable and unbiased allocation. National Focal Point (NFP) of Bangladesh is the coordinator to implement of the NBSAP with cooperation of other Ministries, agencies, organizations, institutions, academic institutions, and co-management team for actions that fall within their responsibilities. The revised NBSAP (2016) creates new idea than that of NBSAP 2004, as shown in Figure 3. The update NBSAP highlights as follow:

(a) Aichi Biodiversity Targets (ABTs), (b) Biodiversity Clearing House Mechanism (BCHM), (c) Adoption of local and traditional knowledge, (d) Sustainable Development Goals, (e) Update National Policies, (f) Digital conservation technologies, and (g) Stakeholders engagement.

Government of Bangladesh submitted revised NBSAP to CBD on 2016, which is being late. The study identified being late submission NBSAP, is very difficult to fulfil the targets within 2020. The study suggested for taking alternative motivational programmes to develop Lawachara National Park area for conserving of biodiversity. For example: Green Banking Activities, Green Awareness programme, School Gardening, College Gardening, Institutional Gardening, Religious Institutional Gardening and reforestation programme.



Where, (i) ICTD- Information Communication and Technology Division, (ii) PoW-Programme of Work on Protected Area., (iii) MoEF-Ministry of Environment and Forests
RIMS-Resource Information Management Systems

Figure 4. Development Model for Biodiversity Clearing House Mechanism

3.3. Develop National Biodiversity Clearing House Mechanism Model

A planned stronger and operative clearing house mechanism developed new multi-channels of communication globally, such as (a) support development of environmental awareness, (b) creating associations to the on-going nature conservation activities, (c) Consciousness levitation, (d) biodiversity information broadcasting. The study illustrates the participation of all the sponsors for necessary actions of national government and non-governmental organisations, private industries, local community leaders, Network Specialists, ICT Company, Park Manager, Team Leader of Co-Management Committee, Indigenous community Leader, Academician, Biodiversity Specialist, Botanists, Zoologists, Researchers, Environmentalists and Lawyers, Local Government Leaders, Policy-makers and effective other stakeholders.

The biodiversity clearing house mechanism creates new effort to the national conservation awareness and disseminating worldwide through online connection as well as interlinked with CBD and other state parties (Figure 4).

This model will be enhanced by the state party for developing of national biodiversity clearing house mechanism, which fulfils the requirements of CBD's CHM. For example: National Plant Species Database, Wildlife Database, National Park Database and so on. These are interlinked with clearing house mechanism either state party as well as Convention on Biological Diversity. This model also can enhance national reporting to CBD. The assessment of the study that it is connected with world database on protected area, Asian protected area network, CBD state parties' networks, IUCN Red List Database, Global Taxonomic Database, Conservation International Database, Taxonomic Database Working Group and digital conservation related new network database. The BCHM is suitable for information dissemination and collection by the researchers, academia, scientist, botanists, zoologists, biodiversity specialist, taxonomists, environmentalists, Lawyers, Environmental educationists, Digital conservationists and natural science philanthropists with development of biodiversity.

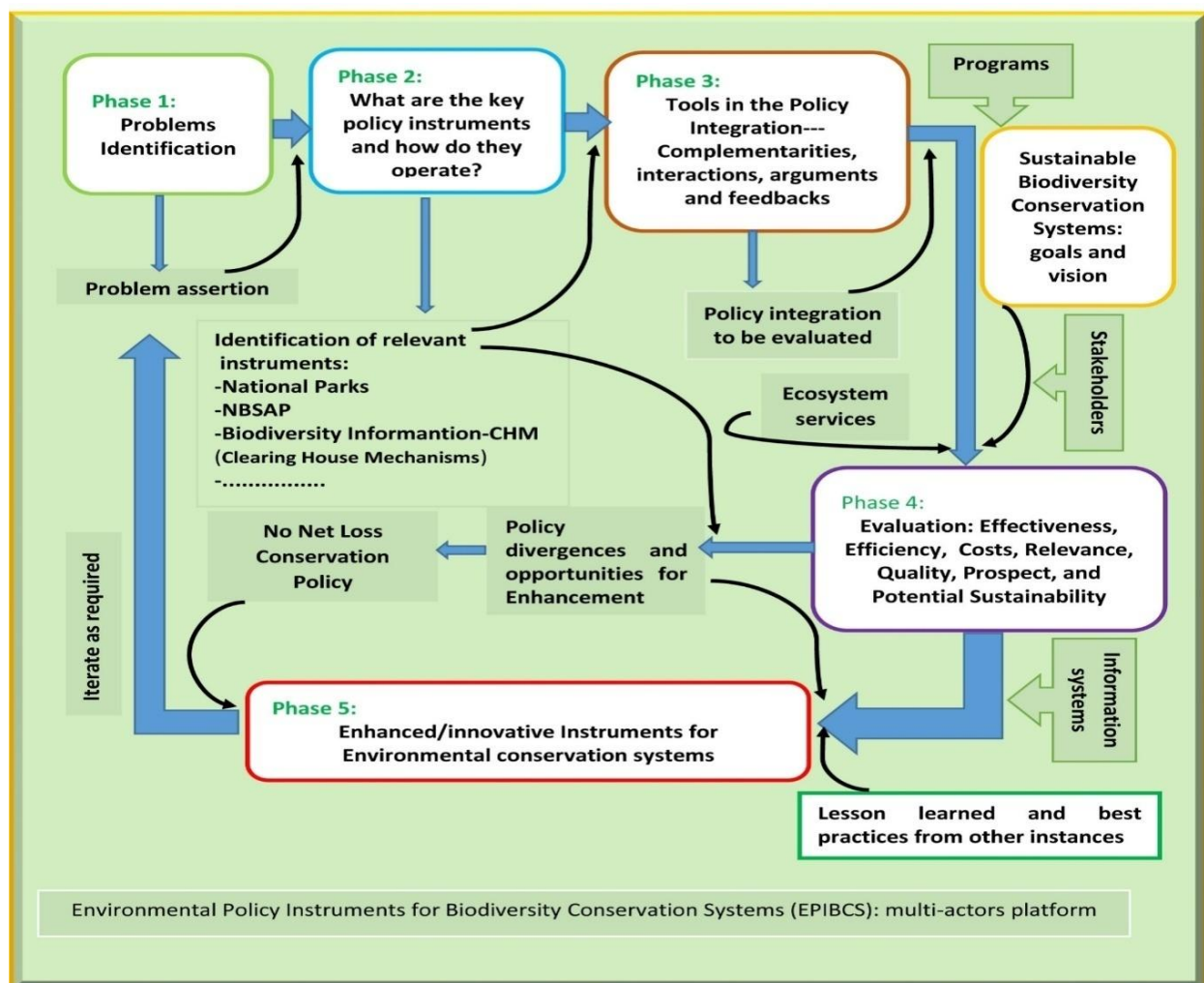


Figure 5. Phases and outcomes of the EPI-BCS policy analysis framework

3.4. A Dynamic Framework on Environmental Conservation Policy Analysis

Environmental Policy Instruments for Biodiversity Conservation Systems (EPI-BCS) is a case study site at Lawachara National Park: A biodiversity policy integration is a combination of environmental policy, biodiversity policy and agriculture policy instruments, which has an influence on the resources efficiency and sustainability of biodiversity conservation including clearing house mechanisms, with a particular focus on co-management inputs and rain water harvesting. An innovative approach assesses policy instruments in different fields, like– wildlife protection and security, revised NBSAP, Policy mix Nishorgo Support Project, Clearing House Mechanism. Overall, this assessment indicated to the problems identification of existing instrument, then includes effective policy operations for integration with feedbacks and performance, then evaluation for effectiveness and potential sustainability, and lastly the innovative instrument disseminates for sustainable conservation towards National Parks according to the provision of ecosystem services. The study illustrated the main steps of the EPI-BCS policy analysis framework includes 5 procedural steps operating in a sequential and iterative mode. These Phases are, (i) Phase 1: Problems Identification, (ii) Phase 2: Select instrument and its operation, (iii) Phase 3: Policy Integration, (iv) Phase 4: Policy Evaluation, and (v) Phase 5: Enhanced Innovative Instruments for sustainable environmental conservation, as shown in Figure 5.

Table 2. Stakeholders Activities and Actions towards Policy Instruments

Stakeholders	Activities	Action
Co-management team, Local stakeholders and Park Administration	(i) Identification of perception of different stakeholders on the reasons for rain water harvesting. (ii) Removal of Invasive Alien Species. from Lawachara National Park, (iii) Possible solutions to reach reduce this issue in the long-term, integration of a wide stakeholder field as there are opinions on who is expert in these field.	(i) Effective time frame (ii) Facilitation, Integration and Initiatives by Team leader. (iii) Supporting parameters.

The primary phase is to select a policy issue (or two main issues) that links directly with EPI-BCS and that will be addressed in the Lawachara National Park. These are (a) scarcity of water for wildlife during dry and winter season, (b) excessive invasive alien species. The main goal is to arrive at a formulation (problem identification) that is agreed by the main stakeholder groups (for example: National Park administration and co-management team) in the LNP area. The final objective of the research is to identify potential enhancements on policies and governance mechanisms related to rain water harvesting and controlling of Invasive Alien Species with these problems that will contribute to

develop an enabling policy for biodiversity conservation with update EPI-BCS products and services. These include some stakeholders like local experts, indigenous people, co-management team member, relevant field specialist, as shown in Table 2.

The research tries to identify the main biodiversity conservation issues/ questions in my case study that the study would like to explore based on the priorities of public bodies (National Park manager, environmental agencies, forestry sector public bodies, nature conservation agencies). It is assumed that these stakeholders take the concerns of public policy and agree for the reflection of the main issues from a broader societal point of view. The documentation of main externalities associated with demanding forest should also be used to inform this discussion, being a relevant link to the work that will be developed in this research. For examples: Externalities are considered in EPI-BCS as the often-unintended side effects of biodiversity conservation activities related to the environment and civil society. Positive externalities: (i) Provision of important (valuable) Lawachara National Park elements and its biodiversity enhancement, (ii) Maintaining adjacent community's coherence, tradition and cultural identity, (iii) Indirect effects on marketing channels/ chains. The policy analysis covers the most relevant policy instruments that shape the forest users (or other relevant stakeholders) decisions in my study area. The policy will not always originate from forestry or environmental rules and regulations merely, but could interlink through miscellaneous sectoral actions (energy or trade policies), as shown in Table 3. The absence of some policies / instruments can also be very relevant to shape the forest users' decisions (rain water harvesting technology provides with low cost) and it is important to identify these gaps to justify the need to adjust/ improve policies in place or design new instruments/ governance mechanisms.

Table 3. Some Examples for Policy Instruments Identification

Sl no.	Some examples
i.	Taxes on access to National Park
ii.	Payments for environmental/ecosystem services/ green tea
iii.	Tariffs/taxes on video conferencing/ digital technology at National Park areas.
iv.	Other forest sectors subsidies and voluntary funding schemes.
v.	Climate policies / carbon taxes.
vi.	Brick fields tariffs/taxes.
vii.	National agri-environmental payments.

Examples of relevant policy instruments identified in LNP area, such as:

- Empowerment of co-management team leader,
- Ensure alternative income generating activities like betel leaf plantation,
- Environmental Education Awareness. As a priority phase to the analysis of the impact of the different instruments on the sustainability of biodiversity

conservation and co-management team, a brief description of each of the instruments identified in the previous section is required. The following aspects are considered in this characterization in Table 4.

The results of the different phases should be used to arrive at a definition of the policy mix that will be studied in the National Parks areas. The related biodiversity policy instrument(s) can be characterized with less detail, including only the relevant elements to understand the links and to allow the development of phase3. Figure 6 presents some examples of potential policy instruments for biodiversity

conservation sustainability, illustrating the case of a hypothetical policy mix for biodiversity conservation.

The performance of the particular tools in the integrated rules is evaluated in this phase. Policy instruments can use a wide range of regulatory and incentive mechanisms, ranging from limits and taxes on harmful activities (e.g., illegal logging), to providing payments for the providing of ecological systems (e.g., betel-leaf cultivation, afforestation program). It is necessary to understand the role of each of the instruments currently applied and the sequencing in their implementation.

Table 4. Different parameters for Policy Instrument Characterization

index	Parameters
a.	Name of the instruments: Legal/In-situ/Information.....
b.	Rationale and objectives of the instrument: brief explanation to justify the need for the instrument, its objectives and how it is expected to address the problem; is the instrument applied in a wider context or is it only applied in a particular case?
c.	It may be relevant to describe the baseline for the implementation of the instrument (e.g., on what basis are payments granted or taxes received? How is the obligation to offset impacts determined?). The baseline describes how property rights are assigned;
d.	Connect to EPI-BCS approach and objects;
e.	Spatial scope (e.g., CBD, national, divisional, district, local and National Park area).
f.	Current status and time horizon: In place from to
g.	Targeted actors (who is targeted by the instrument?). Distinguish between public and private actors/ activities/species/resources;
h.	Governance: includes relevant governance levels of instrument application- often governmental level, but not necessary (e.g., public agency responsible for its proposal and application); the governance level can be: International (e.g., CBD), national (e.g., state party), divisional (e.g., Sylhet division- study area); district (e.g., Moulvibazar district); Local (e.g., Lawachara National Park, and co-management team, Kamalganj sub-district).
i.	Financial issues: required funding/ funding sources/ revenues generated;
j.	Links to other relevant instruments (and new iteration alternatively): Does the instrument typically operate independently or within a policy mix?
k.	Other relevant descriptors for the National Park area.

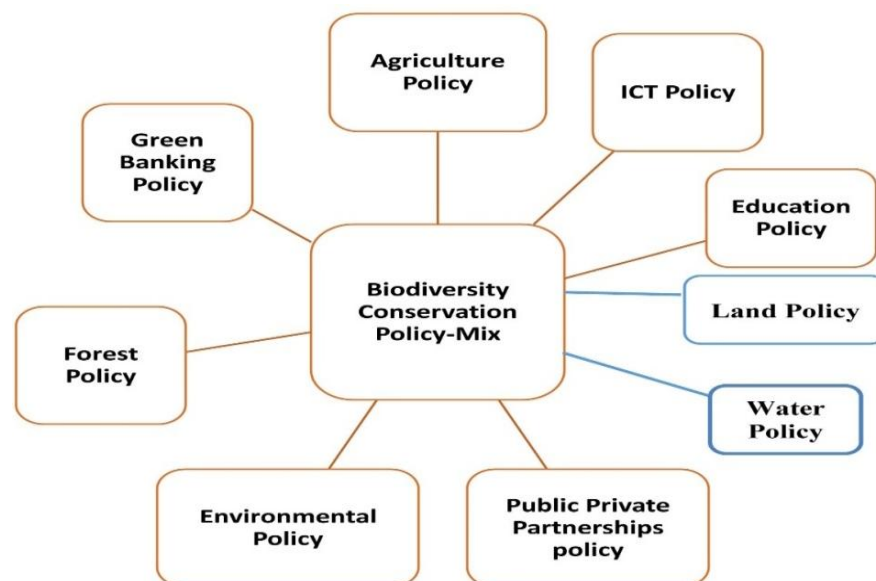


Figure 6. Policy Instruments and policy mixes

To identify the effects of policy interaction, the study should ask the relevant questions, like: (i) which other policy instruments are usually linked with existing instrument?, Yes, National Forest Policy, Environmental Policy, Water Policy, Agriculture Policy, and ICT Policy are linked with existing policy, (ii) what was the sequence of their implementation towards National Park?, Yes, the sequences of their implementation are possible through relevant policy improvement, stakeholder involvement and development of digital conservation, (iii) - Are there hierarchies between legal, in-situ and informational instruments?, Yes, legal instrument tends to informational instrument in presence of in-situ instrument – a reciprocal relationship among them. According to the study, the answers are positive. A balanced combination of biodiversity conservation instruments is desired, and the need to find a synergistic, positive, supportive and complementary interaction among environmental, economic, social, institutional and technological instruments themselves and to avoid negative interaction is predominantly significant. The study can identify national biodiversity policy related interactions:

(i) What's interaction between different policies? Yes, the interaction of different policies is multi-dimensional phases towards Lawachara National Park Biodiversity Management. For example, Forest Policy and Agriculture Policy are interacted with National Park, Agro-biodiversity and Wetland biodiversity.

(ii) Positive interactions identification, yes, established co-management policy at Lawachara National Park - is a positive interaction for conservation management, and

(iii) what process for negative action reduction? Yes, ensure active co-management team and stakeholder's participation with dynamic administration through effective policy for negative action reduction, like illegal logging, land encroachment at Lawachara National Park,

(iv) what's motivation for environmental education towards LNP? Yes, establishment nature education adjacent area of LNP through stakeholder engagement, negotiation and their participations with the help of technological application and political commitment. Besides, ensure

education and training with Alternative Income Generating Activities (AIGA) and Green Income Generating Activities (GIGA) for betel-leaf cultivators. Actually, environmental policy instruments continue with innovative tools and techniques according to national demand and global priorities. Because, the mentioned innovative instruments are used for environmental conservation systems with policy divergences and opportunities towards Lawachara National Park indicating "No-Net-Loss" conservation policy. Overall, the Government of Bangladesh takes initiatives for National Park biodiversity conservation through update NBSAP, BCHM, dynamic administration, sectoral policy integration and stakeholders' participation.

3.5. Effectiveness of Environmental Conservation Policy and Determination

The Government of Bangladesh controls Lawachara National Park. Therefore, the government expected to take comprehensive goals for promoting involvements among the Forest Department, Department of Environment, Water and Agricultural Sector. One of the advances of them intersects the improvements of unique objectives. In this condition, policy makers should to substitute advances in one instrument through damages among each other, which delivers rules and regulations to pertinent performers and stakeholders to accomplish better quality, shown as in Table 5.

Effectiveness of environmental conservation policy connected through the capacity of the relevant instrument to complete the policy strategies in the target-oriented results link to the anticipated objectives of the environmental policy instruments, for example: scarcity of water for wildlife in winter season. For this purpose, effective instrument, like rainwater harvesting can be used for natural water reservation, which affect in the conveyance of vital ecological provision. Performance of selected policies enhanced to identify the utmost applicable and suitable indicators to evaluate the effectiveness on the social, policy and demanded costs as stated indicators, which as shown in Figure 7.

Table 5. Policy effectiveness for National Conservation at National Park

Target-oriented options	Purpose	Data obtained	Policy Effectiveness
Dynamic co-management	Conservation and security	Time- series data: Weekly /monthly	Stakeholder Engagement
Rain water Harvesting	Protection of Wildlife and plants during odd seasons	Time- series data: Rainy season	Rainwater Harvesting Policy
Removal of Invasive species	Ensure native species protection	Time- series data: Monthly/yearly	Wildlife conservation and security Act 2012, ABT 2020
Afforestation program	Regeneration gap filling	Time- series data: Monthly/yearly	Forestry Policy 1994 and draft policy 2016
Intensive Monitoring systems	Quality Reporting and relevant decision-making	Time- series data: Monthly/quarterly	Clearing House Mechanism and digital conservation
Budget allocation	Dynamic efficiency incentives	Cost-benefit analysis	Cost-effectiveness

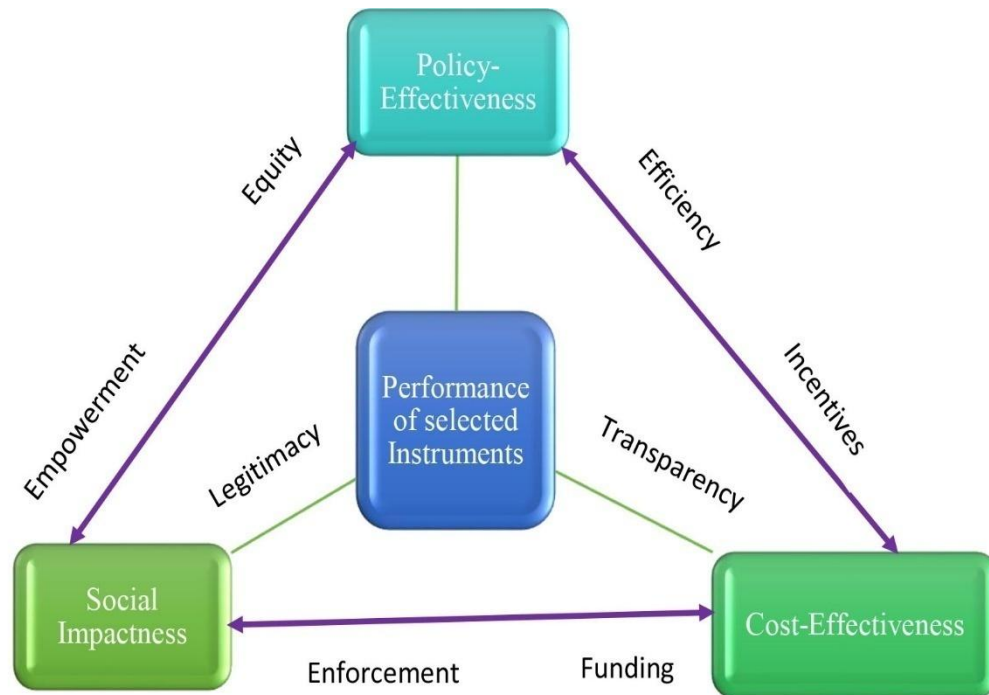


Figure 7. Performance evaluation of selected policy instruments

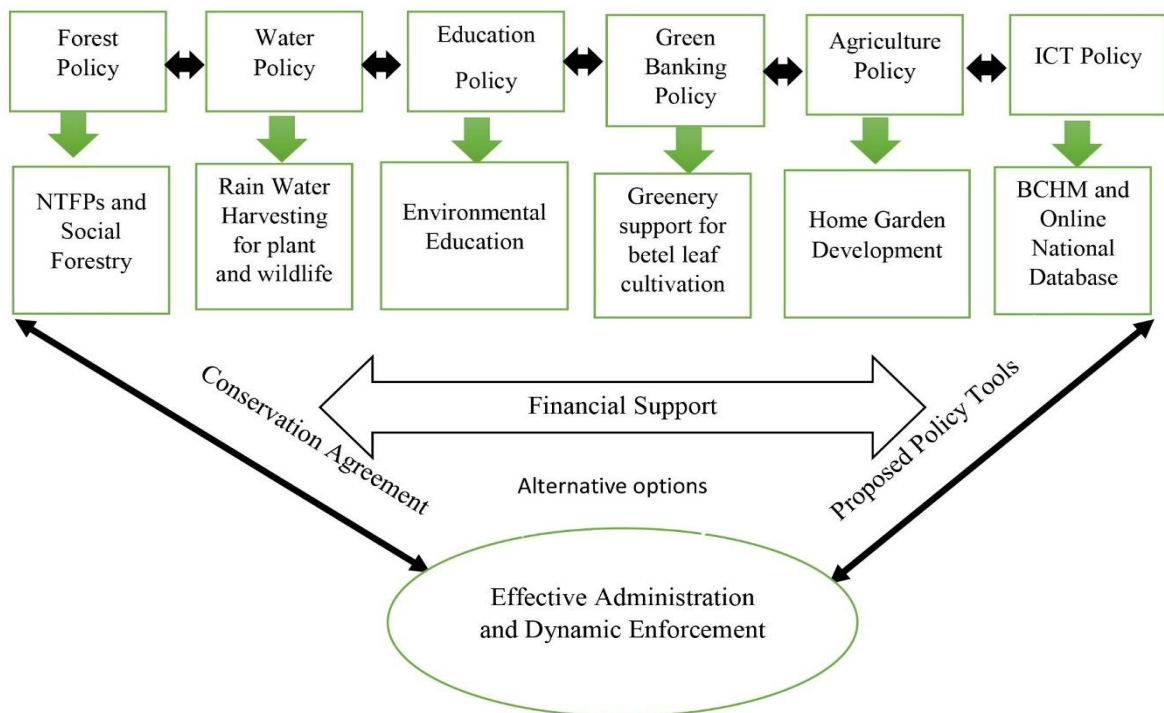


Figure 8. Environmental Conservation related new and alternative policy instruments

Improvement for Innovative policy instrument: This is last phase of policy framework, which is concerned with (i) the identification of the root causes of the existing park, (ii) key significances for existing policy enhancement, and (iii) prospects for presenting innovative tools. The main requirement for this phase to recognise the root causes are (a) no permanent water body, and (b) lack of environmental conservation awareness. The study identified that the

consciousness may increase social Impactness through environmental education among the local and indigenous people, while the poverty will be eliminated and avoided encroachment activities. The key significances for policy enhancement are integration among different sectors, such as: (a) Forest Department integrated with Department of Environment, Agricultural Sectors, Education Sectors, Green Banking Sector and other relevant sectors. For

example: with the cooperation of Park Administration and Co-Management Team, LNP recovered 20-acre encroached forest land and increased grant financing than other national parks in Sylhet division from ecotourism activities.

3.6. Prospects for Presenting Innovative Tools

The study proposed to identify propositions for innovative conservation policy instruments (Figure 8) towards Lawachara National Park with the update on enforcement of Wildlife Conservation and Security Act 2012 as per the requirements of CBD policy. The existing Act of Bangladesh connected with other relevant policies, like Education Policy for Environmental Education, Green Banking policy for betel leaf cultivators, Agriculture Policy for Home Garden, Forest Policy for Social Forestry and ICT policy for Biodiversity Clearing House Mechanism. The presenting of innovative instruments recognised gaps, with the aims to support supplementary and synergies as well as to evade conflicts and restrictions. The study tries to analyse different data according to its objectives with graphical and tabular formats. The research reveals the environmental policy instruments using information systems for conservation of biodiversity towards National Park. For this purpose, the study finds several mathematical views as well as logical views regarding applications of biodiversity information systems and its stakeholders' opinions, growth of National Parks and its distribution, clearing house mechanism and its present status, NBSAP and its structure to compare with other state parties, controlling measure of Invasive Alien Species, and relevant policy status and comparing with Malaysia's policy (Miah *et al.*, 2017).

3.7. Progress of Implementation and Efficiency

Lawachara National Park Biodiversity Research is connected with progress of implementation and efficiencies depending on the Government of Bangladesh. The research is based on bioenvironmental policy and technology for conservation of biodiversity towards national park. As a State Party, Bangladesh ratified with CBD to ensure commitments for sustainable use of natural resources. For these purposes, Government of Bangladesh takes initiative regarding the agreement for proper implementation and efficiency until to date. Government developed biodiversity related law and policies, plans, and strategies and to continue for formulation, update, modification and reforms according to institutional requirements. Some targets also delay in time for start-up is being compensated for with an extension period 2016 to 2021. Implementation delays were also caused by cumbersome procedures within participating state party government for update NBSAP, new declaration of national parks, new law on the wildlife conservation and security Act 2012, announcement bid for national biodiversity clearing house mechanism. In Bangladesh, further implementation delays were faced mainly because of national procedures for hiring consultants for services and studies.

With the good coordination of IUCN, UNDP, GEF, USAID, IPAC and other agencies, the updated NBSAP has been implemented efficiently and has achieved a number of outputs and outcomes. Obtainable inputs and means have been assigned in a transparent and sufficiently flexible manner to where they are most obligatory resulting in tangible outputs with the co-operation of co-management team. Implementation has been adjusted to the reality on the grounds and to the scope for action in different national parks of Bangladesh, particularly Lawachara National Park in Sylhet division. A high number of good-quality outputs have been formed and disseminated to the pertinent target groups and beneficiaries. The several partners are involved in work planning and provide proper progress reports. The National Contact Point also submitted the fifth national report to CBD in time. The grant financing of Lawachara National Park is maximum from the period of 2009 to 2014 than other national parks in Sylhet, which stands out in its achievement as an impressive volume of task with significant impact. Bangladesh currently achieved 106.613 square kilometres of marine area including 19.469 sq. km in the Bay of Bengal in 2014 by a legal judgement of United Nations Tribunal (Turley *et al.*, 2016). On the other hand, the administration of Lawachara National Park achieved 20 acres' area from illegal encroacher in January 2017 (ALNP, 2017).

3.8. Conservation Instruments – Effectiveness to Date

CBD is well on track to achieving most, if not all, premeditated Aichi Biodiversity Targets on time if the necessary course corrections (Bruner *et al.*, 2001) are time-honoured. It has supported the promotion and implementation of NBSAP and BCHM of each state party of CBD within stipulated time. The Government of People's Republic of Bangladesh (MoEF) has approved the Bangladesh Biodiversity Act, 2017, while the Ministry of Environment and Forests announced circulation for bid on BCHM. The research is making a big step effectively introducing environmental policy instruments along with information systems for conserving biodiversity towards national park in Bangladesh, to be incorporated into divisional and district –level plans and actions according to national policies and CBD guidelines/ requirements. Media coverage efforts are being strengthened to raise the national parks, and numerous articles have been published in refereed international journals and conferences.

The discussion on analysis of research findings on environmental policy instruments, along with the assessment of information systems evaluates the biodiversity conservation at Lawachara National Park in Bangladesh.

4. Conclusions

In conclusion, the findings on the existing policy instruments are inadequate in connection with national and global perspectives, where there are some gaps, like policy formulation, sectoral integration, national park declaration,

establishment of digital conservation and insecure wireless sensor networks surrounding national park areas. The researches try to find the policy analysis, its effectiveness to the Aichi Biodiversity Targets 2020. As a developing country, Bangladesh has little research on environmental policy instruments for conserving biodiversity, where there are many analysis gaps. In this regard, the research finds suitable argument on the priority of observing gaps solving with a scientific framework.

5. Declaration

Funding

This research work is a part of PhD Thesis, which was funded by the Zamalah Postgraduate Scholarship of UNIMAS, Malaysia and also sponsored by the Information and Communication Technology Division, Ministry of Posts, Telecommunication and Information Technology, Government of People's Republic of Bangladesh. The funders had no role in the design of the research, in data collection, analyses or final interpretation of data, in the writings of the manuscript, or in the decision to publish the findings.

Data Availability

Data being used to support the findings of this research work are available from the corresponding author upon request.

Competing Interests

The authors declare no potential conflict of interests in this research work.

ACKNOWLEDGEMENTS

The authors acknowledged the authority of Universiti of Malaysia Sarawak (UNIMAS), Malaysia for providing the Zamalah Postgraduate Scholarship for the completion of PhD degree. The authors are also grateful to the authority of the Information and Communication Technology Division, Ministry of Posts, Telecommunication and Information Technology, Government of People's Republic of Bangladesh, for PhD Fellowship during the higher study in Malaysia. The authors acknowledged the authority of North East Medical College affiliated with Sylhet Medical University, Sylhet, Bangladesh for kind supports.

REFERENCES

- [1] Balmford, A. P., Crane, A., Dobson, R., Green, E. & Mace, G. M. (2005). The 2010 challenge: Data availability, information needs and extraterrestrial insights, *Philosophical Transactions of the Royal Society B*, 360, 221–22.
- [2] Jorin Tasnim Parisha, J.T., Md Rahimullah Miah, M.R., Md Mehedi Hasan, M.M., Motia Begum, M. (2022). Impact of Environmental Pollution along with Technology for Conserving of Biodiversity. *International Journal of Ecosystem*, 12(1), 20-30. doi: 10.5923/j.ije.20221201.02. url: <http://article.sapub.org/10.5923.j.ije.20221201.02.html>.
- [3] Juffe, B. D., Burgess, N.D., Bingham, H., Belle, E.M.S., de Lima, M.G., Deguignet, M., Bertzky, B., Milam, A.N., Martinez-Lopez, J., Lewis, E., Eassom, A., Wicander, S., Geldmann, J., van Soesbergen, A., Arnell, A.P., O'Connor, B., Park, S., Shi, Y.N., Danks, F.S., MacSharry, B. & Kingston, N. (2014). Protected Planet Report 2014. UNEP-WCMC: Cambridge, UK.
- [4] Maciel, E.N., Sterling, E.J. & Rao, M. (2008). Protected Areas and Biodiversity Conservation I: Reserve Planning and Design. Network of Conservation Educators and Practitioners, Center for Biodiversity and Conservation, American Museum of Natural History. *Lessons in Conservation*, 2, 19–49.
- [5] Miah, M. R., Rahman, A. A. M. S., Sayok, A. K., Samdany, A. A. & Hannan, M. A. (2021h). How to fight the COVID-19 global crisis. *World Journal of Environmental Research*, 11(2), 31–38. <https://doi.org/10.18844/wjer.v11i2.5855>. URL: <https://www.un-pub.eu/ojs/index.php/wjer/article/view/5855>.
- [6] Miah, M. R., Sayok, A., Sarok, A., & Uddin, M. B. (2017). Towards Dynamic Policy Instruments for Enhancing Biodiversity Conservation in National Parks: A Case Study on Bangladesh and Sarawak, Malaysia. *Borneo Journal of Resource Science and Technology*, 7(1), 11-30. <https://doi.org/10.33736/bjrst.391.2017>.
- [7] Miah, M.R. (2018). *Assessment of Environmental Policy Instruments along with Information Systems for Biodiversity Conservation in Bangladesh* (Doctoral dissertation, PhD Thesis. IBEC, UNIMAS, Malaysia. 1-480. Retrieved from <https://ir.unimas.my/id/eprint/24535/>.
- [8] Miah, M.R. , et al. (2021f). Adverse Effects of Wireless Sensor Technology to Debilitating in Numbness. *International Journal of Virology and Molecular Biology*, 10(1), 12-25. doi: <https://doi.org/10.5923/j.ijvmb.20211001.03>. Retrieved from
- [9] Miah, M.R., et al. (2021g). Impact of Sensor Networks on Aquatic Biodiversity in Wetland: An Innovative Approach. *Geosciences*, 11(1), 10-42. <https://doi.org/10.5923/j.geo.20211101.02>. Retrieved from <http://article.sapub.org/10.5923.j.geo.20211101.02.html>.
- [10] Miah, M.R., et al. (2019). Towards Stimulating Tools for Advancement of Environmental Conservation through Promoting of Psychological Instruments. *Journal of Sustainable Development*, 12(4), 196-224. <https://doi.org/10.5539/jsd.v12n4p196>. Retrieved from <https://www.ccsenet.org/journal/index.php/jsd/article/view/0/40313>.
- [11] Miah, M.R., et al. (2020). Impact of Sensor Technology Enhancing Corona Disease. *American Journal of Biomedical Engineering*, 10(1), 1-11. <https://doi.org/10.5923/j.ajbe.20201002>. Retrieved from <http://article.sapub.org/10.5923.j.ajbe.20201001.03.html>.
- [12] Miah, M.R., et al. (2020a). Impact of Sensor Networks towards Individuals Augmenting Causes of Diabetes. *International Journal of Diabetes Research*, 9(2), 1-10. <https://doi.org/10.5923/j.diabetes.20200902>. Retrieved from <http://article.sapub.org/10.5923.j.diabetes.20200902.02.html>.

- [13] Miah, M.R., et al. (2021). Coronavirus: A Terrible Global Democracy, *International Journal of Applied Sociology*, 11(2), 46-81. doi: 10.5923/j.ijas.20211102.02. Retrieved from <http://article.sapub.org/10.5923.j.ijas.20211102.02.html>.
- [14] Miah, M.R., et al. (2021). Discovery of Coronavirus with Innovative Technology. *Science and Technology*, 11(1), 7-29. <https://doi.org/10.5923/j.scit.20211101.02>. Retrieved from <http://article.sapub.org/10.5923.j.scit.20211101.02.html>.
- [15] Miah, M.R., et al. (2021a). Effect of Coronavirus Worldwide through Misusing of Wireless Sensor Networks. *American Journal of Bioinformatics Research*, 11(1), 1-31. <https://doi.org/10.30564/jer.v3i1.2826>. Retrieved from <http://article.sapub.org/10.5923.j.bioinformatics.20211101.01.html>.
- [16] Miah, M.R., et al. (2021b). A Dynamic Scientific Model for Recovery of Corona Disease. *Frontiers in Science*, 11(1), 1-17. <https://doi.org/10.30564/jer.v3i1.2826>. Retrieved from <http://article.sapub.org/10.5923.j.fs.20211101.01.html>.
- [17] Miah, M.R., et al. (2021c). Processed Radio Frequency towards Pancreas Enhancing the Deadly Diabetes Worldwide. *Journal of Endocrinology Research*, 3(1), 1-20. doi: <https://doi.org/10.30564/jer.v3i1.2826>.
- [18] Miah, M.R., et al. (2021d). Unexpected Effects of Advanced Wireless Sensor Technology on Climate Change. *World Environment*, 11(2), 41-82. doi: 10.5923/j.env.20211102.01. Retrieved from <http://article.sapub.org/10.5923.j.env.20211102.01.html>.
- [19] Miah, M.R., et al. (2022). Myths about Coronavirus: A Research Defense. *Global Journal of Health Science*, 14(2), 63–112. Retrieved from <https://ccsenet.org/journal/index.php/gjhs/article/view/0/46717>.
- [20] Miah, M.R., et al. (2022a). Towards the Misuse of Advanced Wireless Sensor Technology to Enable the Sudden Onset of ARDS. *American Journal of Medicine and Medical Sciences*, 12(6), 616-638. doi: 10.5923/j.ajmms.20221206.05. Retrieved from.
- [21] Miah, M.R., et al. (2022b). Impact of Oscillated Wireless Sensor Networks to Initiate Cardiac Arrest, *International Journal of Internal Medicine*, 11(1), 1-46. doi: 10.5923/j.ijim.20221101.01. Retrieved from <http://article.sapub.org/10.5923.j.ijim.20221101.01.html>.
- [22] Miah, M.R., Hasan, M.M., Parisha, J.T. & Chowdhury, S.H. (2022d). Socioeconomic Impact of the Coronavirus Pandemic with Multiple Factors on Global Healthcare Policy. *Journal of Politics and Law*, 15(4), 242. doi: 10.5539/jpl.v15n4p242, url: <https://doi.org/10.5539/jpl.v15n4p242>.
- [23] Miah, M.R., Hasan, M.M., Parisha, J.T., Sayok, A.K. (2022e). Challenges of Legal Instruments for Biodiversity Conservation along with National Parks. *International Journal of Agriculture and Forestry*, 12(3), 79-101. doi: 10.5923/j.ijaf.20221203.03. url: <http://article.sapub.org/10.5923.j.ijaf.20221203.03.html>.
- [24] Miah, M.R., Hasan, M.M., Parisha, J.T., Shahriar, C.S., Sayok, A.K., Chowdhury, S.H. (2022c). Adverse Global Health Impacts Due to the Proliferation of Man-Made Technological Heatwaves. *Resources and Environment*, 12(3), 67-75. doi: 10.5923/j.re.20221203.01. url: <http://article.sapub.org/10.5923.j.re.20221203.01.html>.
- [25] Miah, M.R., Mustaffa, M.S., Sabil, S., Madihie, A., Saili, J. & Sayok, A.K. (2018). Towards Dynamic Policy for Early Childhood Development Enhanced the Growth of Self-Regulations. *International Journal of Engineering & Technology*, 7(330), 251-255. DOI: <https://doi.org/10.14419/ijet.v7i3.30.18251>.
- [26] Myers, N., Mittermeier, C.G., Da Fonseca, G.A. & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403, 6772, 853–858.
- [27] NPS. (2016). National Parks of Sarawak. url: <http://www.mirimarina.com/images/nationalparkmap.gif> (Accessed on June10, 2017).
- [28] NSW Government (2022). What is the global biodiversity conservation framework? Biodiversity Conservation Trust. Department of Planning, Industry and Environment, Australia. url: <https://www.bct.nsw.gov.au/info/what-global-biodiversity-conservation-framework>.
- [29] Orts, E.W. (1995). A Reflexive Environmental Law. *Northwestern University, School of Law. Northwestern University Law Review*, 89 (4), 1227, 1229–1299.