 doi:10.20944/preprints201906.0014.v1

Article

Dynamic Environmental Governance Enhanced Sustainable Biodiversity Management in Bangladesh

Md. Rahimullah Miah[1*], Md. Sher-E-Alam[2], Alexander K Sayok[3]

[1]Mornington University College of Business, Amborkhana, Sylhet, Bangladesh.
[2]Department of Law and Justice, Metropolitan University, Sylhet, Bangladesh.
[3]Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak.

*Corresponding Author: 14010140@siswa.unimas.my

Abstract: Governance is one of the most essential instruments for environmental management. Biodiversity is in the core field of environmental governance. Yet environmental authorities are persistently challenged the loss of biodiversity as a very important global issue for several years due to high dependent exposure to risks. The study attempts to relook at the key governance tools that strengthen policies towards managing biodiversity within and around the national park's survey in Moulvibazar district. The study showed that biodiversity related legislation amended was the highest in Bangladesh for the period of 2010 to 2016. The growth of policy instruments maximized at but in low environmental governance services within the same period. The study assessed that the existing environmental policy instrument is inadequate and sluggish for effective conservation, compared with several others governance tools and various performances are still below par. Governance knowledge is indispensable for biodiversity management but such knowledge is poorly identified. These results reflect the importance of effective governance for transparency that the State provides. The research is to represent a dynamic and adaptable framework that can be applied for collective governance relevant to policy integration, participation and enforcement in order to foster environmental conservation sustainability.

Key words: Governance, Environmental Management, Biodiversity, Bangladesh.

1. Introduction

Failure to govern biodiversity conservation and prevent loss of biodiversity can have profound negative effects on long term sustainable development and human rights including the right to access to information, access to review, accountability and participation. This can also lead to denial of social, legal, economic and technological protection in particular for vulnerable groups, local and indigenous community living in poverty. Further dynamic governance and public policy reforms are consequently desired to ensure that the management of national park biodiversity conservation provides into poverty reduction and equitable sustainable development [1]. Exclusive of collaborative peace, stability, human rights and dynamic governance based on the rule of law, we cannot hope for sustainable biodiversity development [2]. Collaborative approaches to governance are being applied to address some of the most complicated environmental conservation issues across the world, but there is inadequate focus on the challenges of national park biodiversity management [3]. The challenges of collaboration in environmental governance brings together leading to scientists, researchers and biodiversity specialists from the north-eastern part of Bangladesh and neighboring countries with the extensive array of disciplinary surroundings. These are included planning, designing, public policy, public administration, protected area management, political

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

sciences, biodiversity management, legal status, conflict resolution and related arena – to directly deal with the challenge and restrictions of co-governance in practices [3]. With national park environmental issues having political, managerial, behavioral and technological dimensions, increasing attention has been paid to environmental governance as an overarching means to deal with various environmental difficulties [4].

The study aims to explore the key governance tools that strengthen policies towards conserving biodiversity within and around the Lawachara National Park (LNP) at Kamalganj in Moulvibazar district of Bangladesh. Yet, the study argues that there is still a relative paucity of comprehensive and pragmatic guidance that can be used to outline the assessment, plan, and inquiry of conservation systems of environmental governance at LNP.

1.1 General Context of Environmental Conservation Governance

According to World Bank Report of [5] - the term Governance is defined as: "the manner in which the power is exercised in the management of a country's economic and social resources for development". Here, no doubt that Lawachara National Park is the public economic resource. So, good governance is the vital parameter for protecting of biodiversity. There are some parameters, such as: Attitude, Participation, Transparency, Accountability, Access to Information, Flexibility, Responsibility, Dynamism. On the other hand, environmental governance is the ability of a state to govern its resources as prescribed in forms of legal instruments and enhanced by policy, project, programme and institutional interventions on the priority of environmental conservation. This conservation governance is to assess how various approaches have attempted to address some of the most pressing environmental challenges to our period, which are loss of national park's biodiversity, ecosystem services degradation, environmental issues, global climate change and relevant perspectives [6]. The environmental conservation researchers find that a major part of this study has inclined to accentuate a particular agent of environmental governance as being the most dynamic, particularly policy makers, market actors, state actors, civil society-based actors as collaborative management committee, non-governmental organization and local communities.

A mixture environmental conservation governance strategies is being practiced for national parks biodiversity conservation in connection with national biodiversity strategic action plan (NBSAP), state and civil society-based governance strategies depend on their supports for the fulfillment of social domains and interactions [6]. The study also observes the significance of spatial and organizational parameters to environmental conservation governance, focusing collaborative management [7] as well as co-governance, which is grounded on partnership, participation and notions of individual's attitudes and relevant parameters [8]; [9]. These parameters in environmental conservation governance can possibly be prolonged to involve various types of environmental issues and challenges. The assessment highlights emerging integration manners of related governance that the state provides including co-management, public-private-partnerships and social-private-partnerships [6]. This includes the rules, both formal and informal that govern human behavior, attitude, opinion and application of robust policy and modern technology for decision making process under an appropriate legal framework. The review implies the rule of law and protection of national parks biodiversity at Lawachara National Park, Moulvibazar in Bangladesh. These domains include (i) no one above the law, (ii) accessibility of law, (iii) procedural fairness, (iv) law must be clear, (v) the state must comply with its obligations of international law, (vi) law must be adequate protection of human rights. However, these elements enhanced the legal instrument, which is the major components in Bangladesh environmental conservation governance in both the terrestrial, swamp and marine environment. Besides, there are some agreements signed for national, regional and global rapport buildings including Multilateral Environmental Agreements, Political agreements, Non-binding

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

agreements, Programs, projects and National laws, which exists at various levels in Bangladesh for declaration new national parks and access to information on the update priority of international bindings.

Conservation governance lies within a legal core in which the essential source of environmental governance is to be given the right to govern the natural resources. For this reason, sustainable environmental governance is essential due (a) to reduce the loss of biodiversity, (b) to enact and update national policy of biodiversity, (c) to strengthen the dynamic collaborative-management between stakeholder and policy maker, (d) to improve sectoral policy integration, (e) to make some watchdog institutions for conservation of biodiversity, (f) to ensure a transparent economic mechanism.

Access to information be used for national park biodiversity conservation and relevant tasks [10] (Bhardwaj and Margam, 2016[1]) including (i) Digital conservation, (ii) Environmental Court Information, (iii) Environmental Informatics, (iv) Environmental legal research and Case law reports, (v) Legal database, (vi) Legal online dictionaries, (vii) Legal online library information, (viii) Legal citation, (ix) Legal treaties, convention and agreements, (x) Global legal information network, (xi) Online Legal periodicals, (xii) Information of BAR Association, (xiii) Juris Pedia, (xiv) Institute of Advanced Legal Studies, (xv) International Law Associations, (xvi) Legal Online Conference, (xvii) Legal Information Retrieval, (xviii) Legal tools and media toolkits, (xix) Legal informatics, (xx) Legal Environmental Informatics, (xxi) Online Mock Trial Video Conferencing, (xxii) Online Court Session and Declaration, (xxiii) Legal System connection with Global Navigation Satellite System, (xxiv) National Court Interlinked with Space Research Remote Sensing Organization (SPARRSO), and (xxv) Environmental Court sharing with Supreme Court and District Branch Court for biodiversity governance.

2. Materials and Methods

Bangladesh is a developing country in the north-eastern part of south-east Asia with augmented biodiversity earlier [11] and lies in the earth largest deltaic area between the coordinates of 20°34' and 26°38' north latitude; and 88°01' and 92°41' east longitude [11]. It includes 17 National Parks, 21Wildlife Sanctuaries and 12 other conservation sites [12]. 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 91°47′03″E [13] (NSP, 2005[2]) as the forest conservation case study site (Figure 1). Lawachara National Park is uniqueness in Bangladesh for its scenic beauty and other relevant parameters. The study site was purposefully selected based on a set of conditions like location, suitability, flag species and stakeholders' attractions to permit for the analysis of cases. Lawachara National Park (LNP) was declared as a National

[1] Bhardwaj, R.K. & Margam, M. (2016). Online Legal Information System for Indian Environment: A User's Perspectives. *Library Review*, *65* (8/9), 593–624.

[2] NSP. (2005). Site Strategy for Lawachara National Park. Nishorgo Support Project. BFD-USAID/IRG, Dhaka.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

Park in 1996 with 1,250 hectares (Gazette Notification-PBM (S-3)7/96/367 on 07 July 1996) [14] with highly diverse hilly evergreen forest under the conservation status of the Wildlife Preservation Act-1974 (this Act revealed). The current Wildlife Conservation and Security (WCS) Act, 2012 is effective under the Article 18A of the National Constitution of Bangladesh. Section 21 of this WCS Act mentions collaborative management for national park biodiversity protection. The LNP is one of three national parks in Sylhet region in the north eastern part of Bangladesh [15]. It is semi-evergreen and mixed deciduous forest. Total 460 species consist of floral 167 and 293 faunal species including amphibian 4, reptiles 6, birds 246, mammals 20, insect 17 [16]; [17]).

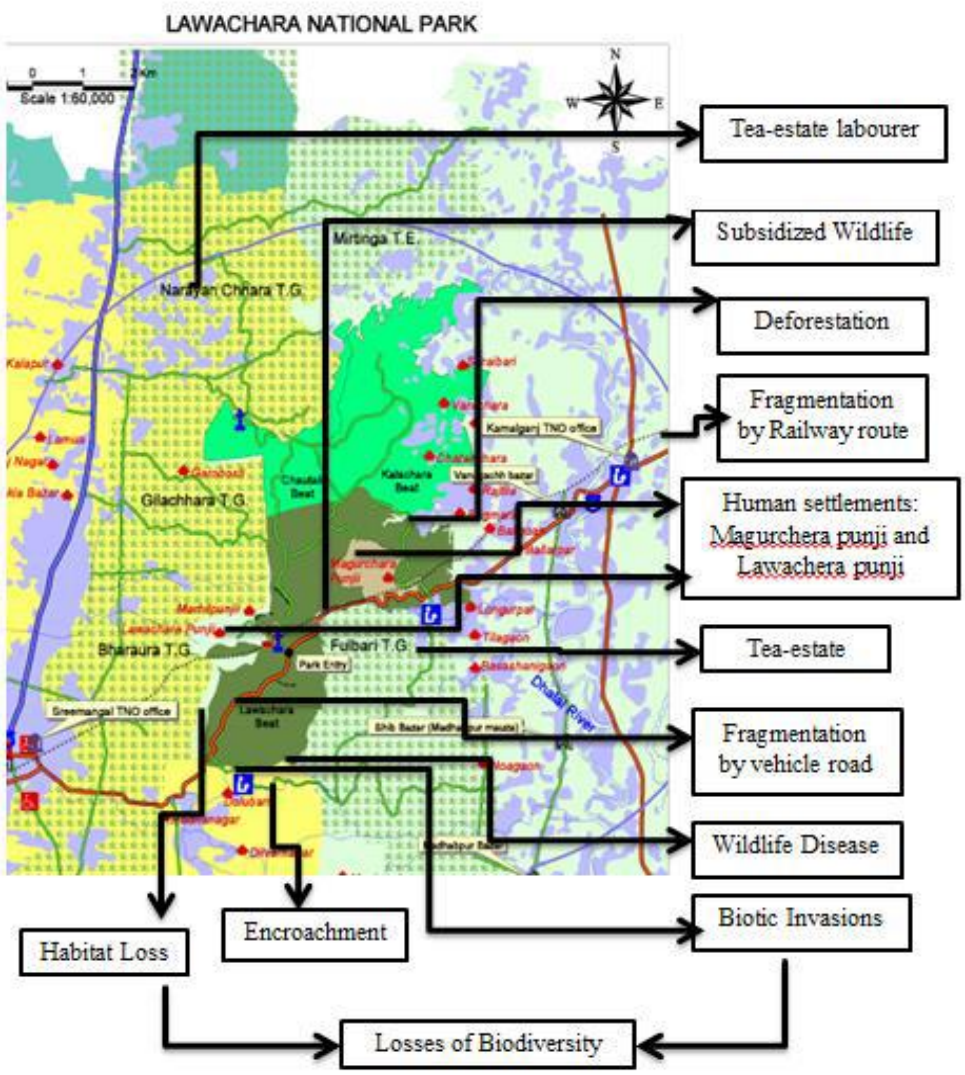

Figure 1: Map of Lawachara National Park, Moulvibazar, Bangladesh

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

The research method was connected with different parameters to enhance data collection, compilation and interpretation. Quantitative and qualitative related environmental governance data were obtained through field observation, interviews, field surveys, focus group discussions, and informal discussion while secondary data were obtained from diverse sources with environmental governance assessment method. The data were compiled and analyzed for presentation and interpretation using standard data analysis software like MS Office Suite 2016.

3. Result and Discussion

The result and discussion included with different parameters of environmental governance, which are listed as following.

3.1 Positive Attitude

The main findings from field descriptions showed that inhabitants of four villages, such as: (i) Lawachera punji, (ii) Magurchera punji, (iii) Dolubari, and (iv) Langurpur. They were highly dependent on natural resources of Lawachara National Park (LNP). Average 63% of respondents opined their positive attitude for environmental conservation governance, which as shown in Table 1.

Table 1: Positive Attitude towards biodiversity conservation

Village name	Total households	Distance from LNP (km)	Positive Attitude towards Biodiversity Conservation
Lawachara Punji	23	Inside, less than 1km	70%
Magurchera Punji	41	Inside, less than 1km	68%
Duluchera	84	within 1km	55%
Langurpur	92	Within 5 km	59%
Total/average	240	Overall, 2 km	63%

3.2 Participation and Awareness

These stakeholders are aware on biodiversity conservation at Lawachara National Park through participation, which as shown in Figure 2. The study found that NGOs and development organizers are more aware (52%) but local villagers (20%) are less motivated than others. It depends upon the participation of all the stakeholders for proposing activities of administration, private sector, Non-governmental Organizations, local and indigenous community leaders.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

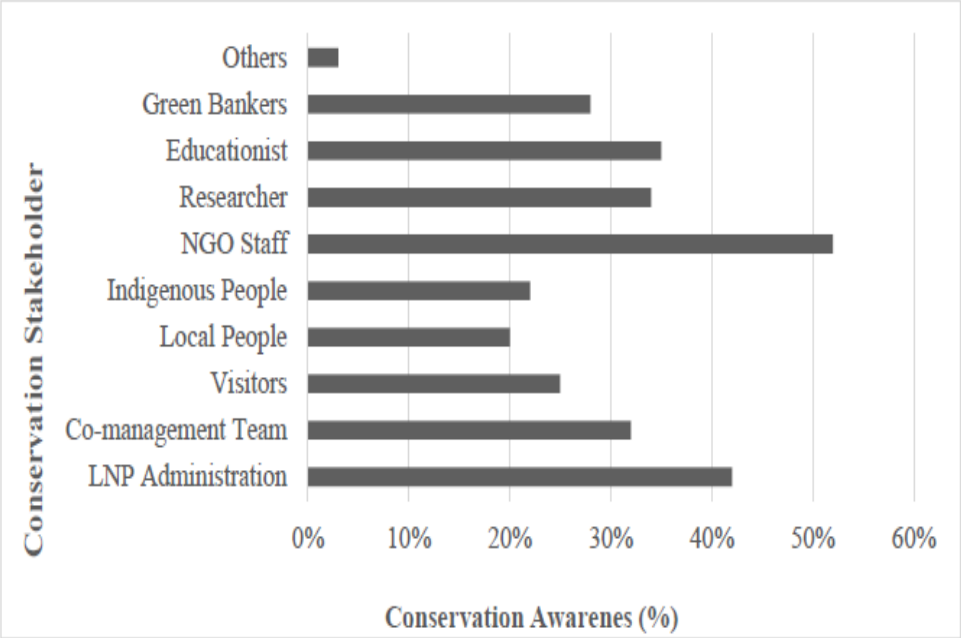

Figure 2: Stakeholders participation for conservation awareness

The stakeholders' average opinion on habitat fragmentation and loss of biodiversity is 90%, where maximum between villagers (94%) and minimum in visitors (85%), as shown in Table2. The study suggested for afforestation /reforestation programme with engagement of stakeholders.

Table2: Stakeholders involvement regarding opinion on loss of biodiversity.

Different parameters regarding loss of biodiversity	Stakeholders' Opinion			
	Villagers	Visitors	Others*	Average
Habitat Fragmentation and Loss	94%	85%	91%	90%
Unsustainable Use/Overexploitation	90%	88%	92%	90%
Negative Impact of Invasive Alien Species	87%	94%	95%	92%
Climate Change driving Biodiversity Loss	88%	93%	95%	92%
Pollution/Nitrogen Posing threat to biodiversity	75%	87%	93%	85%
Limited Capacity including Financial, human and Technical Issues for Biodiversity Loss	88%	82%	94%	88%
Complications in Retrieving Systematic Evidence	86%	94%	96%	92%
Inadequate Consciousness on Conserving of Biodiversity Issue	64%	86%	90%	80%
Constrained National Park's Biodiversity Mainstreaming.	68%	85%	72%	75%
Scrappy Decision-making	62%	76%	90%	76%
Imperfect communications among various department/divisions	54%	88%	92%	78%

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

New legislations relevance to biodiversity conservation initiatives require human resources, institutional capacity, and funding for successful development and implementation to identify the people and organization with the interest and expertise to ensure progress on new legislation development related to biodiversity in Bangladesh (Table 3).

Table 3: Laws and policies to protect biodiversity towards National Park areas in Bangladesh.

Enacted Law	Section/Article	Remarks
The Constitution of the People's Republic of Bangladesh	18A, 102, 152	Conserving national biodiversity and environmental governance
The Bangladesh Biodiversity Act, 2017	3,4,6,8 and 9	National biodiversity conservation and resource dynamism
The Wildlife (Conservation and Security) Act, 2012	2, 11, 12, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24, 27, 28, 29, 30, 34, and 42	Biodiversity conservation and collaborative governance
Bangladesh Environmental Conservation (Amendment) Act 2010.	5, 6, 7, 12, and 15	Environmental conservation and transparency
Bangladesh Forest (Amendment) Act 2000	28, 29, 30, 32, 33, 41, 42, 43, 52, 53, 54, 55, 56, 63, 64, 65, 66, 67, 68	Forest biodiversity protection and accountability
Environmental Court Act2010	4, 9, 11, 14, 15, 18, 19, 20, 21, and 22	Environmental rights, rule of law and responsibility
National Biodiversity Strategic Action Plan 2016	1, 2, 3, 4, 5, 6, 7, 8	Long term planning and community participation for national biodiversity conservation
Brick Prepared and Kiln Establishment (Control) Act 2013	5, 6, and 8	National biodiversity protection and public attitude and flexibility
ICT Act 2013	54, 55, 56, 57	Biodiversity conservation through access to information
Protected Area Management Rules 2017	2, 4, 15, 18, 19, 20,21, 24, 29	National park management with involvement of community.
The Bangladesh Public Private Partnership Act 2015	2, 4,5,6	Biodiversity conservation through partnership.

From Table 3. the study identified 8 environmental governance tools for biodiversity conservation on national parks. These are: (i) Attitude, (ii) Participation, (iii) Transparency, (iv) Accountability, (v) Access to Information, (vi) Flexibility, (vii) Responsibility, (viii) Dynamism.

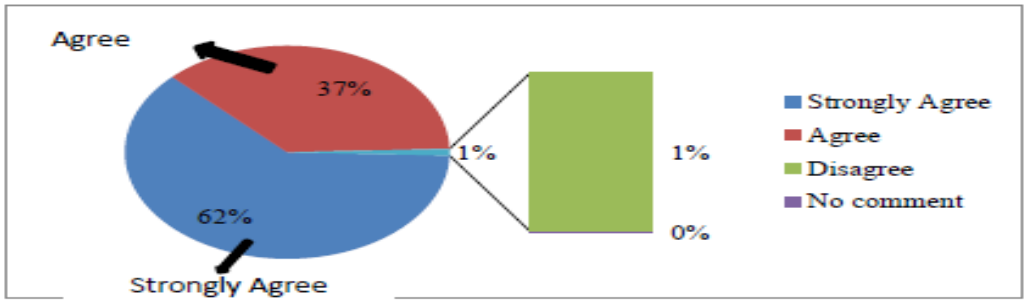

Figure 3: Stakeholders' opinion on Policy Adoption for Biodiversity

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

About 62% of Stakeholders opined the opinion for policy adoption on national park biodiversity conservation in Bangladesh, which as shown in Figure 3. National legislation develops for enhancement of national biodiversity towards National Parks. Biodiversity related national legislation produced maximum within the period of 2010-2018, as shown in Figure 4. The study found that most of legislations related to biodiversity conservation formed after COP-10, in this period, CBD provided circulations to the state parties for update the national legislation for conserving of biological diversity. The represents the fluctuation of policy amended as shown through the polynomial order3 on trend line options (60% policy amended within the last ten years. The Government of Bangladesh produced the Wildlife Conservation and Security Act 2012 within this period. Indeed, it is positive symbol for individual policy. The study suggested that the government takes initiatives for separate law and policy for national biodiversity conservation towards national parks in Bangladesh.

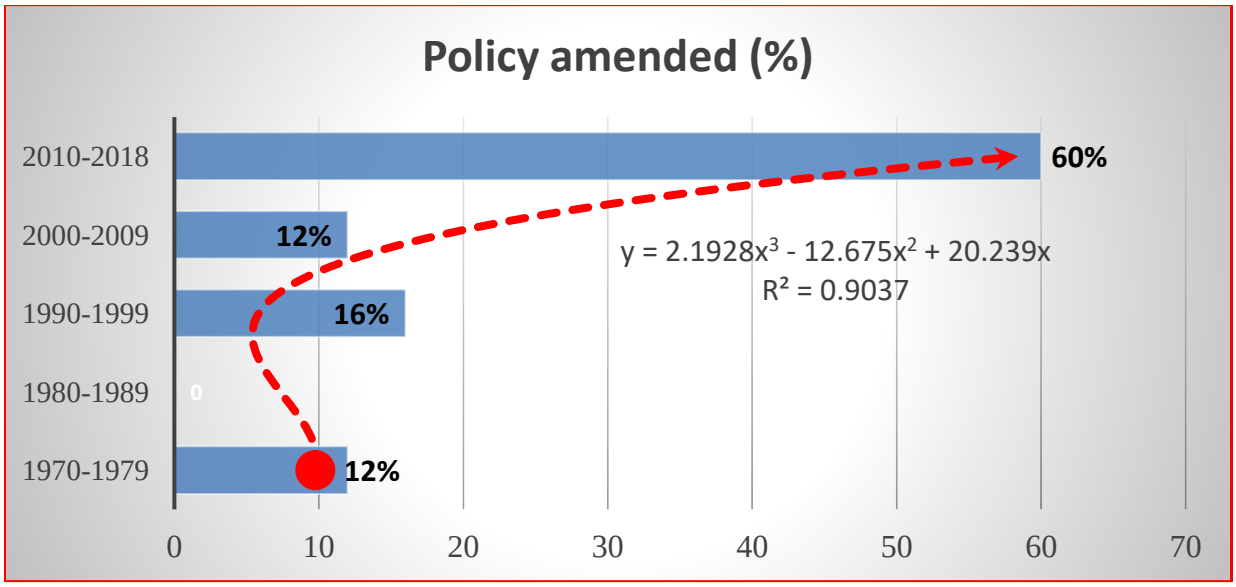

Figure 4: Produced number of biodiversity related legislation in Bangladesh

Bangladesh is a developing country, consists of different sectors and departments, like Bangladesh Forest department, Department of Environment, Department of Agriculture and so on. Each sector has individual policy, viz. forest policy, agriculture policy, environmental policy, and land policy etc. as shown in Figure 5. The study observed that only 36% 'In general' and 64% 'Not mention'. Therefore, the existing law needs to improve. In addition, Bangladesh requires a comprehensive biodiversity law in response to the UN Convention on Biological Diversity (CBD), which embraces the three objectives of the CBD, (a) conservation of biodiversity, (b) sustainable use of resources, and the fair and equitable sharing of the benefits from the utilization of genetic resources to satisfy the needs of present and upcoming generations

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

on the priority of intra-inter-generational equity. From the field survey, the 56% of the respondents opined their opinions as 'inadequate'.

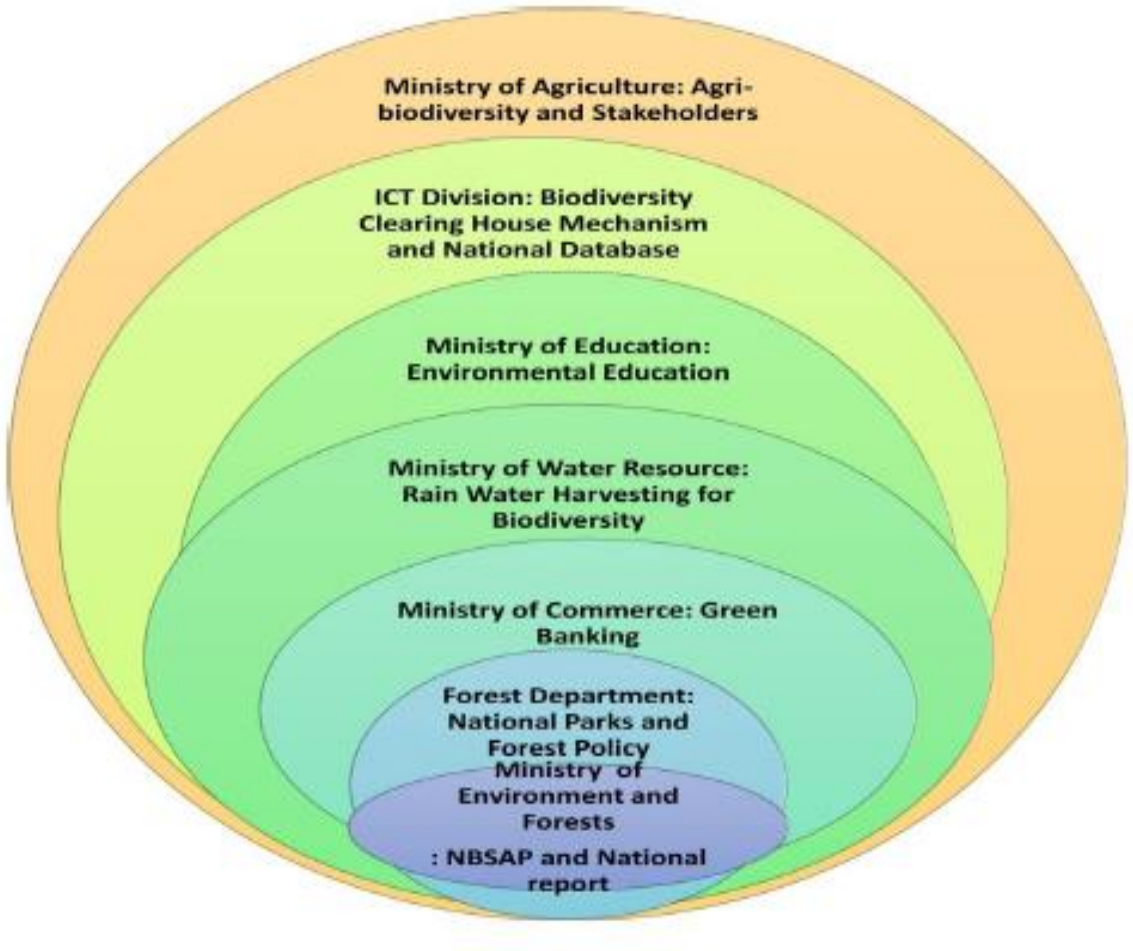

Figure 5: Sectoral Policy Integration

Besides, according to Section 14 (f) of the WCS Act 2012 stated that 'no person shall disturb or threat any wildlife, which may destroy its habitat. Section 21 of the WCS Act 2012 stated that the introduction of co-management system for proper utilization, conservation and management of natural resources of the national park involving forest department, minor ethnic community, local community on participatory basis to ensure active participation of the parties therein. Nevertheless, the Section 21 did not mention on the connection of co-management Committee between Village Conservation Forum, Community Patrol Group and People's Forum—that stated in the Protected Areas Management Rules 2017. Overall, the existing law needs to improve on the priority of Aichi Biodiversity Targets 2020. Bangladesh Islamic Foundation under the Ministry of Religion can develop policy instrument on bio-religious conservation integrity for all National Parks of Bangladesh. Moreover, involvement of religious people can be performed for biodiversity

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

conservation in different ways including involvement, recruitment, inclusion, legislation, multiplication, and incorporation and conservation consciousness of cultural exchange for biodiversity protection with Lawachara National Park vegetation conditions.

3.3 Role of Public-Private Partnership to protect Biodiversity

Public and Private Partnerships (PPP) is the new collaboration for sustainable management of National Park areas. If the Government cannot alone to meet the huge investment needs to protect, conserve, manage and restore the National Parks' Biodiversity, the Government of Bangladesh can build partnership with private agencies [16]. Public Private Partnership Central Unit collaborated to develop a PPP model focused on management, conservation and operation of National Park areas, located national park in Bangladesh (Figure 6).

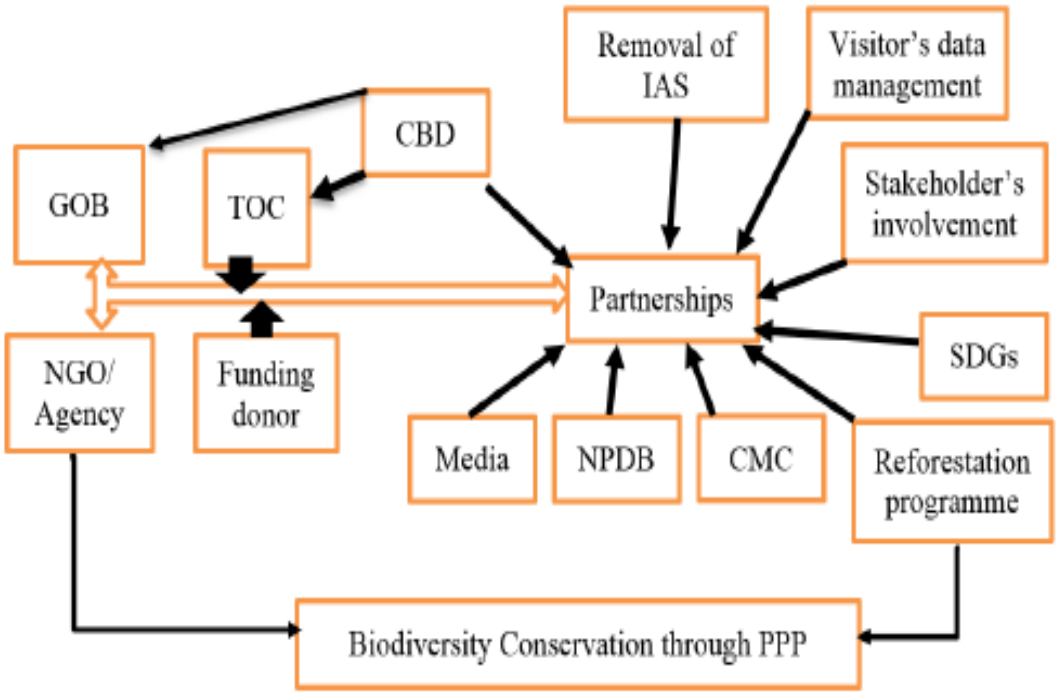

Figure 6: Partnership for biodiversity governance

3.4 Transparency as a catalyst of Good Governance

Lawachara National Park has the maximum grant financing system, the amount of BDT 3620500 (1 US$ equals to BDT80) than that of the other National Parks namely Satchari National Park and Rema-Kalanga Wildlife Sanctuary from the period of 2009 to 2014 [18], which is connected with transparency of environmental governance (Figure 7).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

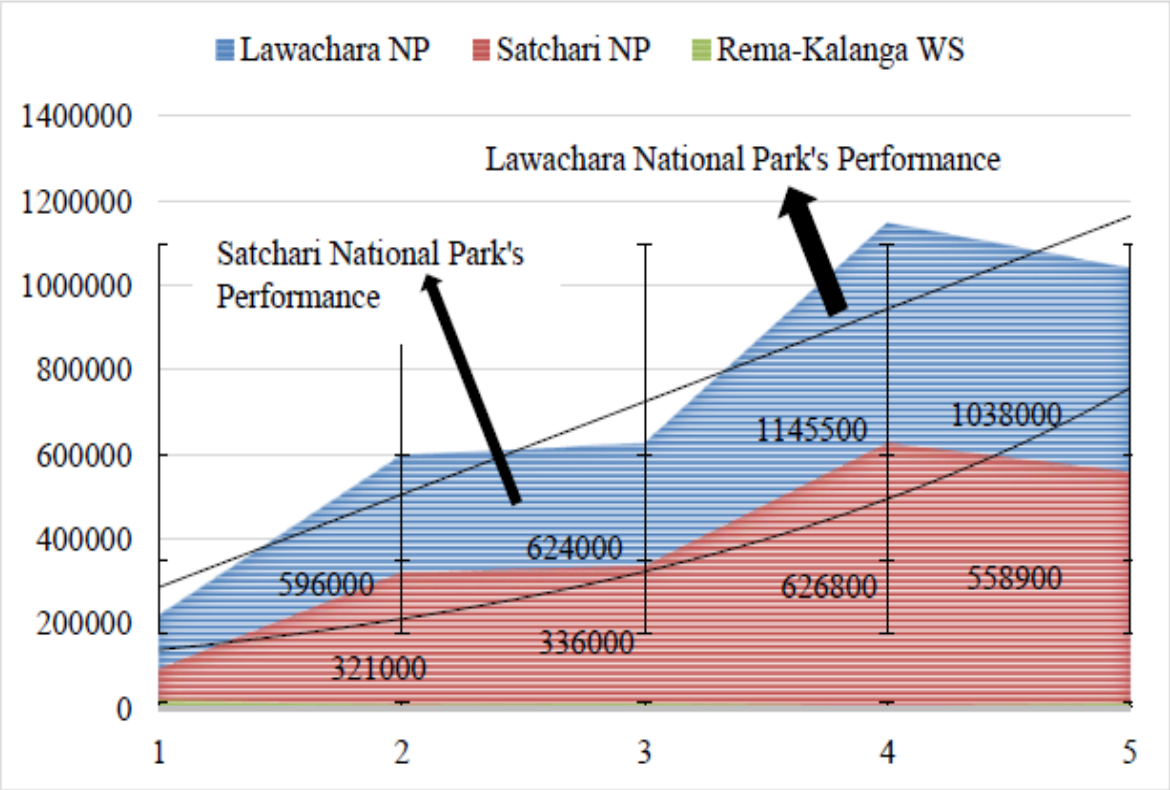

Figure 7: Financial Transparency at Lawachara National Park

3.5 Access to Information and Environmental Justice

The Wildlife Conservation and Security Act 2012 has no a single section for the development of national park biodiversity database on the priority of biodiversity clearing house mechanism (BCHM) of Convention on Biological Diversity.

3.6 Responsibility to Stakeholders

Due to this high dependency on the national park resources, most of the respondents in four villages admitted to undertake illegal as well as unwanted activities inside the park (Figure 8). For example: illegal logging, poaching, hunting, illicit-felling, encroaching. So, there is lack of environmental governance, like effective accountability and collaborative management.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

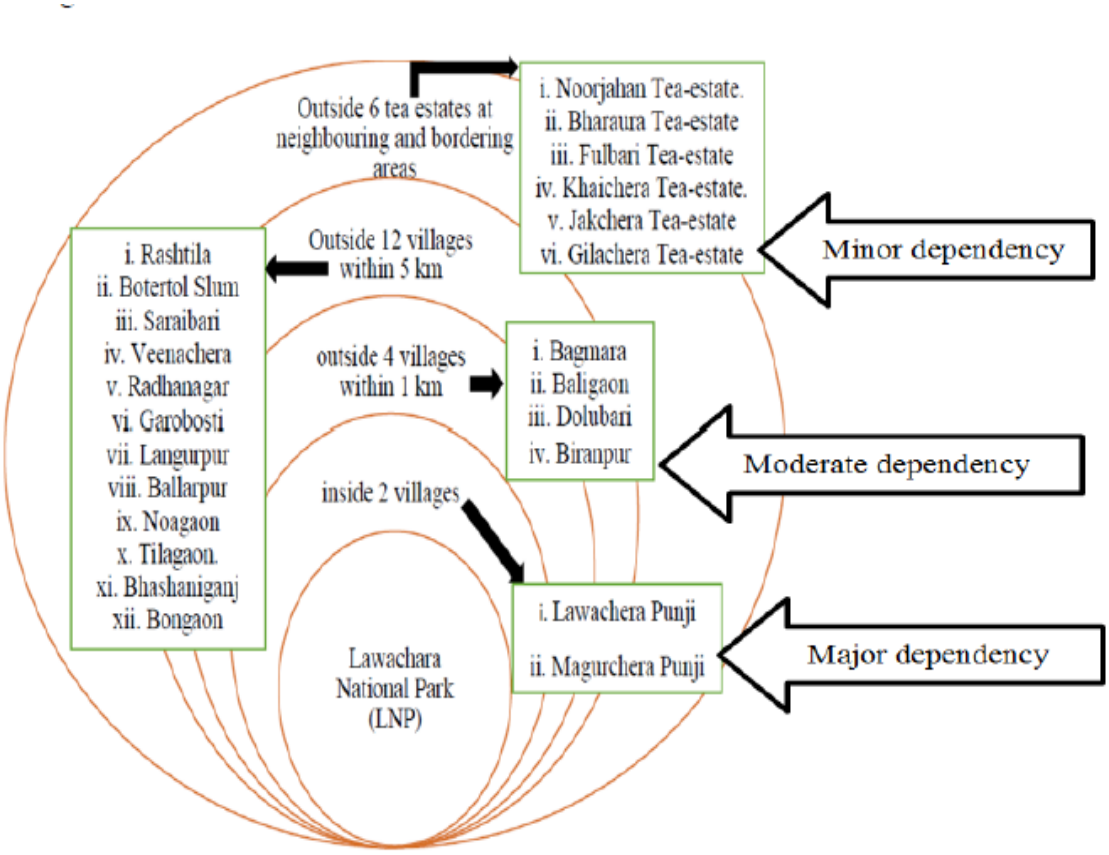

Figure 8: Responsibility of different villagers of surrounded Lawachara National Park

3.7 Collaborative Responses

Collaborative tool is related to the co-management approach on environmental governance. The value of R^2 is below 0.5, which indicated downward portion and neglected (Figure 9).

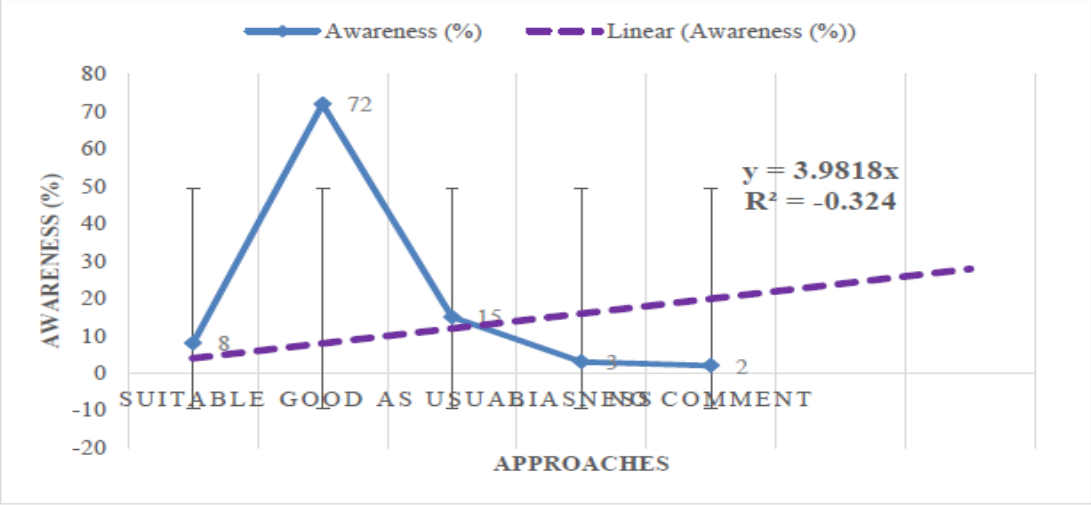

Figure 9: Collaborative approach at Lawachara National Park

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

So, the stated equation is rejected. The developed equation was then employed to simulate human consciousness changes in LNP area for co-management system, if the R^2 value is within 0.5 to 1.0. Differences in changes through co-management approaches between observed and simulated values are estimated effects on LNP in Bangladesh. For this reason, the stated linear equation is rejected. The existing co-management approach will be accepted, if the value of "suitable" options must be reached on 40 or above for more awareness criteria adopted in the listed approaches. However, the policy on co-management is needed update.

3.8 Biodiversity Governance in Lawachara National Park

Top ten-biodiversity governance thinking is the new ideas of developing world for biodiversity conservation applying towards Lawachara National Park. These ideas connect each other reciprocally with governance perspective, which is shown in Figure 10.

Figure 10: Top-Ten Biodiversity Governance Thinking

3.9 Challenges for Dynamic Environmental Governance

Bangladesh faces a number of challenges for empirical dynamic environmental governance. Mainly, it is alarming that matters such as central government policy can be effectively executed at the divisional and department levels in Bangladesh except local's opinion; It would to need sectoral/departmental policies integration. Besides, Bangladesh is more vulnerable on natural catastrophes.

3.10 A Conceptual Framework on Human-Biodiversity Interactions

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 3 June 2019 doi:10.20944/preprints201906.0014.v1

Today more than 75% of the terrestrial surface is impacted by human [19]. Human-biodiversity interactions enhance to counteract possible outcomes [20]. This is the intangible outline of human—biodiversity and national park connections and possible outcomes for strength and safety [21], perception of biodiversity, connection with conservation education and pro-biodiversity behavior [22]. From this framework, conserving of biodiversity reduced anthropocentric pressure from adjacent areas' inhabitants, particularly dependency of human beings towards national parks.

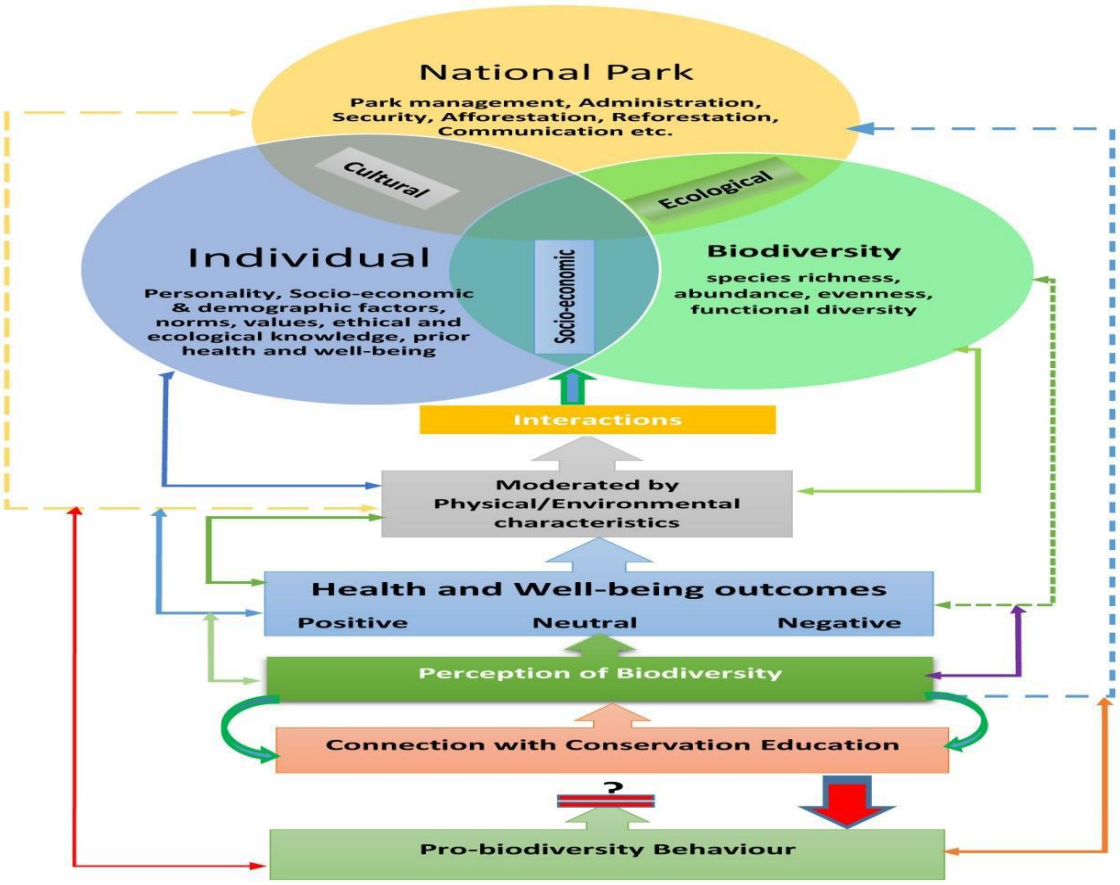

Figure 11: A Conceptual Framework on Human-Biodiversity Governance

This is shown in Figure 11 that the question symbols signify less well-understood associations. The spotted lines characterize response from results back to biodiversity or the specific object. Meanwhile, human-biodiversity reflection connects with local and indigenous people for environmental education to manage national park biological diversity conservation, especially on health and well-being outcomes including the ratio of total landscape area, national park area and population density. The study suggests a conceptual framework established on quantities uncertainty and sensitivity analyses to build cost-effective environmental governance that performs the sustainable conservation of national park biodiversity.

 doi:10.20944/preprints201906.0014.v1

4. Recommendations

The study advocates future research trajectories of a new kind collaborative alternative approach to drive the methodological agenda and recommendations on how to further incorporates the demanding environmental governance towards national parks' biodiversity management. There are some recommendations included are:

- Should expand support for media programs on well-watched television channels, radio, newspapers and magazines that highlight positive conservation activities in Bangladesh to build awareness.
- Should establish Nature Education Centre adjacent of national park community area to raise awareness on the need to protect our biodiversity.
- Should need ethical and cultural knowledge dissemination through mosques, gereza, pagoda, theatre hall and other relevant cultural and religious institutes.
- Should improve policy instruments consistent and transparent decision-making progressions through committed issues.
- Should establish a database management system ensuring accountable environmental justice with introducing new Section of Wildlife Conservation and Security Act 2012.
- Should establish dynamic collaboration between co-management team and local community with amendment of Section 21 of Wildlife Conservation and Security Act 2012
- Should improve sectoral policy integration through reducing corruption.
- Should make some watchdog institutions for conservation of biodiversity with the help of local community.
- Should ensure a transparent economic mechanism of grant financing as a tourist zone.

5. Conclusion

The study had assessed eight types of governance of World Bank for environmental conservation. These are attitude, participation, responsibility, accountability, collaborative, access to information, transparency and partnership for Bangladesh with Lawachara National Park (LNP) – as a study site. Based on these governance tools, LNP is not well managed on the priority of access to information and responsibility for environmental conservation. However, this study has attempted to develop a complete scenario of the causes of less governance on national park biodiversity conservation in Bangladesh. The findings of this study clearly indicate that traditional forest policy, illegal logging, wildlife poaching, parkland encroaching and no national park database in connection with biodiversity clearing house mechanisms.

6. Conflicts of Interests

No potential conflicts of interest were reported by the authors.

7. Acknowledgement

The authors acknowledged the authority of Universiti Malaysia Sarawak, Malaysia and Information Communication & Technology Division (ICTD), Ministry of Information Communication Technology and Tele-communication, Government of People's Republic of Bangladesh, both who provided doctoral fellowship namely as Zamalah Postgraduate Scholarship and PhD Fellowship respectively.

8. References

1. UNDP. (2019). Environmental Governance for Sustainable Natural Resource Management Programme. url: http://www.undp.org/content/undp/en/home/ourwork/sustainable-development/natural-capital-and-the-environment/extractive-industries-/environmental-governance-for-sustainable-natural-resource-manage.html (accessed Jan 8, 2019 at 8:00 p.m. national time).

2. SDG (Sustainable Development Goals). (2019). Goal 16: Peace, Justice and Strong Institutions. Sustainable Development Goals 2030. UNDP. url: http://www.undp.org/content/undp/en/home/sustainable-developement-goals/goal-16-peace-justice-and-strong-institutions.html

3. Margerum, R.D. and Robinson, C.J. (2016). The Challenges of Collaboration in Environmental Governance - Barriers and Responses: New Horizons in Environmental Politics series. Elgar, ISBN: 978 1 78536 040 4, 1–424.

4. Bennett, N.J. and Satterfield, T. (2018). Environmental Governance: A Practical Framework to Guide. Design, Evaluation and Analysis. *Conservation Letters*, 1–13.

5. World Bank (1992). World Bank Report: Governance. 1-5.

6. Lemos, M.C. and Agrawal, A. 2006. Environmental Governance. *Annual Review Environmental Resource*, *31*, 297–325.

7. WCS. (2012). The Wildlife Conservation and Security Act, 2012 (Act No. XXX of 2012, 10 July, 2012/26 Ashar,1419). Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

8. Sonnenfeld, D.A. and Mol, A.P.J. 2002. Ecological modernization, governance, and globalization. *Am. Behav. Sci.* 45, 1456–1461.

9. Evans, P. (1996). Government action, social capital and development: reviewing the evidence on synergy. *World Dev.* 24,1119–1132.

10. Bhardwaj, R.K. & Margam, M. (2016). Online Legal Information System for Indian Environment: A User's Perspectives. *Library Review*, *65* (8/9), 593–624.

11. DoE. (2016). National Biodiversity Strategy and Action Plan of Bangladesh 2016–2021. Department of Environment (DoE), Ministry of Environment and Forests (MoEF), Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, ver2, 1.

12. PAB (2016). Protected Areas of Bangladesh, Forest Department, Ministry of Environment and Forests (MoEF), Government of People's Republic of Bangladesh, url:http://www.bforest.gov.bd/index.php/protected-areas. (Accessed on June10, 2017).

13. NSP. (2005). Site Strategy for Lawachara National Park. Nishorgo Support Project. BFD-USAID/IRG, Dhaka.

14. Halim, M.A., Shahid, A., Chowdhury, M.S.H., Nahar, M.N., Sohel, M.S.I., Nuruddin, Jahangir, M. & Koike, M. (2008). Evaluation of land-use pattern change in West Bhanugach Reserved Forest, Bangladesh, using remote sensing and GIS techniques. *Journal of Forestry Research*, *19*(3), 193−198. doi 10.1007/s11676-008-0044-1.

15. RIMS (Resource Information Management Systems). (2015). RIMS Unit, Bangladesh Forest Department, Ban Bhaban, Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka., 1–3.

 doi:10.20944/preprints201906.0014.v1

16. IPAC. (2012). Degree of Pressures and Threats to Protected Areas. Integrated Protected Area Co-management (IPAC). State of Bangladesh's Forest Protectedv Areas' 2010. International Resources Group (IRG), BFD-USAID, 39–40.

17. Jalil, M.A. (2009). Site Level Appraisal for Protected Area Co-management: Lawachara National Park. International Resources Group, USAID and Bangladesh Forest Department, Ministry of Environment and Forests, Government of People's Republic of Bangladesh.

18. IPAC. (2012). Degree of Pressures and Threats to Protected Areas. Integrated Protected Area Co-management (IPAC). State of Bangladesh's Forest Protectedv Areas' 2010. International Resources Group (IRG), BFD-USAID, 39–40.

19. Islam, M.T. (2014). People's Participation in Protected Areas of Bangladesh. Presentation at 1st Asia Parks Congress (APC). Management Planning Unit, Forest Department, Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka.

20. Ellis, E.C., Goldweijk, K., Siebert, S., Lightman, D. & Ramankutty, N. (2010). Anthropogic Transformation of the Biomes 1700 to 2000. *Global Ecology and Biogeography*, *19*, 589–606.

21. Gardner, T.A., Barlow,J., Chazdon, R., Ewers, R., Harvey,C.A., Peres, C.A. & Sodhi, N.S.S. (2009). Prospects for tropical forest diversity in a human-modified world. *Ecology Letters*, *12*, 1–21. doi: 10.1111/j.1461-0248.2009.01294.x.

22. Barber, C. V. (2004). Parks and people in a world of changes: Governance, participation and equity. In Barber, C. V., Miller, K. R., & Boness, M. (Eds.), *Securing protected areas in the face of global change: Issues and strategies*. IUCN, Gland, Switzerland and Cambridge, UK, 97–136.

23. Pett, T.J; Shwartz, A., Irvine, K.N., Dallimer, M. & Davies, Z. (2016). Unpacking the People–Biodiversity Paradox: A Conceptual Framework. *BioScience*, *XX* (x), 1–8. .doi:10.1093/biosci/biw036, url: http://bioscience.oxfordjournals.org