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Applications of Biological Diversity Information Systems towards Lawachara National Park in Bangladesh

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ABSTRACT

The study investigates a framework for Biological Diversity Information Systems (BDIS) with relevant rules and regulations that emphasize the need for interdisciplinary research collaborations at national, regional and global scales on nature conservation mechanisms at Lawachara National Park (LNP) in Bangladesh. To date, Bangladesh has no Integrated National Biodiversity Database with Clearing House Mechanisms. So, there is a lot of nature conserving problems faced on biodiversity management systems. The study integrates technological information from stakeholders like park manager, biological diversity specialists, network officers, ecological specialists, policy-makers, wildlife managers, academicians and relevant bodies. The study represents the uniqueness of the tools used to enhance conservation professionals on the national biodiversity strategic action plan through existing policies and technology, literature reviews, observations, interviews and reconnaissance findings. Approximately 64% of the respondents agreed for the development of Integrated Biological Diversity Information Systems (BDIS) for conserving nature at LNP. The study describes the essential information needed for comprehensive data exchange, data indexing, web-publication and reports on Convention on Biological Diversity with the help of Resources Information Management System. Finally, the study suggests future research trajectories using a new collaborative approach to drive the methodological agenda and recommends ways to further incorporate the information systems integrating next generations' biodiversity conservation perspectives.

Key words: Biodiversity, Information Systems, Stakeholders, Lawachara National Park, Bangladesh

INTRODUCTION

We human-beings live in the age of information with modernized technology. This technology enhances the production, storage, and sharing of information with rules & regulations to make a significant facet of economic, cultural and scientific affairs at scales from local to global (Michael et al., 2006).So, we are experiencing a digital revolution with an information explosion to become individuals highly susceptible to information anxiety or overload (Biggs, 1989; Holtham and Courtney 1999). It is clear that Information Communication and Technology (ICT) has become a driving force in the area of biodiversity conservation and the establishment and management of protected areas (ICEM 2003; Wilson, 2003; Henry and Armstrong, 2004; Dogadernegi, 2014). There is a great deal of academic discourse and debate around theories of the information society (Fuller, 2005) and protected areas. These areas operate with rules and regulations for promoting and harmonizing of biodiversity policy through conservation systems. These systems integrate with Information systems developing dataset biological diversity Information Systems (BDIS). BDIS is a group of tools which can increase the competitiveness and gain better information for decision making with relevant diversity's system and orders. But till to date, there is no effective national

biodiversity database including clearing house mechanisms (CHM) as well as information systems in Bangladesh and other local places. Consequently, many organizations decide to implement BDIS to improve the effectiveness and efficiency of their organizations particularly in monitoring protected areas. Researchers in Bangladesh had made several attempts to develop a framework of information systems with biodiversity conservation policy systems in Bangladesh particularly for Lawachara National Park in Moulvibazar district. So, Bangladesh lacks proper information related to conservation and management information systems. Information needs for biodiversity are many and varied (Salem, 2003; Peri et al., 2011) with agencies and localities, and the state of knowledge is all too often unsatisfactory for proper evaluations to be made (Heywood, 1997). Lack of reliable information and sound assessments can cause consequences for the understanding of biodiversity, update rules and regulations and for the development of indicators and indices which permit changes and trends to be observed and transformed over time.

The overall objective of having the mentioned efforts is to enhance the capacity of developing countries for data management with Clearing House Mechanisms (CHM) to support the implementation of the Convention on Biological Diversity (CBD). A diversity information system should support the assessment and monitoring processes by providing the data needed to describe current environmental baseline conditions, identify the species and habitats at greatest risk, guide land management decisions, and model the effects of alternative conservation policies(Davis et al., 1990; Salem, 2003).Nations, therefore, must have the motivation to develop national information management strategies (needs, sources means of collection, management, and accessibility). However, towards this end, no country has a perfect information management system, with appropriate information available to whoever needs it(Harrison, 1995), but there have been significant developments. For these reasons, this study attempts to develop a framework related to the Biological Diversity Information Systems (BDIS) indicating the Lawachara National Park in Moulvibazar district of Bangladesh.

GENERAL CONTEXT OF THE RESEARCH

Biodiversity information systems is a dataset of biodiversity which can be used in its monitoring (Reyers and McGeoch, 2007), bioregional planning (Smith and Wolfson, 2004), identifying and categorizing threatened species (Tweddle, et al., 2009), understanding the impacts of global change on biodiversity (Coetzer, et al., 2012; Skelton and Coetzer, 2011; Cherry, 2009; Skelton et al., 1995); developing mitigation strategies; informing sustainable harvesting programs; control of alien, invasive species (Foxcroft et al., 2009), ecological niche modeling (Phillips et al., 2006), disease vectors; environmental impact assessments (Coetzer et al., 2012)and decision making on policy status of biodiversity protection. Biodiversity information in specimen databases of natural history museums has seen renewed interest and much innovation and development in the last decade (Bisby, 2000;Soberón and Peterson, 2004;Johnson, 2007;Peterson et al., 2010). Article 7 of the CBD obligates each contracting party 'as far as possible and as appropriate' to identify components of biodiversity important for its 'conservation and sustainable use' (BLI, 2006; UNEP, 1992). The multidisciplinary study of conservation biology was developed in 1944 to connect pure ecology and the practical issues of species and habitat conservation (Soulé and Wilcox, 1980). This discipline incorporates biodiversity and habitat, wildlife management, ecology, genetics, population and social sciences. Because the distribution of plant and animal species identifies no national or political boundaries in the globe, it can be developed with detailed mapping and analysis of geographic features, species distribution and natural resources and relevant tasks through online integrated information systems database either nationally or globally. Conservation biology places a key emphasis on the preservation of biodiversity and this, in turn, means that data on the distribution of endangered species and of suitable habitats for such species in of paramount concern to biologists working in the field. Researchers and educators are being challenged to take information systems to a global level to manage energy resources and embrace environmental sustainability as a core principle (Watson et al, 2010). When all information systems become Geographic Information Systems (GIS), then the challenges of conservation biology were met, and overcome, to create a viable future for all the inhabitants of Earth. It has become so widely established in plant protection in particular, that habitat evaluation and monitoring is now be carried out with a high degree of accuracy so that even rare, endemic species with highly limited habitats can be accurately monitored and assessed for conservation (Krigas et al., 2012).

Information

During the Fourth World Parks Congress meeting of Protected Areas Managers that recognized the individuals and organizations involved in protected areas' work need better information (Salem, 2003) for making decisions (IUCN, 1993). According to the key to success of the Nature Conservancy's protection efforts is the ability to set clear conservation priorities based on scientific information (Stein, 1997; Salem, 2003). One of the ironies of the information age is that as the technology of delivering information becomes more sophisticated, the possibility of processing them all becomes more remote (Wurman, 1989). The amount of information produced globally is both astounding and increasing. For example, there were five Exabyte of new information was created and stored in 2002 as this value

had increased by 30% per year between 1999 and 2002 (Lyman and Varian, 2003). It is not just only the volume of information generated and stored; but, it is the transmission or flow of information also that contributed to our management challenges (Wurman, 1989**;** Wade, 2006). The internet, wireless communication, and a host of emerging digital media make data proliferation and exchange almost effortless. Rapid changes in information and communication technology (ICT) (Eric, 2015; SUN, 2014**)** are assembling more information obtainable to more people and places at escalating rates. Filtering and selecting the right information has become a primary task of modern managers including those of protected areas (Michael et al., 2006).Any organized, classified, meaningful data which make in a sense is called information. Information, as we know it today, includes both electronic and physical information. The organizational structure (IM, 2016) must be capable of managing this information throughout the information lifecycle regardless of source or format (data, paper documents, electronic documents, audio, video, etc.) for delivery through multiple channels that may include cell phones and web interfaces (Info M, 2016).

Information Systems

Information Systems (IS) is a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization (Laudon and Laudon, 2010). Figure 1 shows the information systems as applied in a relevant organization with pertinent components.
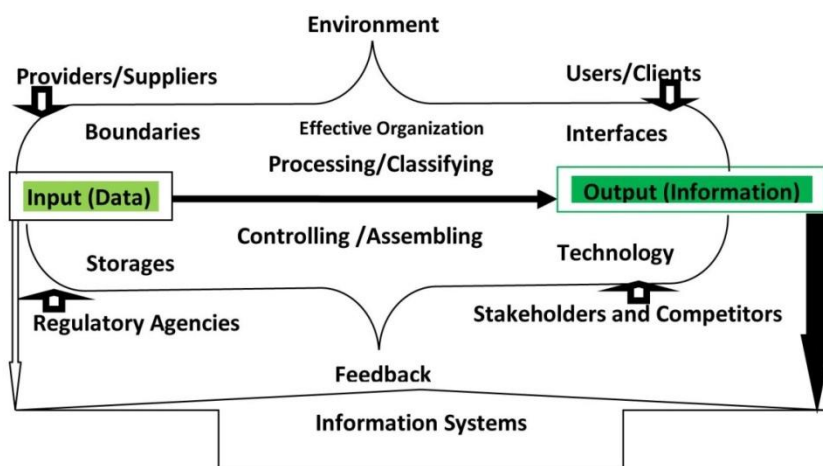

Figure 1: Information Systems with relevant components (Laudon and Laudon, 2010)

Information Systems should be built to support individual, group, and organizational decision making that has the different characteristics, viz. (i) They are flexible and provide many options for handling data and evaluating information (DA, 2016), (ii) They are capable of supporting a variety of style, skills, and knowledge as well as keeping track of many alternatives and consequences, (iii) They are sensitive to the organization's bureaucratic and political requirements, and (iv) Information Systems are building to create corporate value. An Information System represents an organizational and management solution, based on information technology, to a challenge posed by the environment. In protected areas management, information technology for biodiversity includes databases of the species, remote sensing (RS), global positioning systems (GPS) and geographic information systems (GIS) (Michael et al., 2006; CD, 2016). Information Systems provide amounts of information on a comprehensive scale for an application both as data and software uses conservation biology. Information systems connect with networked information which does not only deliver speed-wise answers to scientific demands, but also extends the universe of possible questions on the conservation and sustainable utilization of biological diversity **(**Canhos et al., 1998**).**It enhances collaborative and individual research groups to tap into an array of natural resources forward-thinking often for other purposes and operate them for specific research related project as well as practical applications.

MATERIALS AND METHODS

Study Site

Bangladesh is a developing country with enriched biodiversity; the world largest deltaic region lies in the northeastern part of South Asia between $20^034'/$ and $26^038'/$ North latitude and $88^001'/$ and $92^041'/$ East longitude. Total 38 protected areas cover an area of 4,39798.18 ha (about 10.72% of total forest area*)*, which accounts for 16% of the total area managed by the Forest Department and less than 2% of total area of Bangladesh (Hossain, 2001**)**. It includes 17 National Parks, 21Wildlife Sanctuaries and 12 other conservation sites (PAB, 2016) which showed in the Figure 2.The survey was undertaken adjacent villages at Lawachara National Park (LNP), one of four national parks in Sylhet region in the north eastern part of Bangladesh. It declared as a National Park in 1996 with 1,250 hectares of

highly diverse hilly evergreen forest under the conservation status of the Wildlife Preservation Act-1974 (This Act revealed and current Wildlife Conservation and Security Act, 2012). The LNP situated in the Union and Upozilla of Kamalganj in Moulvibazar district of Bangladesh coordinates with 24°32′12″N 91°47′03″E. Surrounded all around by human habitats, the park is a critical home for several primate species including the only ape of the country, the Hoolock Gibbon (*Hylobateshoolock*). The park was also a hotspot for biodiversity to find several species of a new and regional record for biodiversity conservation of Bangladesh (Rufford, 2014). There are 14 villages around the LNP. I surveyed four villages out of them for different data collection related to conservation knowledge, using technology, biodiversity preservation policy, and protected areas management perspectives.

Methods

The survey on Lawachara biodiversity conservation system was undertaken in four (two inside and other two outside) of the 14 villages around Lawachara National Park. Data related to conservation knowledge, usage of technology, biodiversity conservation policy and protected area management perspectives collected from the respondents. In-depth interviews were conducted with respondents who (WFP, 2012)involved in Lawachara National Park such as Park Manager, Team Leader of Co-management Committee, Visitors, Indigenous Community Leader, Academics, Biodiversity Specialist, Researchers, Botanists, Zoologists, Learners, Local Government Leaders, Key stakeholders, Policy makers and relevant bodies.

Data Collection

Various data collection methods have employed the study to collect both secondary and primary. These methods include observations, semi-structured interviews, and questionnaires. Semi-structured interviews were used and selected based on the representation point of view and additionally regarding their relevance to the conceptual questions (Rufford, 2014; FWI, 2012). Furthermore, key informants from the relevant administrative, analyst, professional, environmental lawyers and local users were interviewed on the existing phenomena. Secondary data collected from journals, books, Bangladesh Bureau of Statistics (BBS), Forest Department (FD), Space Research Remote Sensing Organization (SPARRSO), Government institutions (Forest department, Ministry of Environment and Forests, Forest College and Training Centre, Universities, International /National-NGOs, Stakeholders and relevant other sources.
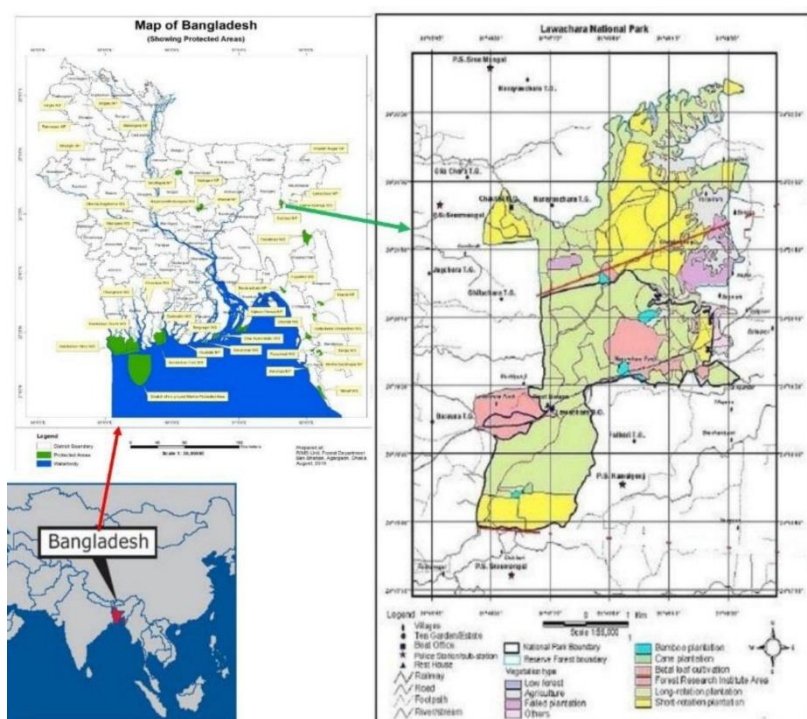

Figure 2: Showing the study area of Lawachara National Park with all Protected Areas in Bangladesh (NSP, 2005)

Data Compilation

At first, all the general information regarding the occurrence of biodiversity 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. After the data had been collected, they were checked properly for accuracy, by

using the crosschecking method, i.e. checking the same information from the different sources and verify the sources of information. Information regarding the initiatives of the authority towards the conservation of biodiversity was also collected through different relevant secondary information and field survey, which carefully compiled and evaluated (FWI, 2012). Then the information included preparation of data mastersheet and their manipulation into convenient forms used in the result and discussion section subsequently. The primary and secondary data compiled with the renowned MS Excel and relevant software.

Data Handling and Analysis

Data obtained from the field were analysed using (Emeka et al., 2014) standard data analysis software. In this research study, deductive strategies were used to present the results that ascertained through the interpretations made with the combined Supervisor and Investigator after collecting the data, organizing the data, classifying the data and then figuring out the relationships that existed (Rufford, 2014)using the relevant software, like such as MS Excel, SPSS, MS Access, Operating System and update software on conservation systems. All questionnaires were analyzed using the statistical software to generate general statistics on their trends from the responses.

RESULTS AND DISCUSSION

Biodiversity is important in our life. However, we cannot perform a single task without its information. The importance of biodiversity information is essential to the respondents in the study areas are shown in the Figure 3. About the 55% of the respondents opined their opinions as very essential and 42% as essential with only 1% 'No Comment'While much biodiversity and ecosystem information presently exist and much more is composed on a periodic basis, it is still not possible for all those who could benefit from having access to this information to locate, retrieve, integrate, and apply (Otago, 2014; Randow, 2012)it in any reliable approach. In many cases, public and private funds are unknowingly spent on re-collecting information that may actually already exist in some undocumented or unavailable fashion. Much existing biodiversity and ecosystems information cannot be widely used (Randow, 2012) at the protected area because it has not yet converted into an electronic (computerized) format. In most cases, because of different formats, conventions, or technologies, it is difficult to truly integrate information from more than one source or system (Otago, 2014; Randow, 2012). An important issue is determining how to use this information to best predict existing species biodiversity among sets of areas (Stein, 1997).
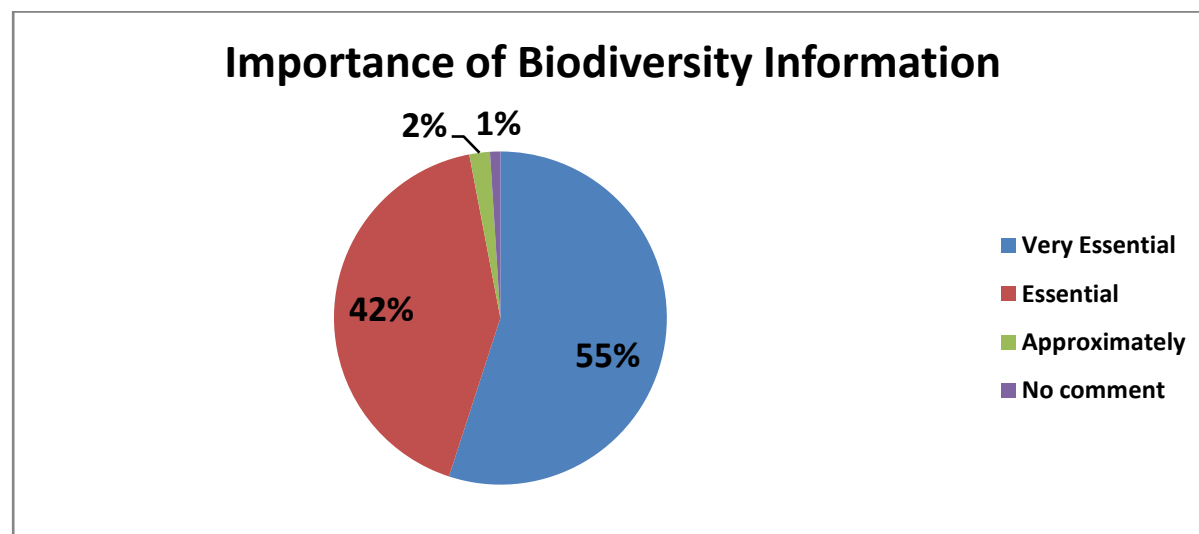

Figure 3: Importance of Biodiversity Information applying in the Lawachara National Park

Research Role Identification on Biological Diversity Information Systems (BDIS)

BDIS plays an important role in researches on biodiversity and conservation especially in the field of natural science and technology that deals with the impact of activities on eco-systems. In the Figure4, it can be seen that about 58respondent who are academic staff performed utilizing BDIS for their research activities sturdily for sustainable protected area management, compared 2 Postgraduate/Post Doctorate for their research. From another study, we know that indigenous community people may have specific knowledge of endangered species within Lawachara National Park (LNP) which can improve the level of awareness of conservation biologists, scientists and researchers. It is, consequently, required to spread perception of the need to treat biological resources as capital assets and invest accordingly to prevent their depletion (Salem, 2003; CBD, 2016) at Lawachara National Park.
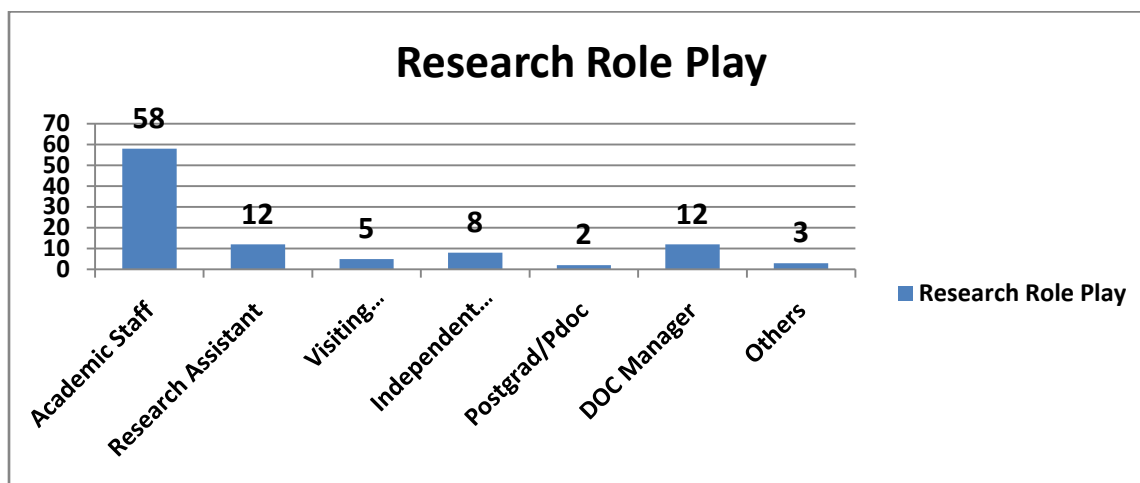
Figure 4: Research Role Play among Stakeholders on Biological Diversity Information Systems for Conserving Biodiversity at the Lawachara Protected Area Management

Knowledge of Respondents in Biological Diversity Information Systems

Knowledge of Respondents in Biodiversity Information Systems is imperative, because, with the knowledge on BDIS, they need to know the worth of relevant database that deals with the input, processing, and output with the technology and information systems. In the Figure5, that the findings revealed that about 43% of respondents have simple knowledge for more informed research knowledge to maintain strappingly for sustainable protected area management as compared to 11% of respondents who claimed that are 'more informed' of the BDIS.
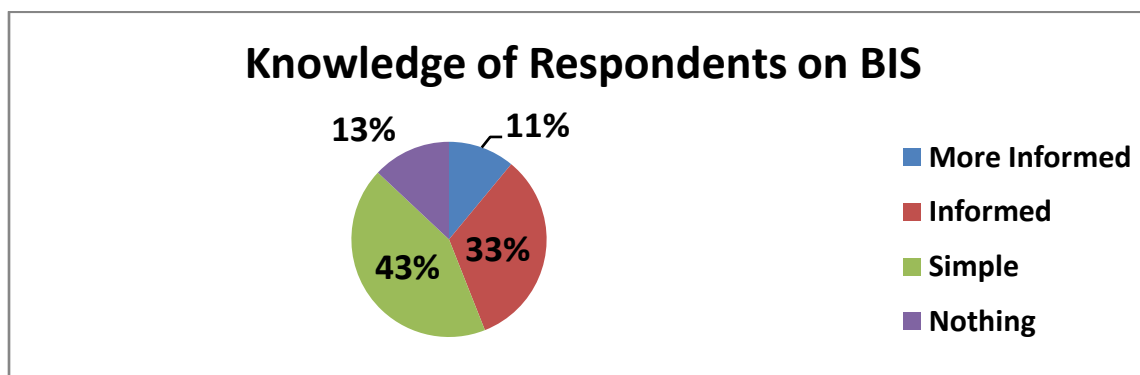
Figure 5: Knowledge of Respondents in Biological Diversity Information Systems (BDIS) for Conserving and Promoting the Biodiversity at the Lawachara National Park

The results revealed that BDIS implementation performed surrounding challenges which were mainly concern management, administration, and people involved in BDIS application processes. Additionally, it can be concluded that the key issues which the BIS implementation project should present with primarily focused on the project team and their team work. The last main finding is concentrated on effects and consequences, and it found out (BMC, 2014; Kornkaew, 2012) that BIS implementation mainly affects the mentioned process which leads to change, for instance situation, routines, recent advancements in information technology application, national biodiversity and protected area databases, related system database design, research evaluation, ecological monitoring, public rendezvous, data security and so forth at LNP in the north-eastern part of Bangladesh.

Integrated Biological Diversity Information Systems-Online Biodiversity Conservation Database

Biodiversity conservation database can be constructed to predict where survey efforts may be targeted, to be used as substitutes for full assessments of species in an analysis of biodiversity at a regional scale, and to predict possible impacts of environmental changes (CBD, 2016; Aspinall, 1995). Integrated Biological Diversity Information Systems (IBDIS) is a central database which interlinked with Ministry of Environment and Forests including Bangladesh Forest Department and Directorate of Environment. It is the application of information systems that helps to improve management, operation, monitoring, sharing, discovery, exploration and analysis of the biodiversity. It builds on the foundation of taxonomic, biogeographic and ecological information stored in digital form. The database stores information on visitor's catalog, vegetation mapping with the connection of Regional Navigation Satellite System (RNSS) interlinked with Space Research Remote Sensing Organization (SPARRSO).Therefore, other

stakeholders can utilize the IBDIS according to their requirements as indicated in Figure 7below. A particular value of IBDIS is to identify organisms which can be used as bio-indicators of ecosystem health and provide early warning of changes in protected and other areas (CBD, 2016; Hawksworth, et al., 1992).

Security of BDIS Database

All data base need proper safety for its effective and efficient operations. But in Bangladesh about 53% respondents were of the opinion that less secure as a whole that deals virus, spam, cookie, malware and so on with the obsolete technology and information systems, compared to only 7% who were of the opinion that BIS database more secure which showed in Figure 6.This research also wish to explore the BDIS awareness and status linkages with lawyers, policy makers, government officials, academics, researchers, visitors, decision-makers and relevant stakeholders with tools connecting to update technological arena with the help of computer-based Resources Information Management System (RIMS) unit in Forest Department for promoting and harmonizing the existing nature conservation policies in Bangladesh. The study also investigates the actual indicators/instruments and regulatory framework of the available conservation operations and policies related to biodiversity safeguarding at Lawachara National Park in Sylhet division of Bangladesh. These research efforts have resulted in the study of Biodiversity Information Systems, which support an elaborate global protected area network particularly national parks. The National Biodiversity Strategic Action Plan (NBSAP), Program of Work (POW) and Access to Benefit Sharing (ABS) and to integrate the available methods and the better use of existing information in a complementary manner. This information is needed to develop new strategies for different species. Users require biodiversity information on the context of which and the issues on which they need to focus. They want options backed by documents, maps, and expert opinion (CBD, 2016).
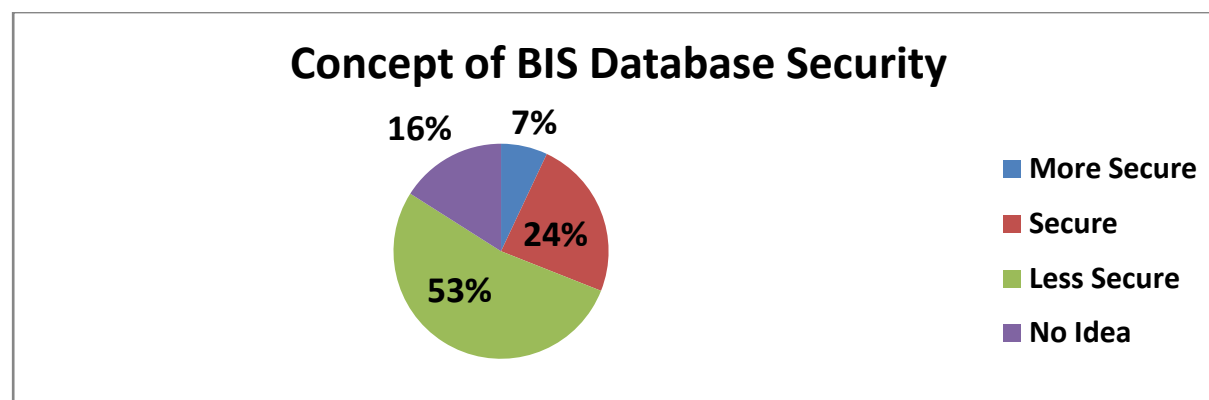
Figure 6: Conceptual Idea of Biological Diversity Information Systems (BDIS) Database Security for Developing Research Work on Biodiversity at the Lawachara National Park.

CONCLUSION

BDIS helps the protected areas for maintaining biodiversity, securing habitats and reducing threats with evaluating the system effectiveness of nature conservation policy. It is essential that BDIS are utilized to identify and conserved at protected areas for the present and future generations. The BDIS is a user-friendly system that helps to address both scientific and social issues around the protected areas. Furthermore, it is essential for informed decisions for the sustainable development of biotic resources and the ecosystems that harbor those (Burger et al., 2009) as per required laws and regulations. However, this calls for uniform spread and accessibility of such data. Still, BDIS is not up to date and its application not uniforms throughout the country. There is no mechanism to measure our progress that can encourage demand-driven and deterministic investment in achieving uniform improvement in BDIS (BMC, 2014).It is believed that such uniform advancement will help to reduce the existing imbalance of accessibility to biodiversity and legal issues at Lawachara National Park. Further investigations in stabilizing and enriching the BDISs are essential to implement for promoting and harmonizing biodiversity in protected area in the north-eastern part of Bangladesh. This biodiversity database system can be operated smoothly by the National Park Manager, Academia, Biodiversity Specialist, Scientist, Network Technologist and relevant researchers. Finally, we focus future research trajectories of a new kind collaborative approach to drive the methodological agenda and recommendations for further incorporation the biological diversity information systems indicating biodiversity conservation policy that can potentially form with essential mechanisms in the science-policy-society interface for conserving biodiversity at national parks.
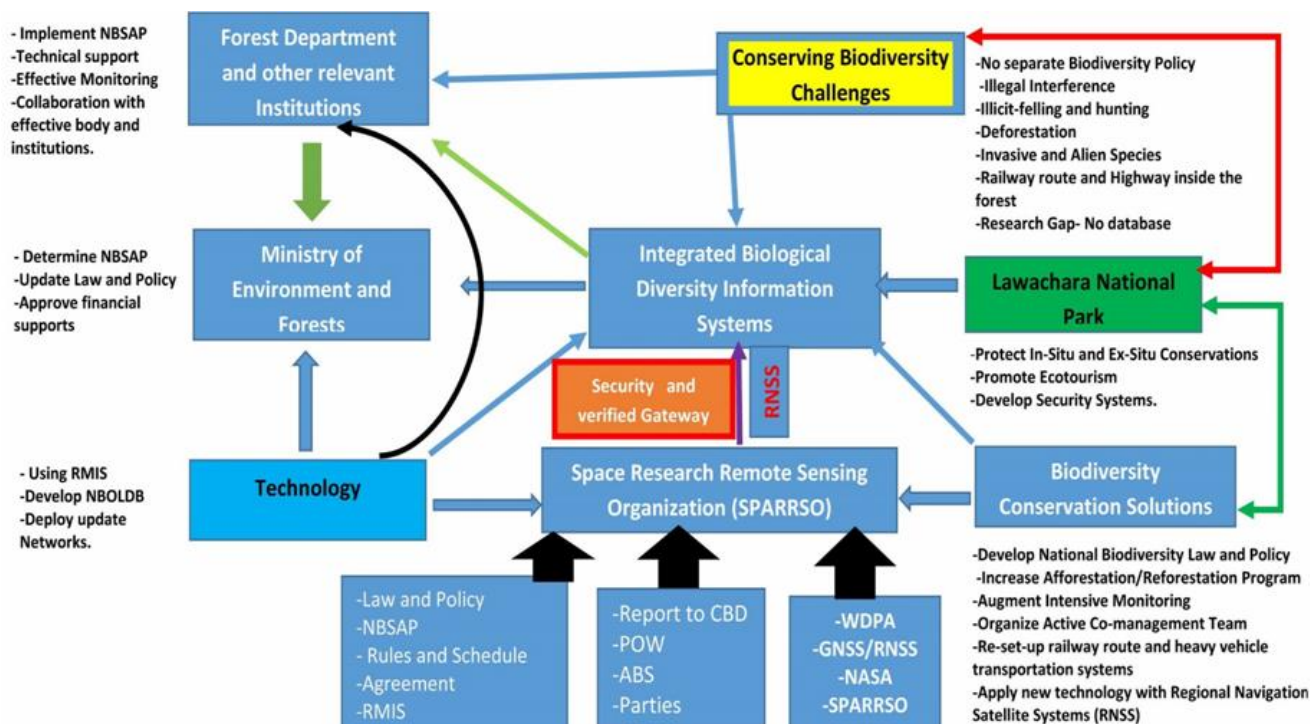
Figure 7: Showing the framework on integrated Biological Diversity Information Systems (IBDIS) at Lawachara National Park

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