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Research Article

Comparative Study of Plant Diversity in "Durga Sagor Eco Park" and "Planet Park" Ecosystem in Barisal, Bangladesh

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Abstract

Biodiversity is a common means of ecosystem resiliency; as a diversified community can withstand in a small to medium scale disturbance or can build back better by using its own resources (species). Two adjacent Eco park eg. Durga Sagor Eco Park and Planet Park of Barisal in the district of Barisal, Bangladesh have managed terrestrial ecosystem with a lot of plant diversity. This study focuses on to formulate a diversity index and assessing ecosystem resiliency by using the index of two different ecosystems. For conducting this research visual screening is conducted by the authors, secondary data sources like annual report of Park authority, books, journals etc. have been used respectively. The major findings of this study are that Durga sagor ecosystem has greater biodiversity than Planet Park ecosystem. The Shannon Index and Shimpson Index of Durga sagor and Planet Park is 2.71, 2.62 and 0.14, 0.13 respectively. Evenness of two adjacent ecosystems is 0.80 and 0.77. Finally the results indicate that Durga sagor ecosystem is more resilient than planet park ecosystem as its biodiversity is greater than Planet Park. In case of any natural disturbance (natural disaster) Durga sagor ecosystem will withstand more time than Planet Park ecosystem.

Keywords: Biodiversity index, Ecosystem resiliency, Plant biodiversity

Introduction

Biodiversity generally means the variations and differences of life (terrestrial and aquatic) and a specious spectrum of biological range that's starts from genetic diversification within species to biome allocation on earth [1, 2]. According to United National Environment Programme biodiversity is the variation includes all organism, species and population as well as genetic variation among these[3]. The variation in species, populations, community of plant on the planet is refers to plant biodiversity and the role of plant biodiversity function in ecosystem has been focused to ensure ecosystem resiliency[4].

The biodiversity indexing is calculating by using score based on various major aspects (species richness, evenness etc.) of an ecosystem and every perspective formulated by using available data or indicators of that ecosystem [5]. Simpson index which was established for state the species diversity of a given ecosystem by using an equation (given in methods) [6] and calculate the effective number of species and species richness[7]. Shannon index is a statistical mechanism for marking the species diversity in an ecosystem or bio-community especially for the effective number of species and the species richness and quantify the entropy of communities species [8, 9]. The Shannon index (given in methods) is also known as Shannon-Weiner function used for ecological monitoring of a community [10].

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Species evenness means how imminent each species have there in an ecosystem that express in number and it also shows how equally and evenly distributed every species in an environment [11]. The richness is a system for express the total number of species in a community in land or water (marine and fresh) or in a particular area[12]. The effective number of species is a standard diversity index that gives the idea of stability and also the standard number of species for a particular value (for index) of an ecosystem [13]. Ecosystem is made up of biotic and abiotic components that are interdependent upon each other; the interaction of biological organism and their physical environment for sustaining life through nutrient cycle and energy flow [14].

Ecosystem resiliency is the ability of an ecosystem to resist in an adverse event for reducing damage and bouncing back as soon as possible or in a minimum time after a disastrous event. Ecosystem resiliency ensure the stability of nutrient cycle and energy flow for maintain ecological function[15].

Materials and Methods

Description of the study area

This study is conducted in two parks in Barishal district. One is Durga Sagar eco park and another one is Planet Park. The location of Durgasagor parks is 90 degree 17 minutes 18 seconds East longitude and 22 degrees 45 minutes 48 seconds north latitude (Figure 1). It is surrounded by Madhap Pasa union in different directions. Durga Sagar, known locally as Madhabpasha Dighi, is the biggest pond in southern Bangladesh. It has a total area of about 45.42 acre. The lake is about 11 kilometres (6.8 mi) away from Barisal city. Rani Durgabati, mother of Raja Joy Narayan, had the pond excavated in 1780. There is a small island in the middle of the lake. It is located at Madhabpasa village of Babuganj Upazila, about 11 kilometres (6.8 mi) away from Barisal town. The total number of individual in Durga sagor Eco Park is 765 and species number is 30.

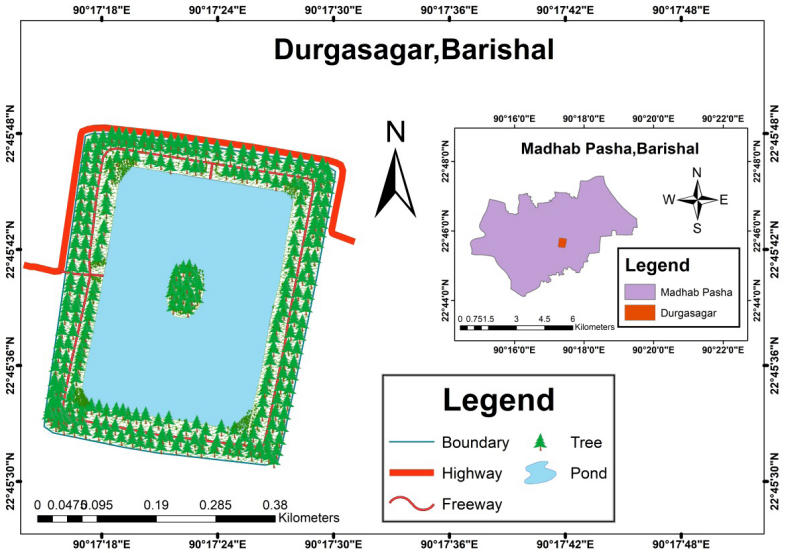

Figure 1.Location of Durgasagor Eco Park

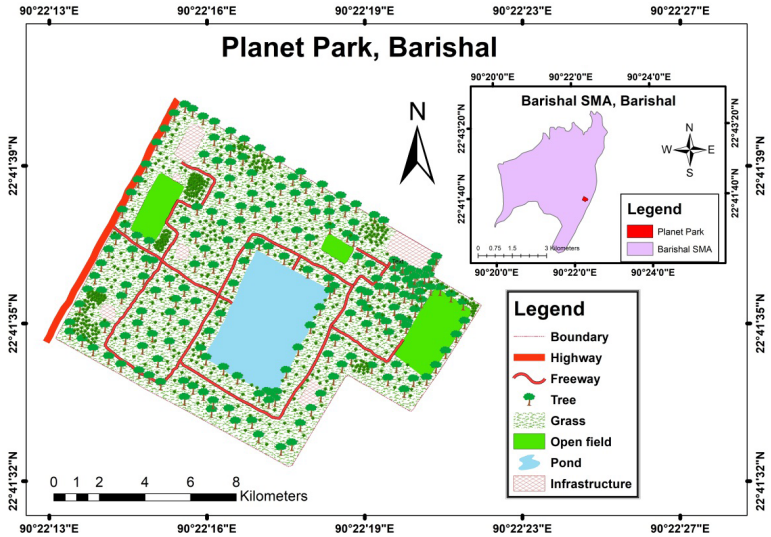

Figure 2.Location of Planet Park, Barisal

The location of Planet Park is 22 degrees 41 minutes 32 seconds north latitude and 90 degree 22 minutes 27 seconds' east latitudes (Figure 2). There have lot of plant biodiversity including lake view. Total Eco Park is managed ecosystem and serving for refreshment of local people and visitors. Every day a huge number of tourist visit both park and that's serves for cultural services of ecosystem. The authority of planet park is very much concern to protect its biodiversity. It has more than 30 species and total number of individual is more than 500.

Materials and Methods

a. To fulfil the objectives authors firstly review the literature regarding biodiversity and ecosystem resiliency and made an extension trip to find out the present condition (species richness, relative abundance, and total number of species) of those ecosystem.
b. After collection of field raw data from proper authority biodiversity index is formulated by using the following three equations:

i. Shannon Index: $-\sum_{i=1}^{S} Pi \ln (Pi)$

Here, H= Shannon Index, Pi= Proportion of species with total number of individual. S= Species Richness, Effective Number of Species: Exp (H)

ii. Evenness, $J=\frac{H}{Ln(s)}$

iii. Simpson Index: $D= \sum_{i=1}^{S} Pi\text{^}2$

Here, D=Simpson index, Pi= Proportion of species with total number of individual and S=Species Richness.

c. After getting evenness and effective number of species from above equation the comparative result for ecosystem resiliency is drawn.

Results and Discussion

In Durgasagor eco park authors noticed there exists two types of ecosystem. Some area covered by natural ecosystem and some are anthropogenic. The major proportion of this ecosystem is natural. The ecosystem is mainly build up around the lake. In lake there found some natural ecosystem like water lily, distressing, arum, birds, various species of fishes etc. There found various species of trees. Some species are moribund now. Artificial ecosystem included dear farm, duck farm and some types of tree like flowers.

Planet park ecosystem have more artificial ecosystem than Durgasagor. The comparative study of ecosystem index is shown in Table 1:

Effective number of species is the number of species that would have given the same value of the Shannon index, if all species had occurred with the same number. After calculating Shannon index it is found that there have about 14 (13.782) species that would have given the same value if all species had occurred with the same number in case of planet park ecosystem. Similarly in case of Durga sagor ecosystem the result is greater and is 15.08. It actually takes almost half number of total species. So, the bio diversities quality is good and not dominated.

Table 1.Comparative result of two ecosystems

Sl no.	Parameter	Durga Sagar Ecosystem	Planet Park Ecosystem
1	Shannon Index -(H)	2.71	2.62
2	Effective Number of Species -(Exp)H	15.08	13.78
3	Evenness- (j)	0.80	0.77
4	Simpson Index- D	0.14	0.13
5	Effective Number of Species- (1/D)	6.90	7.63

Here the evenness is 0.771 for Planet Park. That means almost of each species are evenly distributed. That shows us that 71% species are represented in similar numbers. That is above 50%. So, we can say that the diversity of Planet Park is well distributed or all are evenly distributed. In case of Durga sagor eco park, evenness is greater (0.80) than planet park. So it can be concluded that Durga sagor ecosystem have greater biodiversity than planet park ecosystem.

Simpson's Diversity Index is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases. Here Simpson index value is 0.13 (Planet Park) and 0.14 (Durga sagor) so its relative abundance is 13% and 14%. The effective number of species gain from Simpson index is 7.64 (Planet park) and 6.90 (Durga Sagor). In this format the biodiversity quality is relatively good.

Conclusion

Biodiversity is the variety of all living things; the different plants, animals and microorganisms, the genetic information they contain and the ecosystems they form. Both Durgasagor and Planet Park are full of natural biodiversity. There have different result in biodiversity indexing. While in Durgasagor ecopark the shimpson index value is 0.14, in planet park ecosystem the value is 0.13. The Shannon index indicates different value in two respective ecosystems. The evenness value indicates about different result that means there have different ecosystem resiliency. Durga sagor ecosystem is more resilient than Planet park ecosystem.

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