

INVESTIGATION OF BIODIVERSITY STATUS IN ACCORDANCE OF SIMPSON'S DIVERSITY INDEX AND ITS CONSERVATION STRATEGY AT RAMSAGAR NATIONAL PARK IN DINAJPUR DISTRICT OF BANGLADESH

M. A. Islam*, R. Ahmed and M. K. H. Real

Department of Disaster Management, Begum Rokeya University, Rangpur-5404, Bangladesh

*Corresponding author's email: islamaminulak@gmail.com

ABSTRACT

The present study was designed to assess the biodiversity status at Ramsagar National Park (RNP) in Dinajpur district, Bangladesh period from June 2019 to August 2020. Data on the diversity of the floral and faunal species were gathered using the KII and FGD by forest-responsible persons especially bit officer and forest rangers. A total of 100 residents of the research area participated in a questionnaire survey to perform the study. The study's findings revealed that 10.09% of climber species, 31.95% of herbs, 13.45.1% of shrub species, and 44.51% of tree species made up the total floral diversity. According to the study, Ramsagar National Park's strong floral variety status was reflected by the Simpson's diversity index value of 0.97. On the other hand, 74.23% aves, 13.78% amphibians, 5.31% reptiles, 6.68% mammals and cultivated different types of fish species in the aquatic body were found in Park. According to the result of Simpson's diversity index, the status of the faunal diversity is very rich and diverse which was 0.93. In the park, there were various barriers to the conservation of biodiversity and the growth of ecotourism viz. poor planning and management, disregard for management authority, etc. The report recommended that the responsible government authority quickly take necessary action to increase staffing, obtain strong authorization, include the media, execute policies and regulations for conserving its biodiversity.

Key words: Biodiversity, conservation, simpsons' index, eco-tourism, park.

Introduction

Ramsagar is a historically significant National Park that is part of the Forest Division of Bangladesh (Banglapedia, 2012). Due to its very rapid decline, biodiversity has recently been a topic of concern on a global scale. IUCN Red List (2004) affirmed that there are currently 15,589 species that are endangered, along with 12% of all known bird species, 23% of mammals, and 32% of amphibians (Baillie *et al.*, 2004). The diversity and variability of living things, including plants, animals, and microorganisms, are also mentioned. Through the provision of biological resources and ecological services in this area, biodiversity in Ramsagar National Park serves as a crucial resource foundation for development and the security of livelihoods (Rimi *et al.*, 2013). Nutrient cycling, air and water purification, drought and flood mitigation, and soil recovery are just a few of the crucial functions that ecosystems offer. These services are not always easily quantified in terms of money (Reza, 1992). It is therefore necessary from an ecological perspective to conduct research on floral diversity in various national parks and wildlife refuges in Bangladesh (Mia *et al.*, 2012). The biodiversity of Ramsagar National Park in Dinajpur area is protected in several ways. However, the Eco-park forest, which has the greatest variety of flora and wildlife, has been severely impacted by the brutality of nature. The priceless biodiversity is thus in grave danger of being lost.

Objectives of the study:

- i. To identify the present biodiversity status,
- ii. To assess the floral and faunal biodiversity condition,
- iii. To investigate the conservation strategy of biological diversity and
- iv. To make recommend the appropriate suggestions for improvement the management system of Ramsagar National Park in Dinajpur district of Bangladesh.

Materials and Methods

Geographical condition of the study area: In the Dinajpur district of Bangladesh, the Ramsagar National Park (RNP) is situated within the Sadar Upazila roughly between the latitudes of 25°44' N and 25°33' N and the longitudes of 88°30' E and 88°44' E (Fig. 1). The Park was 146.44 acres in size. There are 68.54 acres of reserve woodland. Most of the region is plain land. It is centered on the Ramsagar tank, a sizable water storage facility constructed by Raja Ramnath in the previous century (BBS, 2006).

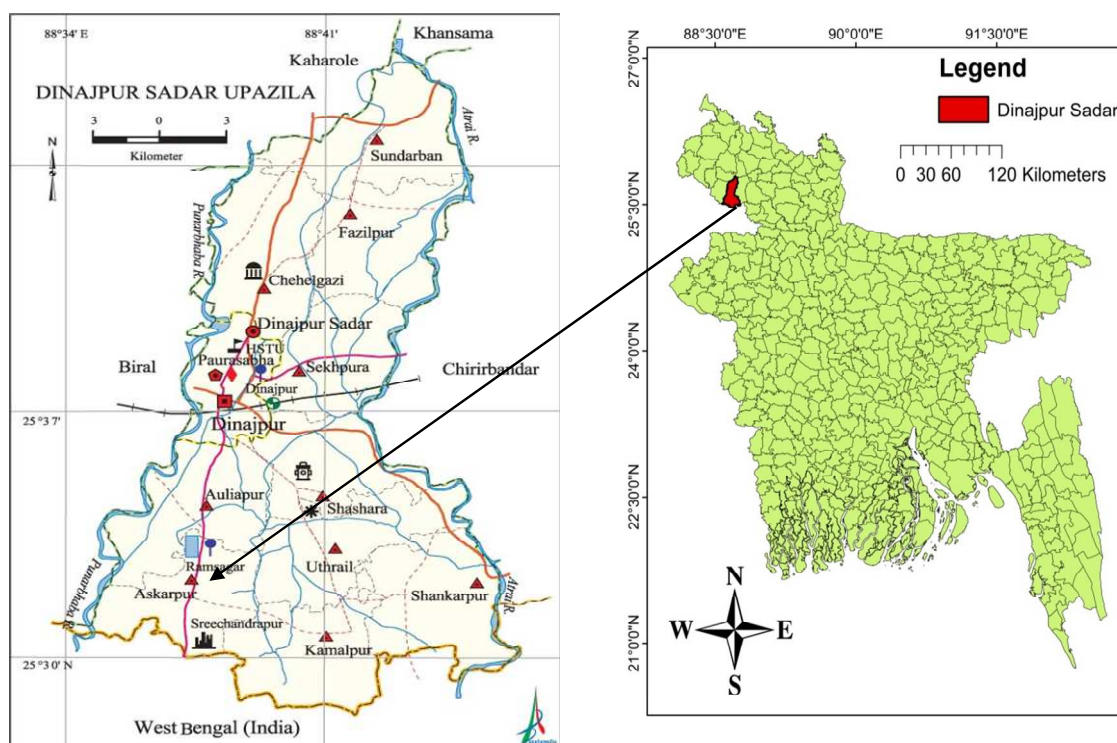


Fig. 1. Map showing the study area of Ramsagar National Park in Dinajpur district

Data collection: Data were gathered during June 2019 to August of 2020. The bit officer and park manager were interviewed for information on the floral and faunal biodiversity, and other information was gathered from their record book and magazine. The state of floral biodiversity was estimated accordingly Simpson's Diversity Index (Simpson, 1949). The number of plant species within various species, such as trees, shrubs, herbs, and climbers, is used to compute Simpson's Index. Additionally, the quantity of each species' individuals was recorded. The value of D with this index lies between 0 and 1, where 1 denotes a lack of diversity and 0 symbolizes an infinite diversity. That is, the diversity decreases as D value increases. According to Simpson's diversity index,

$$SID=1-D$$

Where; $D=\sum n(n-1)/N(N-1)$

D = Simpson's Index, which has a range of 0 to 1.

n = The total number of every species.

N stands for all the people.

Then, Simpson's Index of Diversity, $SID=1-D$ (Islam *et al.*, 2017)

After finishing the research in the chosen area of Ramsagar National Park, we organized the floral and faunal data into distinct systemic categories to make it simple to determine the state of the study area's extant and extant species. The acquired data were properly assembled, tabulated and statistical analysis was performed on them. The gathered data were displayed and analyzed using Microsoft Office Excel 2019. Charts and tabular presentations of the study's findings were also made for better reflection.

Results and Discussion

Floral composition and diversity estimation by Simpson's Index Method (SIM): Total numbers of 82 floral species under the 67 genera and 46 families recorded in the study area (Table 1). The largest category of plants was the timber plants, which included 31 species from 20 families. The second largest group of plants was the shrubs, which included 23 species from 18 genera and 16 families. The climber has 9 species under 9 genera and 8 families, whereas the herb has 18 species under 16 genera and 12 families. A total of 19 plants have been identified under the fruit plant species, with 16 genera (genus) and 13 families each possessing 19 trees. There were 42 medicinal species with 31 genera and 25 families. There were determined to be a total of 44.51% species of trees, 13.45% species of shrubs, 31.95% species of herbs, and 10.9% species of climbers (Fig. 2) which depicted that the rich with tree species followed by shrub, herb, and climbers. Accordingly Simpson's diversity index, total biodiversity estimated in Ramsagar National Park indicated that the status of the floral diversity is very rich and diverse which was 0.97.

Table 1. List of floral diversity and estimation by Simpson's Index method of Ramsagar National Park

Local Name	Scientific Name(genus)	Family	Total Number (n)	n (n-1)
Tree species (31)				
Dhakijam	<i>Syzygium jambos</i>	Myrtaceae	15	210
Aam	<i>Mangifera indica</i>	Anacardiaceae	78	6006
Akasmoni	<i>Acacia auriculiformis</i>	Mimosaceae	25	600
Jarul	<i>Lagerstroemia speciosa</i>	Lythraceae	12	132
Jam	<i>Syzygium cumini</i>	Myrtaceae	30	870
Deya	<i>Artocarpus lacucha</i>	Moraceae	2	2
Amloki	<i>Phyllanthus emblica</i>	Euphobiaceae	9	72
Horitoki	<i>Terminalia chebula</i>	Combretaceae	13	156
Bohera	<i>Terminalia bellirica</i>	Combretaceae	2	2
Debdaru	<i>Polyalthia longifolia</i>	Annonaceae	80	6320
Kathal	<i>Artocarpus heterophyllus</i>	Moraceae	30	870
Sal	<i>Shorea rubusta</i>	Dipterocarpaceae	28	756
Segun	<i>Tectona grandis</i>	Verbinaceae	13	156
Peyara	<i>Psidium guajava</i>	Myrtaceae	20	380
Arjun	<i>Terminalia arjuna</i>	Combretaceae	11	110
Bakul	<i>Mimusops elengi</i>	Sapotaceae	15	210
Jamrul	<i>Syzygium samarangense</i>	Myrtaceae	2	2
Kamranga	<i>Averrhoa carambola</i>	Averrhoaceae	3	6
Eucalyptus	<i>Eucalyptus camaldulensis</i>	Myrtaceae	32	992
Sadakoroi	<i>Albizia procera</i>	Mimosaceae	7	42
Kala koroi	<i>Albizia lebbek</i>	Mimosaceae	9	72
Sissoo	<i>Dalbergia sissoo</i>	Papilionaceae	8	56
Simul	<i>Bombax ceiba</i>	Bombaceae	5	20
Bot	<i>Ficus bengalensis</i>	Moraceae	3	6
Pakur	<i>Ficus comosa</i>	Moraceae	4	12
Dumur	<i>Ficus carica</i>	Moraceae	16	240
Amra	<i>Spondias pinnata</i>	Anacardiaceae	5	20
Tetul	<i>Tamarindus indica</i>	Caesalpinieae	5	20
Jalpai	<i>Elaeocarpus robustus</i>	Elaeocarpaceae	4	12
Litchi	<i>Litchi chinensis</i>	Sapindaceae	6	30
Neem	<i>Azadirachta indica</i>	Meliaceae	11	110

Local Name	Scientific Name(genus)	Family	Total Number (n)	n (n-1)
Shurb species (23)				
Makla	<i>Stephania japonica</i>	Menispermaceae	7	42
Anantamul	<i>Hemidesmus indicus</i>	Asclepiadaceae	5	20
Thuja	<i>Thuja orientalis</i>	Cupressaceae	12	132
Chaitan	<i>Alstonia scholaris</i>	Apocyanaceae	8	56
Lajjabati	<i>Mimosa pudica</i>	Luguminaceae	13	156
Nayantara	<i>Vinca rosea</i>	Apocynaceae	5	20
Nayantara (Sada)	<i>Vinca alba</i>	Apocynaceae	7	42
Sarpogandha	<i>Rauwolfia serpentine</i>	Apocynaceae	5	20
Kalokesunda	<i>Cassia sophera</i>	Caesalpinieae	8	56
Bhuikumra	<i>Ipomoea digitata</i>	Convolvaceae	10	90
Amloki	<i>Allamonda cathartica</i>	Annonaceae	4	12
Pindal	<i>Randia uliginosa</i>	Rubiaceae	6	30
Ulatkambol	<i>Abroma augusta</i>	Sterculiaceae	6	30
Dhutora	<i>Datura metel</i>	Solanaceae	4	12
Bonbegun	<i>Solanum ferox</i>	Solanaceae	3	6
Joba	<i>Hibiscus rosasinensis</i>	Malvaceae	9	72
Jhumkojoba	<i>Hibiscus schizopetalus</i>	Malvaceae	7	42
Bely	<i>Jasminum sambac</i>	Oleaceae	10	90
Kalmilata	<i>Ipomoea aquatic</i>	Convolvulaceae	3	6
Sabujnakful	<i>Cyperus difformis</i>	Cyperaceae	7	42
Khudipatai	<i>Cyperus flavidus</i>	Cyperaceae	4	12
Golap	<i>Rosa sp.</i>	Rosaceae	6	30
Sadarangan	<i>Ixora arborea</i>	Rubiaceae	3	6
Herb species (18)				
Mat grass	<i>Axonopus compressus</i>	Poaceae	51	2550
Hastipodo	<i>Elephantopus scaber</i>	Boraginaceae	31	930
Durba ghas	<i>Cynodon dactylon</i>	Poaceae	71	4970
Nirbishighas	<i>Chloris virgate</i>	Poaceae	2	2
Muthaghas	<i>Cyperus haspen</i>	Cyperaceae	22	462
Katanoty	<i>Amaranthus spinosus</i>	Amaranthaceae	11	110
Kesuti	<i>Eclipta alba</i>	Compositae	32	992
Pathorkuchi	<i>Bryophyllum calycium</i>	Crassulaceae	20	380
Ghada (African)	<i>Tagetes erecta</i>	Compositae	11	110
Kachuripana	<i>Eichhornia crassipes</i>	Pontederiaceae	33	1056
Panikachu	<i>Monochoria hastate</i>	Pontederiaceae	12	132
Khudipana	<i>Lemna minor</i>	Lemnaceae	16	240
Kachu	<i>Colocasia esculenta</i>	Araceae	11	110
Helencha	<i>Jussleua repens</i>	Onagraceae	6	30
Dol	<i>Hygrorhiza aristata</i>	Gramineae	7	42
Panimorich	<i>Polygonum oriental</i>	Polygonaceae	9	72
Shusni	<i>Marsilia quadrifolia</i>	Marseliaceae	7	42
Bontula	<i>Sonchus arvensis</i>	Compositae	9	72
Climber species (9)				
Telakucha	<i>Coccinea cordifolia</i>	Cucurbitaceae	12	132
Ishwarmul	<i>Aristolochia indica</i>	Aristolochiaceae	11	110
Sharnalata	<i>Cuscuta reflexa</i>	Convolvaceae	33	524
Mateaalu	<i>Bryophyllum calycium</i>	Crassulaceae	11	110
Bissatu	<i>Tragia involuerata</i>	Euphorbiaceae	9	72
Shatamuli	<i>Asparagus sprengeri</i>	Liliaceae	8	56
Nishinda	<i>Vitex negundo</i>	Verbanaceae	11	110
Malotilota	<i>Aganosma caryophylla</i>	Apocynaceae	7	42
Lotabot	<i>Fiscus pumila</i>	Moraceae	12	132
Total			N=1130	n(n-1)=33106

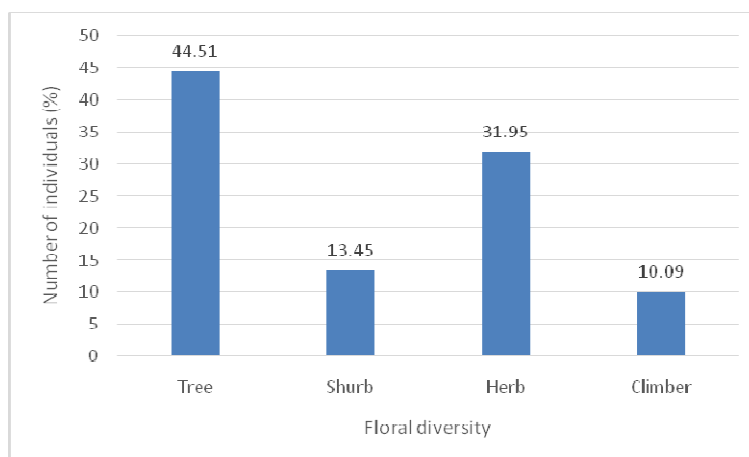


Fig. 2. Floral diversity of Ramsagar National Park

Faunal composition and diversity estimation by SIM: The total numbers of 27 faunal species from 25 families, among them 6 species belong to mammals under 6 families, and whereas 6 species belong to reptiles under 6 families, 5 species from amphibians under 2 families and 10 species belongs to aves under 9 families were observed in the study area (Table 2). A total number of 74.23% aves, 13.78% amphibians, 5.31% reptiles and 6.68% mammals were found (Fig. 3) in the study area. According to the result of Simpson's diversity index, faunal diversity estimated in Ramsagar National Park indicated that the status of the faunal diversity is very rich and diverse which was 0.93.

Table 2. List of faunal diversity and estimation by Simpson's Index method of Ramsagar National Park

Local Name	Scientific Name(genus)	Family	Total Number (n)	n (n-1)
Mammals				
Harin	<i>Muntiacus muntjac</i>	Carvidae	65	4160
Sheyal	<i>Canis aureus</i>	Canidae	37	1332
Bezi	<i>Herpestes auropunctatus</i>	Herpestidae	307	93942
Badur	<i>Pteropus giganteus</i>	Pteropodidae	204	41412
Banor	<i>Macaca mulatta</i>	Cercopithecidae	54	2862
Chita biral	<i>Felis bengalensis</i>	Felidae	67	4422
Reptiles				
Gokhrashap	<i>Naja naja</i>	Elapidae	209	43472
Elapidae	<i>Varanus begalensis</i>	Varanidae	86	7310
Roktochosha	<i>Calotes versicolor</i>	Agamidae	98	9506
Maitashap	<i>Gerardia prevostiana</i>	Natricidae	72	5112
Anjoni	<i>Mabuya carinata</i>	Scincidae	86	7310
Laudogashap	<i>Ahaetulla nasuta</i>	Colubridae	32	992
Amphibians				
Kuno bang	<i>Bufo melanostictus</i>	Bufoinidae	705	496320
Jhijhi bang	<i>Fejervarya limnocharis</i>	Dicroglossidae	98	9506
Shona bang	<i>Hoplobatrachus tigrina</i>	Dicroglossidae	206	42230
Geso bang	<i>Polypedates leucomystax</i>	Rhacophoridae	407	165242
Kola bang	<i>Hoplobatrachus tigerinus</i>	Dicroglossidae	98	9506
Aves				
Kana bak	<i>Ardeaolagrayii</i>	Ardeidae	996	991020
Doyel	<i>Copsychussularis</i>	Corvidae	705	496320
Bulbuli	<i>Pycnonotus cafer</i>	Pycnonotidae	702	492102
Masranga	<i>Alcedo atthis</i>	Alcedinidae	1009	1017072

Local Name	Scientific Name(genus)	Family	Total Number (n)	n (n-1)
Vat shalik	<i>Acridotherus tristis</i>	Sturnidae	308	94556
Pecha	<i>Alba</i>	Tytonidae	1004	1007012
Kath thukra	<i>Dinopium benghalense</i>	Picidae	806	648830
Shadabukmasranga	<i>Halcyon smyrnensis</i>	Halcyonidae	776	601400
Lakhhipecha	<i>Tyto alba</i>	Tytonidae	996	991020
Goboreshalik	<i>Sturnus contra</i>	Sturnidae	853	726756
Total			N=10986	n(n-1)=8010724

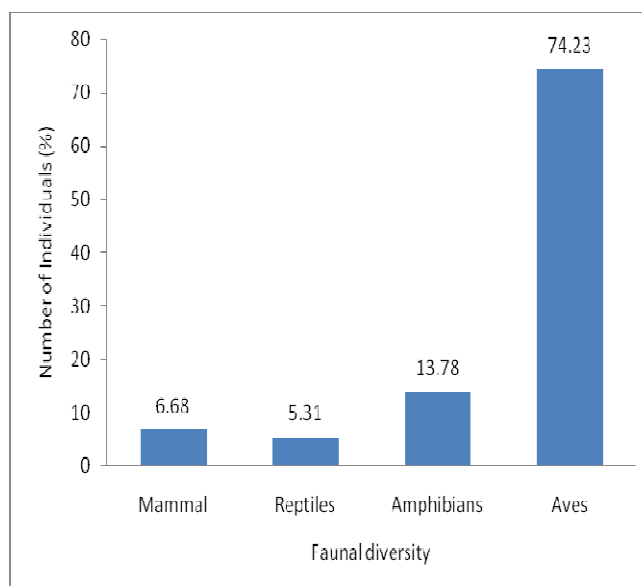


Fig. 3. Faunal diversity of Ramsagar National Park

Fish species in RNP: Total 169.741-ton fishes were found in the study area among that largest quantity of Rui (28 ton), Katila (27 ton), Silver (18 ton), Japani (27 ton) and Magur (15 ton) species under 15 families and 24 genera. There are 28 species of freshwater cultivated fish in the RNP has shown in Table 3.

Table 3. List of fish species of Ramsagar National Park

Local name	Scientific name (genus)	Family	Quantity (ton)
Rui	<i>Labeo rohita</i>	Cyprinidae	28
Darkina	<i>Rasbora rasbora</i>	Cyprinidae	0.045
Pabda	<i>Ompokbi maculatus</i>	Siluridae	0.02
Tengra	<i>Mystus vittatus</i>	Bagridae	2
Sal baim	<i>Mastacembelu sarmatus</i>	Mastacembelidae	1
Bheda	<i>Nandus nandus</i>	Nandidae	0.035
Gol chanda	<i>Parambassis ranga</i>	Ambassidae	3
Chela	<i>Chela bacaila</i>	Cypinidae	0.028
Shol	<i>Channa striata</i>	Channidae	0.043
Tit puti	<i>Puntius tieoto</i>	Cypinidae	2
Gojar	<i>Channamarulius</i>	Channidae	0.106
Katila	<i>Xenodoncancila</i>	Belonidae	27
Jatputi	<i>Puntius sophore</i>	Cypinidae	1.5
Magur	<i>Clarius batrachus</i>	Clariidae	15
Shing	<i>Heteropneustestossilis</i>	Heteropneutidae	5
Boal	<i>Wallaguattu</i>	Siluridae	0.086

Local name	Scientific name (genus)	Family	Quantity (ton)
Foli	<i>Notopterus notopterus</i>	Notopteridae	0.098
Chital	<i>Chitalachitala</i>	Notopteridae	4
Poa	<i>Macropsinosacuja</i>	Sciaenidae	24
Koi	<i>Anabas testudineus</i>	Anabantidea	7
Kholisha	<i>Colisa fasciatus</i>	Belontiidae	1.5
Kuicha	<i>Monopterusuchia</i>	Mastacembelidae	0.051
Taki	<i>Channa punctata</i>	Channidae	0.047
Cheng	<i>Channa orientalis</i>	Channaorientalis	1.8
Chanda	<i>Chanda nama</i>	Ambassidae	1.3
Air	<i>Aorichthysaor</i>	Bagridae	0.082
Japani	<i>Sillago japonica</i>	Plecoglosside	27
Silver	<i>Lapisma saccharina</i>	Salmonide	18
Total			169.741

Constraints of biodiversity management: The constraints of biodiversity management in Ramsagar National Park has shown in Fig. 4, where 30% respondents suggested regarding lack of proper planning and management, 23% respondents to negligence of management authority including lack of enough budget (14% respondents), governmental allocation (12% respondents), tourism pressure (11% respondents), and lack of human resources (10% respondents), respectively.

Conservation strategy of RNP: The conservation strategy of RNP has shown in Fig. 5. From the Fig. 5 it is affirmed that 27% respondent were suggested to awareness increase, 24% respondent suggested to conservation (ex-situ and in-situ), 20% respondent suggested to restoration, 10% respondent suggested to manpower utilization, 8% respondent suggested to institutional research, 8% respondent suggested to policy and regulation implementation and 3% respondent suggested to media involvement to conserve the biodiversity of RNP.

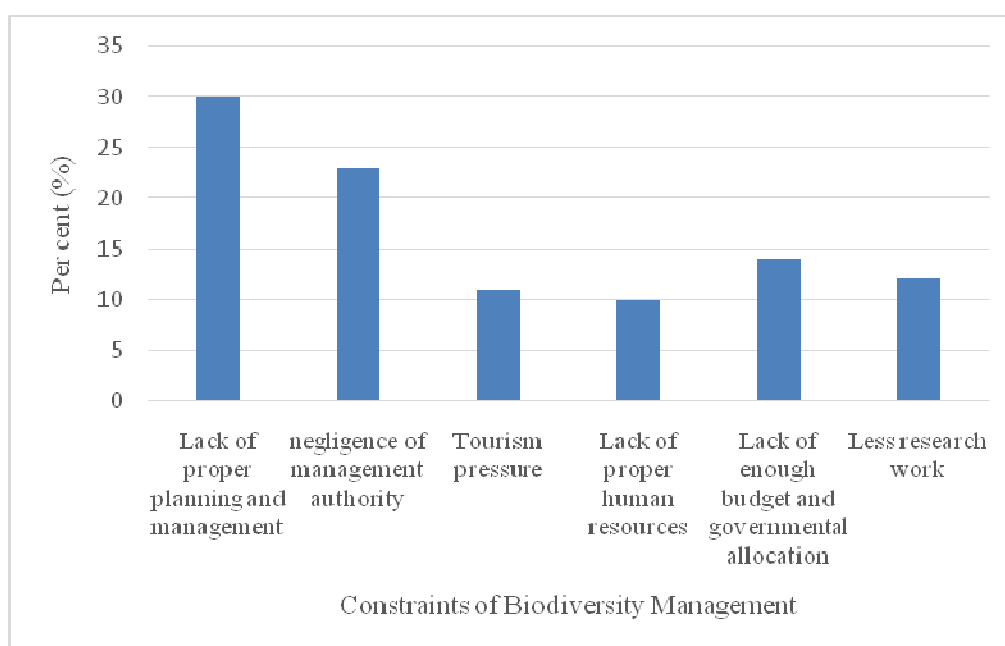


Fig. 4. Constraints of biodiversity management of RNP

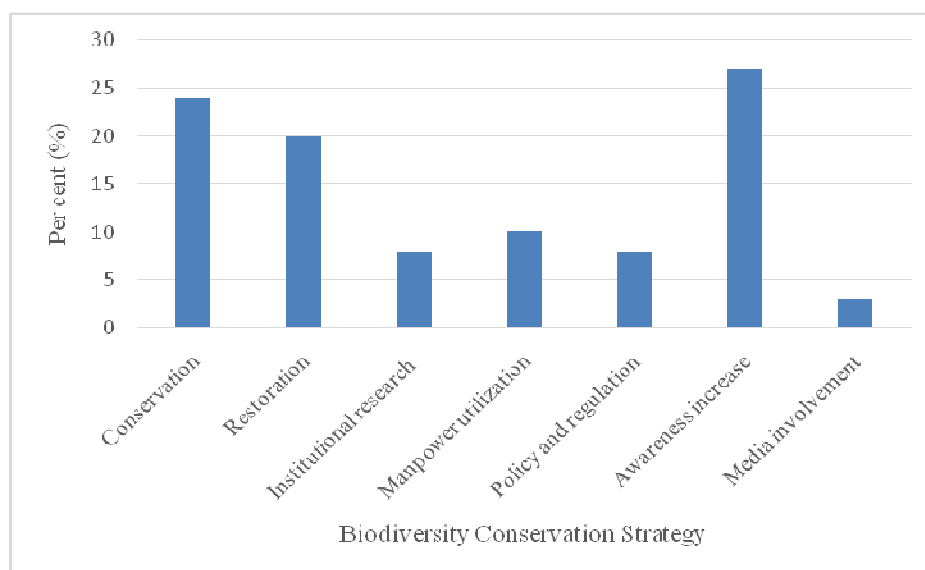


Fig. 5. Biodiversity conservation strategy of RNP

Conclusion

Ramsagar National Park was very rich both for floral diversity (SID 0.97) and faunal diversity (SID 0.93) but that diversity disturbed by the unwanted behavior of tourists and local people in the park. Current management practices were inefficient to manage this park sustainably thus, the park management should be modernized through master plans, acts, and policies. Finally, government needs to take necessary actions for developing the current management.

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