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A check list of floral and faunal diversity of National Institute of Technology, Rourkela, Odisha: implication on conservation and environmental studies

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ABSTRACT

The paper reports a preliminary check list of plant species and 109 fauna belonging to 45 families including avifauna along with scientific name, vernacular name(s), family and habitat, available in the campus of National Institute of Technology, Rourkela, India. The study was conducted during 2013 -2015 in all seasons. Among the plant species, 53 are medicinal, 43 are ornamental and 33 are edible along with the 23 weeds are recorded. Of the faunal diversity, 12 are reptiles, 55 are birds, 4 are mammals and 33 are butterflies were observed. Present field observatory work highlights the uses of local floras, scientific identification and conservation of available flora and fauna in the institute campus. Paper, also gives attention towards the conservation of bio-resources of the campus and proper utilization of bio-wealth in research, academic activities and other uses. Documentation of fauna and flora check list will be helpful in the environmental study too.

Keywords: Faunal Diversity, Floral Diversity, National Institute of Technology Rourkela, Biodiversity Conservation.

INTRODUCTION

Biodiversity is the omnium gatherum of all the genes, species and ecosystems which are found in the nature (Nielsen *et al*. 2014). It comprehends microorganisms, flora, fauna and abiotic components in which they thrive and interact. Human beings cannot survive on this planet for long without the floral and faunal wealth (Lubbe *et al*. 2011; Cilliers *et al*. 2012; Jaganmohan *et al*. 2012; Clarake *et al*. 2014), because it gives life stuffs (Tilman and Lehman 2001). These wealth bestows food, medicine, fodder and also has paramount economic and socio-cultural worth throughout the world. They are also helpful in maintaining the

ecosystem (Maity *et al*. 2004). Floral and faunal diversity is elite integrant of biological diversity (Sedelnikov *et al*. 2008). These resources provide primary need (Ripu *et al*. 2012; Annika *et al*. 2009) to local communities of any region. Still in this modern era, most of rural and tribal communities who living close to forest depend on these bio-resources for their livelihood. The traditional uses of plants and some selected animals are bygone (Sen *et al*. 2011) and their parts are foregone practices (Aliotta *et al*. 2008; Alyes 2009). The atavistic Indian literature also indicates that therapeutic uses of bio-wealth is being practiced since as old as 5000-4000 B.C. (Posey and Dutfield 1996). Floral and faunal diversity is directly proportional to the richness of traditional knowledge (Alyes 2009). The World Health Organization (WHO) has estimated that as many as 60% of the world population is dependent on traditional medicine for their primary health needs (Mazzocchi 2006; Saslis *et al*. 2014; Actis *et al*. 2015). Traditional medicine is the sum total of all knowledge and practices whether explicable or not used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observation transferred by individuals from generation to generation (Byg and Balslev 2001; Sen *et al*. 2011). Due to various biotic and abiotic factors, the floral and faunal diversities are declining in alarming rate (Geslin *et al*. 2013; Campbell *et al*. 2014). It is the rationale behind the environmental problems, climatic changes and scarcity of therapeutic as well as food resources. Recent global researches indicate that people are bending towards the green society (Koedam and Godefroid 2007; Singh *et al*. 2013). It is quite recent knowledge that not only natural, semi-natural landscapes and rural and tribal areas in and around the forest can be highly diverse in flora and fauna, but also rich in urban areas in the form of small patches, campus of educational, institutional and other government bureaus (Kuhn *et al*. 2004; Gatesire *et al*. 2014; Voigt *et al*. 2014; Daye and Healey 2015).

Urbanization is spreading at a gallop across the world, pivotal challenge for the conservation is to understand how it affects the biodiversity (McKinney 2002). This increasing trend has severe consequences for the environment (Breuste 2013), as it fragments and changes natural areas and alters environmental conditions. Urban-institutional ecosystems differ from forest ones in a number of ways (Marzluff *et al*. 2008; Haase *et al*. 2014). Although most of the factors which affect ecosystems in the cities such as climate, soil, water conditions, human impact are comparable to those in non-urban areas. The combination of these factors creates unique urban-institutional ecosystems. So, the city has to be regarded as a "New type of Environment" with species compositions and habitats peculiar to urban-institutional areas. In addition to more natural landscapes, conservation of biodiversity in institutional campus should be a major task for nature conservation. People with higher socio-economic status were found to harbour more diverse species assemblages in their gardens/ campus than those of lower socio-economic status (Munyuli 2011; Shwartz 2012). This phenomenon was termed the "luxury green concept". Outside India, urbanization and its consequences have been intensively studied (McKinney 2006; McKinney 2008). Plant species richness in cities is usually greater than in surrounding areas (Sukopp and Werner 1983; Pysek and Pysek 1990; Kuhn *et al*. 2004), and cities may harbour biodiversity hot spots and natural areas of a high wildlife value. The high diversity of urban landscapes, resulting from variable land use, creates a great variety of ecological conditions for flora and fauna (Gilbert 1989). Numerous studies have also investigated on biodiversity at a variety of scales in urban Odisha, India. We now have a good understanding of the factors structuring vegetation composition in such sites (Neil and Wu 2006). Recently, Kumar and Satapathy's (2011) studied the floral wealth of the campus of Regional Institute of Education and reported 77 herbaceous medicinal plant species and give attention in their utilization in research and education as well as in conservation of these bio-resources. This interest in urban floras can be attributed to the fact that cities are remarkably rich in such species because of high habitat diversity (Gilbert 1989). Conservation of biological diversity thus represents an important objective not only in nature reserves and semi-natural areas, but has also become vital in areas where human activity is most intense and institutional campus. These resources also play vital role in balancing of pollution and other environmental factors in institutional campus.

Therefore, keeping the all above cited factors in view, an attempt was made to document the major floras and faunas of the campus of National Institute of Technology, Rourkela, Odisha, India (Plate 1). The present study addresses the importance of the bio-wealth in urban areas to maintain the urban

biodiversity to the students and researchers. The present study also highlights the importance of campus floras and faunas along with give attention on their conservation and in environmental education.

MATERIALS AND METHODS

The study site

Campus of National Institute of Technology (NIT), Rourkela, established on 15th August 1961 as Regional Engineering College (Prusti and Behera 2007) is unique with floral and faunal diversity in an urban environment. It is situated between 22°14' 57" N to 82° 54' 58" E (Kumar *et al*. 2013). It is located at the Eastern end of Steel City having 1024 acres land, give the honour of 2nd largest engineering campus in the country. The average height of the study area is about 219 msl (Haines 1991-1925; Prusti and Behera 2007; Kumar *et al*. 2013). Geographically, it is land mass of red and laterite soils with quite rich in minerals, particularly iron ore. Campus enjoy tropical climate and receives high rainfall during Southeast monsoon and retreating Northeast monsoon. The average rainfall is about 160 to 200 cm. It has semi-evergreen or tropical dry deciduous forest (Saxena and Brahmam 1994-1996; Kumar and Satapathy 2011). The field studies were carried out during the year of 2013 to 2015 in different seasons to enumerate the floral (Christian and Brigitte 2004) and checklist of faunal (Yair and Martinez 2014; Raut and Pendharkar 2010; Vrcidradic *et al*. 2010; Dellarossa *et al*. 2010; Feijo and Nunes 2010) wealth of the NIT, Rourkela campus.

Seasonal variations and frequency of plants and animals occurrence were noted. During the field visit, survey was made in different places i.e. waste land, bare lands, play grounds, road side, grass lands and gardens. Common and ethno-botanical uses of plant species are noted by the local people inhabitating in and around the campus area through a set of questioners as passport data form. In addition, the frugivorous birds were observed to make relation between birds and fruit bearing plants.

The flora and fauna were identified by the authors following the floras & fauna books (Haines 1924; Brahmam and Saxena 1995; Ahimaz 2014) and published articles (Kumar and Satpathy 2011). The tabulation was done with each species, its scientific name, local name/ common name, habit, nature and type of the species.

RESULTS

Field survey revealed that the campus of NIT, Rourkela is rich in biodiversity. The authors recorded 154 plant species under 128 genera and 55 families whereas 109 species of fauna are observed in the campus, in which 55 Avifauna, 33 Butterflies, 4 Mammals, 12 Reptiles, 3 Amphibians and 2 Pisces are recorded (Table 2, Fig. 3). It was analysed that in the diversity of floras, the taxa including monocotyledonous and diocotyledons, Asteraceae contributed a maximum of 12 species, followed by Apocynaceae and Caselpinaceae with 9 species (Fig. 1). Euphorbiaceae contributed 7 species. Fabaceae and Malvaceae each contributed 6 species. It was also observed that out of total species, maximum species were tree (45) followed by herb (49) and shrub (28). Climbers contributed 20 species and grass the least (5). The most usage ways of taxa were medicinal (53) followed by ornamental (43), edible (33), common weed (23), timber (14) and cultural (2). The study indicates that the largest number of medicinal flora belongs to tree. One plant species, *Saraca asoca* (Fig. 3) was recorded as RET (rare, endangered and threatened) in the campus. The most common medicinal plants are *Borehivia diffusa, Terminalia bellirica, Paderia foetida, Saraca asoka* and *Mucuna pruriens*; edible plants are *Dioscorea bulbifera, Amaranthus spinosus, Annona reticulate, Annona squamosa, Artocarpus heterophyllus, Commelina benghalensis, Dillenia indica, D. alata, Emblica officinalis*, *Mitragyana parviflora;* common weeds are *Pelicetum penicellatum, Ipomea carnea, Tridex procumbens, Xanthium strumarium;* common cultivated plants are *Peltophorum pterocarpum, Allamanda cathartica, Bauhinia acuminate, Canna indica* etc. While the faunal diversity was recorded, it was observed that the most common dominant families were Nymphalidae (14), Lycaenidae (7), Hesperiidae (6), Scincidae (4) and Pieridae (3) (Fig. 2). Analysis of the diversity of flora and faunal, the authors found one RET (rare, endangered and threatened) reptile (*Naja naja*) (Fig. 3) belonging to family Elapidae (Table 1).

Table 1: Check List of Faunal diversity of NIT, Rourkela campus

Scientific name	Family	Common Name	IUCN status
Birds			
Accipiter badius	Accipitridae	Shikra	LC
Acridotheres tristis	Sturnidae	Common myna	LC
Aedo atthis	Aedinidae	Blue kingfisher	LC
Anastomus oscitans	Ciconiidae	Asian openbill stork	LC
Ardeola grayii	Ardeidae	Pond heron (Plate 1.8)	LC
Athene brama	Strigidae	Spotted owlet	LC
Ayon smyrnensis	Aedinidae	White throated Kingfisher (Plate 1.5)	LC
Bubu usibis	Ardeidae	Cattle egret	LC
Caprimulgus asiaticus	Caprimulgidae	Commn nightjar	LC
Centropus sinensis	Cuculidae	Greater coucal	LC
Columba livia	Columbidae	Blue rock pegion	LC
Copsychus saularis	Turdinae	Oriental magpie robin	LC
Coracias benghalensis	Coraciidae	Indian roller	LC
Coracina melanoptera	Campephagidae	Black headed cuckoo shrike	LC
Corvus splendens	Corvidae	House crow	LC
Cuculus canorus	Cuculidae	Indian cuckoo (Plate 1.4)	LC
Dendrocitta vagabunda	Corvidae	Rufous treepie	LC
Diceum agile	Dicaeidae	Thick-billed flowercatcher	LC
Dicrurus macrocercus	Dicruridae	Black drongo	LC
Egretta garzetta	Ardeidae	Little egret	LC
Elanus caeruleus	Accipitridae	Black shouldered kite	LC
Eudynamys scolopacea	Cuculidae	Asian koel	LC
Megalaima zeylanica	Capitonidae	Brown headed barbet	LC
Merops orientalis	Meropidae	Green bee-eater	LC
Metopidius indicus	Jacanidae	Bronze winged jacana (Plate 1.7)	LC
Hydrophasianus chirurgus	Jacanidae	Pheasant tailed jacana	LC
Amauromis phoenicurus	Rallidae	White breasted waterhen	LC
Porphyria porphyria	Rallidae	Purple swamphen	LC
Gallinule chloropus	Rallidae	Common moorhen	LC
Chrysomma sinense	Sylviidae	Yellow eyed babbler (Plate 1.1)	LC
Lonchura punctulata	Estrildidae	Scaly breasted munia	LC
Nettapus coromandelianus	Anatidae	Cotton pygmy goose	LC
Dendrocygna javanica	Anatidae	Lesser whistling duck	LC
Sturnia malabarica	Sturnidae	Chestnut tailed starling (Plate 1.2)	LC
Milvus migrans	Accipitridae	Black kite	LC
Nectarinia asiatica	Nectariniidae	Purple sunbird	LC
Nectarinia zeylanica	Nectariniidae	Purple rumped sunbird	LC
Orthotomus sutorius	Sylviinae	Common tailorbird	LC
Passer domesticus	Passerinae	House sparrow	LC
Phalacrocorx niger	Phalacrocoracidae	Little cormorant	LC
Ploceus philippinus	Ploceinae	Baya weaver	LC
Prinia inornata	Sylviinae	Plain prinia	LC
Prinia socialis	Sylviinae	Ashy prinia	LC
Psittacula cyanocephala	Psittacidae	Plum headed parakeet	LC
Psittacula eupatria	Psittacidae	Alexandrine parakeet (Plate 1.6)	LC
Psittacula krameri	Psittacidae	Rose-ringed parakeet	LC

Table 1: Continued…

Scientific name	Family	Common Name	IUCN status
Pycnonotus jocosus	Pycnonotidae	Red-whiskered bulbul	LC
Pycnonotus cafer	Pycnonotidae	Red-vented bulbul	LC
Saxicoloides fulicata	Turdinae	Indian robin	LC
Streptopelia chinensis	Columbidae	Spotted dove	LC
Sturnus contra	Sturnida	Asian pied starling	LC
Turdoides striata	Timaliinae	Jungle babbler	LC
Oriolus xanthornus	Oriolidae	Black headed oriole	LC
Megalaima zeylanica	Megalaimidae	Brown headed barbet	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	LC
Butterflies			
Abisara echerius	Lycaenidae	Plum Judy	NE
Acraea violae	Nymphalidae	Tawny Coster	NE
Papilio polytes	Papilionidae	Common Mormon	NE
Ariadne merione	Nymphalidae	Common Castor	NE
Danaus genutia	Nymphalidae	Striped tiger	NE
Catopsilia Pomona	Pieridae	Common Emigrant	NE
Danaus chrysippus	Nymphalidae	Plain Tiger	NE
Euploea core	Nymphalidae	Common Crow	NE
Eurema blanda	Pieridae	Three Spot Grass Yellow	NE
Eurema hecabe	Pieridae	Common Grass Yellow	NE
Euthalia aconthea	Nymphalidae	Common Baron	NE
Freyeria trochylus	Lycaenidae	Grass Jewel	NE
Graphium doson	Papilionidae	Common Jay	NE
Junonia atlites	Nymphalidae	Grey Pansy	NE
Junonia hierta	Nymphalidae	Yellow Pansy	NE
Junonia lemonias	Nymphalidae	Lemon Pansy	NE
Junonia orithiya	Nymphalidae	Blue Pansy	NE
Matapa aria	Hesperiidae	Common Redeye	NE
Melanitis leda	Nymphalidae	Common Evening Brown	NE
Mycalesis perseus	Nymphalidae	Common Bush brown	NE
Oriens goloides	Hesperiidae	Common Dartlet	NE
Papilio demoleus	Papilionidae	Lime Butterfly	NE
Pareronia valeria	Pieridae	Common Wanderer	NE
Phalanta phalantha	Nymphalidae	Common Leopard	NE
Pseudozizeeria maha	Lycaenidae	Pale Grass Blue	NE
Sarangesa dasahara	Hesperiidae	Common Small Flat	NE
Spialia galba	Hesperiidae	Indian Skipper	NE
Spindasis vuanus	Lycaenidae	Common Silverline	NE
Tagiades gana	Hesperiidae	Suffused Snow Flat	NE
Neopithecops zalmora	Lycaenidae	Quaker	NE
Athyma perius	Nymphalidae	Common sergent	NE
Zizina otis	Lycaenidae	Lesser Grass Blue	NE
Zizula hylax	Lycaenidae	Tiny Grass Blue	NE
Mammals			
Bandicota bengalensis	Muridae	Lesser Bandicoot-rat	LC
Funambulus palmarum	Sciuridae	Three-striped Palm Squirrel	LC
Mus musculus	Muridae	House Mouse	LC
Rattus rattus	Muridae	House Rat	LC

Table 1: Continued…

Scientific name	Family	Common Name	IUCN status
Reptiles			
Calotes versicolor	Agamidae	Indian Garden Lizard	LC
Psammophilus blanfordanus	Agamidae	Indian Rock Lizard	LC
Macropishodon plumbicolor	Colubridae	Green Keelback (Plate 1.11)	LC
Cyrtodactylus nebulosus	Gekkonidae	Clouded Indian Gecko	LC
Hemidactylus brookii	Gekkonidae	House Gecko	LC
Lygosoma punctuate	Scincidae	Common skink	LC
Eutropis carinata	Scincidae	Keeled Indian Mabuya	LC
Eutropis macularia	Scincidae	Grass Sun Skink	LC
Boiga trigonata	Colubridae	Indian gamma snake	LC
Ptyas mucosus	Colubridae	Rat snake	NE
Bungarus caeruleus	Elapidae	Common krait	NE
Naja naja	Elapidae	King cobra	V
Amphibians			
Duttaphrynus melanostictus	Bufonidae	Asian Toad	LC
Fejervarya orissaensis	Dicroglossidae	Dutta's Cricket Frog	LC
Hoplobatrachus tigerinus	Dicroglossidae	Indian Bull Frog	LC
Pisces			
Chana gachua	Channidae	Dwarf snakehead (Plate 1.10)	LC
Lepidocephalichthys thermalis	Cobitidae	Common spiny loach	LC

(LC: Least Concern, NE: Not Evaluated, V: Vulnerable)

Table 2: Relation between plants & avifauna available in NIT, Rourkela campus

Birds name	Scientific name	Fruit bearing plants	Family
Asian koel	*Eudynamys scolopaceus*	*Ficus benghalensis*	Moraceae
		Ficus religiosa	Moraceae
		Bombax ceiba	Malvaceae
		Ficus religiosa	Moraceae
Black headed oriole	*Oriolus larvatus*	*Ficus benghalensis*	Moraceae
		Bombax ceiba	Malvaceae
Brown headed barbet	*Megalaima zeylanica*	*Artocarpus hetrophyllus*	Moraceae
		Ficus religiosa	Moraceae
Chestnut Tailed Starling (Plate 3.2)	*Sturnia malabarica*	*Morus alba*	Moraceae
		Michelia champaca	Magnoliaceae
Coppersmith barbet	*Megalaima haemacephala*	*Ficus relegiosa*	Moraceae
		Ficus benghalensis	Moraceae
		Bombax ceiba	Malvaceae
Palm headed Parakeet	*Psittacula cyanocephala*	*Psidium guajava*	Myrtaceae
		Hemarthria compressa	Poaceae
		Sorghum vulvugare	Poaceae
		Bombax ceiba	Malvaceae
Red-vented bulbul	*Pycnonotus cafer*	*Butea monosperma*	Fabaceae
		Ficus benghalensis	Moraceae
Red-whiskered bulbul	*Pycnonotus jocosus*	*Bauhinia purpurea*	Caselpinaceae
		Memecylon umbellatum	Melastomataceae
Rose ringed parakeet	*Psittacula krameri*	*Spathodea campunalata*	Bignoniaceae
		Psidium guajava	Myrtaceae
		Moringa oliofera	Morangiaceae
Rufous Treepie	*Dendrocitta vagabunda*	*Lannea coromandalica*	Anacardeaceae
Scaly breasted munia	*Lonchura punctulata*	*Pennisetum pedicellatum*	Poaceae

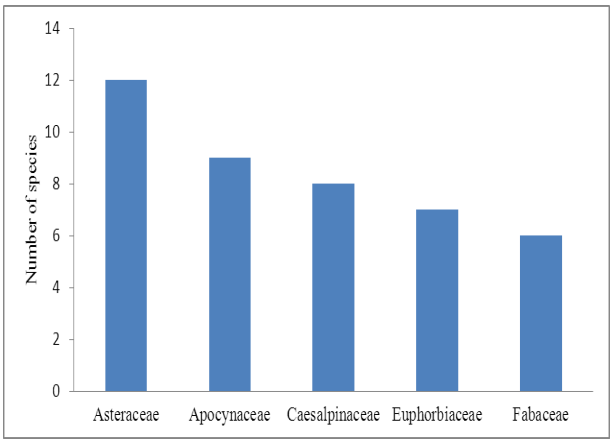


Fig. 1 Most common dominant families of Floral diversity

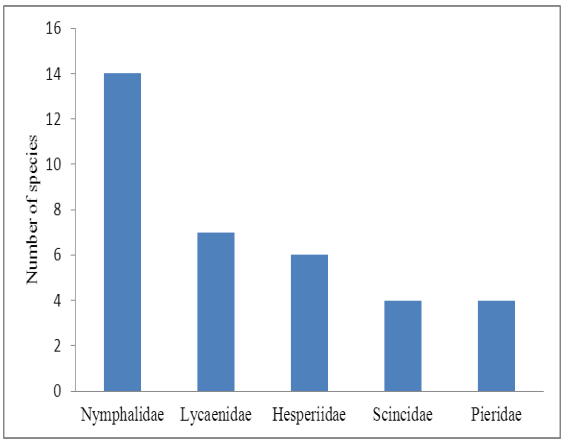
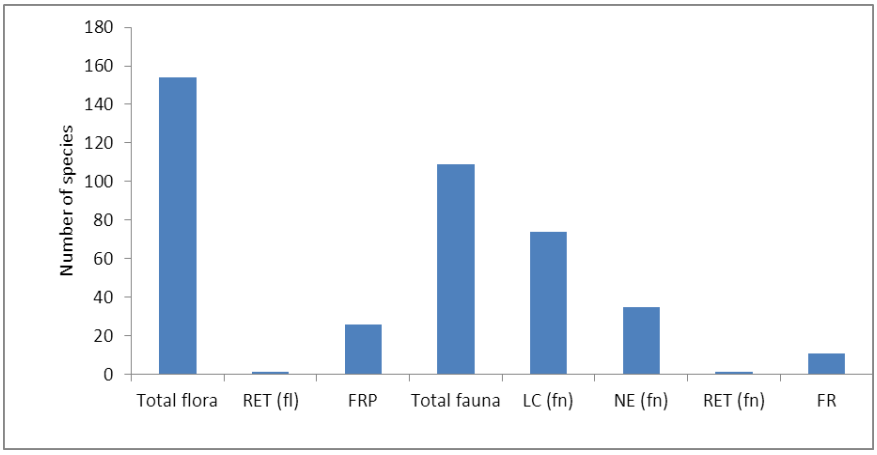


Fig. 2 Most common dominant families of Faunal diversity



(RET: rare, endangered and theratened, FRP: furgivore related plants, NE: Not evaluated, FR: Furgivore, LC: Least concern, fl: flora, fn: fauna)

Fig. 3 Status and diversity of flora amd fauna at NIT campus Rourkela

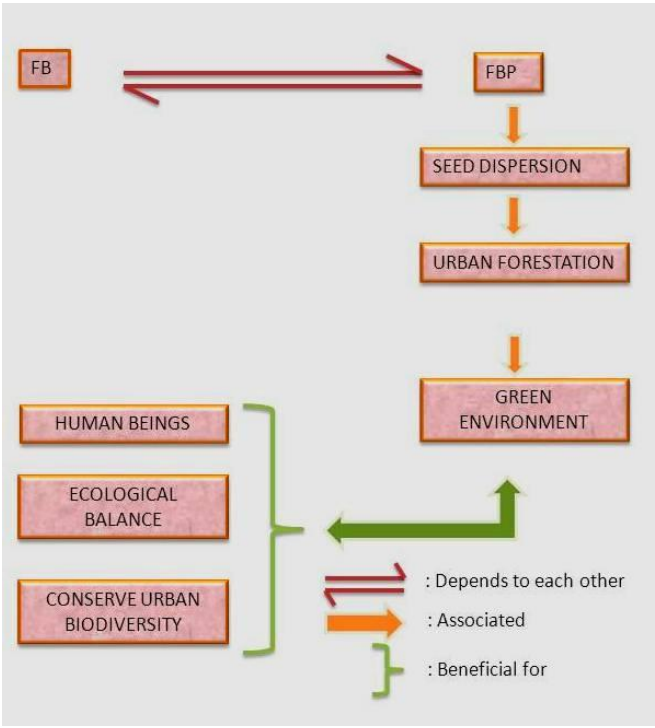


Fig. 4 Role of avifauna to conserve urban biodiversity (FB: Frugivorous birds, FBP: Fruits bearing plants)

Plate 1 Faunal diversity of NIT, Rourkela campus, 1:Yellow eyed babbler, 2:Chestnut tailed starling, 3:Spotted dove, 4: Indian Cuckoo, 5:White throated Kingfisher, 6:Alexandrine parakeet, 7: Bronze winged Jacana, 8: Pond heron, 9: Asian pied starling, 10: Dwarf snakehead, 11: Green Keelback

Of the total faunal diversity in our list, the most common are birds. The common avifauna are Common Myna (*Acridotheres tristis),* Blue Rock Pigeon (*Columba livia),* Oriental Magpie-Robin (*Copsychus saularis),* House Crow (*Corvus splendens),* Black Drongo (*Dicrurus macrocercus),* Asian Koel (*Eudynamys scolopacea),* House Sparrow (*Passer domesticus),* Red-vented Bulbul (*Pycnonotus cafer),* Asian Pied Starling (Plate 1.9) (*Sturnus contra),* Spotted Dove (Plate 1.3) (*Streptopelia chinensis) etc.* The 33 species of butterflies are recorded. The most common are Common Castor (*Ariadne merione),* Common Grass Yellow (*Eurema hecabe),* Yellow Pansy (*Junonia hierta),* Common Silverline (*Spindasis vuanus*) etc. Out of faunal diversity, we recorded the most common mammals is Three-striped Palm Squirrel (*Funambulus palmarum,* reptiles are Indian Garden Lizard (*Calotes versicolor),* Keel *(Macropisthodon plumbicolor),* Indian gamma snake (*Boiga trigonata)* & Asian Toad (*Duttaphrynus melanostictus)* and Dwarf snake head (Plate 1.10) (*Channa gachua*) are most common amphibian and fishes (Table 1). During field survey of the campus, we also observed the associated birds of the fruit bearing plants and recorded 11 birds associated with 26 fruit bearing plants (Fig. 4). Details are listed in Table 2.

DISCUSSION

The floral and faunal wealth of the urban ecosystem is strikingly under-reported in the urban biodiversity. In the quantative survey of flora and fauna in urban ecology. It was seen that the Singh, (2012) reported the 395 medicinal plant species of Banaras Hindu University, main Campus, Varanasi. Kumar and Satapathy (2011) reported 72 herbaceous flora from the campus of Regional Institute of Education, Bhubaneshwar. Singh (2011) reported 119 vascular wall floras of Banaras Hindu University, Varanasi. Verma *et al*. (2007) reported 72 medicinal plants of Banaras Hindu University, Varanasi. Pasayat *et al*. (2013) reported 20 ethno-toxic effects of some common angiosperms around the Rourkela.

Therefore, It is quite recent knowledge that not only natural and semi-natural landscapes can be highly diverse in flora, but that also urban, institutional and industrial areas show a wide variety of habitats, organisms, and communities. Urbanisation has increased tremendously over the last 60 years so that more than 50 % of the world population now live in cities. This is especially true for in developed countries, but it is expected that developing countries will take the lead in future urban population growth. This increasing trend of urbanisation has severe consequences for the environment, as it fragments and changes natural areas and alter environmental conditions. Therefore, there is a need of more exploration and awareness research to conserve the urban floras. The present study to make awareness among the students, researchers, employees of the institute and also highlights the uses. This type of study will be very helpful for the student of environmental sciences, plant taxonomy, biodiversity conservation and related topics.

CONCLUSION

We concluded after identification and documentation of floral and faunal diversity in the campus of National Institute of Technology, Rourkela that the campus is rich with bio-resources in an urban and industrial area of steel city of Odisha, India. Campus enjoys the diverse variety of flora and fauna having multifunctional values along with RET species. The campus is full of furgivorous birds which play important role in forestation by the seed dispersion. Moreover, campus along with its bio-resources provides an ideal situation for the environmental education, both in formal and non-formal sector. As bio-wealth is vanishing very rapidly due to climate change, habitat loss, invasion of exotic species and other factors, Institutional campus like NIT campus provide ideal site for conservation as in the present study. Therefore, there is immediate need to make strategy to conserve the flora and fauna in these important places for the sustainable uses of bio-wealth and ecological balance in urban areas.

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