

Green Roof Studies at Ujjain (a sub tropical city) with reference to Faunal diversity

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Abstract:

Extensive green roof concept has gained much popularity in the past. One of the prime roles that green roofs play is conservation of several faunal species in urban areas where suitable habitat loss (for concerned species) is considerably high. In the present study a survey was carried out at a subtropical region (Ujjain city, southwest of Madhya Pradesh) to inventorize various faunal species harbored by man made extensive green roofs. Interesting results were observed and about 51 faunal species including spiders, moths, beetles butterflies, dragonflies, reptiles and even birds were recorded during a span of 05 years (Jan-2016 to Dec-2020). Interestingly the species recorded were more during the year 2020, which was also the year of pandemic outburst in India.

Key Words:

Green Roof, Faunal Diversity, Sub Tropical Region

Introduction:

Habitat suitability is of great concern for the very survival of the floral and faunal species. Unplanned and unjust urbanization in several underdeveloped and developing countries worldwide is causing great damage to the natural habitat of several living forms. Green roof concept can help in mitigating the damage to some extent. Green roofs in city can provide sufficiently good quality habitats for several species including higher forms such as birds and reptiles. The creation of wild life habitat on building surface has long been recognized as one of the principle benefits of green roofs (Dunnett, 2006).

With rapid urbanization, urban population is expanding at a great pace and so is the urban landscape. Since space limitation and urban population density is to be balanced, the concept of green roofs become a necessity and an urge for town planners and architects to make provision for green roofs in the expanding concrete jungles. Emphasis should be given to more of the local flora than exotic ones on the rooftops so that the local and native faunal species can be protected and conserved with ease.

Extensive green roofs have been considered relatively species-poor alternative habitats for plants and animals, populated with highly mobile pioneer species and unsuitable as permanent habitats for ground dwelling organisms

(Buttschardt, 2005). Basically, extensive green roofs are a low management type of green roof that has substrate depth ranging from 3 to 8 inches. Due to the shallow substrate plants are typically low growing ground cover species that are extremely sun and drought tolerant (Brenneisen, 2006).

Most of the green roof studies have been conducted in temperate and sub-temperate conditions and the present study deals with exploration of green roof projection possibilities in sub-tropical climatic conditions.

Methodology:

The present study was conducted in Ujjain city (A sub tropical region under the Malwa plateau) of Madhya Pradesh. Maximum temperature in April and May ranges from 38°C to 44°C. The minimum temperature during December and January varies between 7° to 13°C. The historic city Ujjain is also famous as Tropic of Cancer passes through it. The city is situated at 23°18'N, and 75°78'E. Three man made extensive green roofs (50 m² area each; Photo-plate-1) were observed for five consecutive years (2016-2020), to record various life form nesting or visiting these sites. Photo-shots of various species / visitors were taken using Digital Camera SONY-DSX-HX9V and Cool Pix-P900 (Make Nikon) during different seasons throughout the study period. Pan traps were also used to sample the diversity and abundance of various faunal species.

Result and discussion:

Green roofs are a potential strategy for dealing with environmental challenges such as loss of available habitat for wild life (Oberndorfer et al., 2007). Rapid urban sprawl and intensive agricultural practices especially in developing countries like India is replacing considerable mounts of native habitats containing relatively high biodiversity. Green roofs can provide suitable habitat for foraging and/or nesting for a variety of insects (Colla et al., 2009). According to William et al., (2014) green roofs are novel eco systems that are increasingly common in urban cities and possess a significant value for conserving biodiversity. Even though the parks, residential gardens and street side vegetation act as buffer zones for conservation of local biodiversity, the role of urban interiors (limited open areas and vegetation) is of great value. They provide promising prospects for biodiversity conservation. Green roof might help achieve urban biodiversity conservation goals, but like successful ecological restoration projects these goals need to be realistic (Williams et al., 2014) since green roofs are isolated habitats, roof height, conditions on surrounding roofs and adjacent ground level land use may also influence the biological assemblages (Braaker et al., 2014).

The present study, even though a preliminary one supports the above view and provide evidence that green roofs in sub tropical climate and even in small yet rapidly expanding city like Ujjain can support a high variety of life forms (Table-1; Photo-plate-2). In all 51 faunal species were recorded during the study period which included 06 sp., of spider, 04 of moth, 07 of bees/wasps/flies, 08 of beetles/bugs, 03 of mentis, 04 of dragonflies, 10 of butterflies, 01 of reptile and 08 of birds. Interestingly in the year, 2020 that happened to be the year of pandemic outburst in India recorded comparatively more faunal species than other years. This observation supports the view that nature has its own course of rebuilding and balancing the ecological dynamics.

Environmentalists and ecologists need to ally with engineers, architects, builders and town planners to evaluate prospects of green roof biodiversity and help design green roofs based on ecological principles to maximize biodiversity gains.

Table-1: Biodiversity recorded at green roofs during the study period of five consecutive years (Study area Ujjain city, SW of Madhya Pradesh state, India)

Name of species	2016	2017	2018	2019	2020
Spiders					
<i>Hasarius</i> sp.	+	+	+	+	+
<i>Plexippus paykulli</i>	+	+	+	+	+
<i>Hasarius adansoni</i>	+	+	+	+	+
<i>Oxyopes salticus</i>	-	-	-	+	+
<i>Araneus</i> sp.	-	-	-	+	+
<i>Telamonia dimidiata</i>	-	-	+	+	+
Moths					
<i>Diaphania hyalinata</i>	+	+	+	+	+
<i>Maruca vitrata</i>	-	-	+	+	+
<i>Achaea janata</i>	-	-	-	+	+
Unknown	-	-	-	-	+
Bees/Wasp/Flies					
<i>Apis dorsata</i> (Rock bee)	+	+	+		+
<i>Apis florea</i> (Red dwarf Honey bee)	+	+	+	+	+
<i>Ropalidia marginata</i> (Paper Wasp)	-	-	+	+	+
<i>Sargus</i> sp (Soldier flies)	-	-	+	+	+
<i>Musa domestica</i> (Common Housefly)	+	+	+	+	+
<i>Eristalinus taeniops</i> (Brand eyed Drone fly)	-	-	+	+	+
<i>Cicadas</i> (Cicadoidea)	-	-	-	+	+
Beetles and Bugs (Hemipteris & Homoptera)					
<i>Aphis nerii</i>	+	+	-	-	-
<i>Pelidnota punctata</i>	+	+	+	+	+

<i>Attagenus unicolor</i>	+	+	+	+	+
<i>Gryllus campestris</i>	-	-	+	+	+
<i>Coccinella septempunctata</i>	-	-	+	+	+
<i>Dysdercus cingulatus</i>	-	-	+	+	+
<i>Attagenus unicolor</i>	-	-	-	+	+
<i>Spilostethus pandurus</i>	-	-	-	+	+
Mentis	-	-	-	-	-
<i>Mantodea</i> (Common Mantis)	+	-	-	-	+
<i>Aethalochroa insignis</i> (Indian Stick Mentis)	-	-	+	+	+
Unknown	-	-	-	-	+
Dragonfly					
<i>Pantala flavescens</i> (Wandering Glider)	+	+	+	-	-
<i>Ceriagreion sp.</i> (Marsh Dart)	-	-	+	+	+
<i>Rhyothemis variegata</i> (Variegated Flutterer)	-	-	-	+	+
Unknown	-	-	-	-	+
Butterflies					
<i>Hypolimnas misippus</i> (Danaid eggfly)	+	+	+	+	+
<i>Leptotes plinius</i> (Plumbago or Zebra Blue)	+	+	-	+	-
<i>Haplolimnas bolina</i> (Blue moon butterfly)	+	+	+	+	+
<i>Papilio demoleus</i> (Lime butterfly)	-	+	+	+	+
<i>Junonia lemonias</i> (Lemon Pansy)	-	+	+	+	+
<i>Junonia almana</i> (Peacock Pansy)	-	+	+	+	+
<i>Danaus chrysippus</i> (Plain Tiger)	-	+	+	+	+
<i>Catopsilia pomona</i> (Common emigrant)	-	+	+	+	+
<i>Eurema hecabe</i> (Commun grass yellow)	-	+	+	+	+
<i>Spindasis vulcanus</i> (common Silverline)	-	-	-	+	+
Reptiles					
<i>Calotes versicolor</i> (Oriental Garden Lizaed)	-	-	-	+	+
Birds					
<i>Copsychus saularis</i> (Oriental Magpie- Robin)	+	+	+	+	+
<i>Pycnonotus cafer</i> (Red- vented Bulbul)	-	+	+	+	+
<i>Cinnyris jugularis</i> (Olive-backed Sunbird)	-	+	+	+	+

<i>Cinnyris asiatica</i> (Purple Sunbird)	-	+	+	+	+
<i>Merops orientalis</i> (Asian green bee-eater)	-	-	+	+	+
<i>Megalaima haemacephala</i> (Coppersmith Barbet)	-	-	+	+	+
<i>Dicrurus macrocerus</i> (Black Drongo)	-	-	-	+	+
<i>Turdoides striata</i> (Jungle Babbler)	-	-	-	+	+

()- Common name ; + ---- Present ; - Absent



Photo Plate-1: Experimental green roof plot with mixed vegetation





Photo Plate-2: Faunal diversity recorded at green roof during the study period

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