ANNALS OF PLANT SCIENCES
ISSN: 2287-688X
OPEN ACCESS
www.annalsofplantsciences.com

ORIGINAL RESEARCH ARTICLE

Study of roadside weed diversity along the constructed and non constructed roads in Palghar, Maharashtra, India.

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Received: June 19, 2016; **Accepted:** June 27, 2016.

Abstract: The study aims to explore the floristic diversity of the weeds occurring along the roadside of the Palghar Tehsil by calculating various diversity indices of two distinctly identified sites, one being disturbed, constructed sites with high usage while other is relatively less disturbed mainly non-constructed sites and limited usage. The further purpose of the study was to draw conclusion in terms of floristic differences based on 3 indices viz. Shannon Weiner Index, Species Richness, Species evenness Index, Simpson's Index and Sorenson's Similarity Index. On comparison it was seen that the area that has limited usage has evenly distributed community and rich diversity as compared to another site. Diversity of the community occurring near non constructed road was found to be more as compared to the community occurring near constructed road.

Key words: Diversity index; weeds; constructed; non constructed roads; Palghar

Introduction

Development activities in various areas create direct or indirect impacts on the biodiversity. Although road development provides much needed connectivity; it continues to be a major player in the overall reduction of biodiversity. Habitat fragmentation, loss, corridor restriction directly affects the ecology. Introduction of invasive species through road verges, ecological disequibrilium and transmission of disease can be considered as a negative impact due to the new development. Sometimes roads may also cause a negative impact such as source of barrier for seed dispersion of many species (Angold, 1997). Therefore, to understand the differences in the species distribution; a study and comparison of these developed sites and relatively undeveloped sites is crucial as it possibly will provide the information about the status of biodiversity. Road verges are ecologically and environmentally unique areas that act as habitat for many species. The small marginal habitats in a landscape serve as important passage for movement of a species and support community structure of that area (Sara, 2006). Therefore, study of roadside vegetation has been proposed and accepted throughout the world (Wilson *et al.*, 1992).

Palghar Tehsil is a rapidly growing semi urban area, situated nearly 70 km away on the northern side of the Mumbai. The region as well as its surrounding towns is well connected internally with several roads being developed for residential complexes which are fast arising in this town. The proximity of this small town to an major metropolis is resulting in several construction activities, converting barren lands, agricultural plots and areas near ponds or lakes into industrial or residential units.

Ecological assessment of the road verges of constructed and non-constructed roads was done to study changing gradient of distribution and density of weeds along the road. Weeds are plants that are not sown purposely yet are one of important part of the ecosystem in which they are growing.

Materials and Methods

Study Site: Current study was carried out at 4 different areas *viz.* Saphale, Palghar, Boisar and Kelwe in the Palghar Tehsil (Figure 1). With an aim to understand the differences in the ground flora two types of sites *viz.* well-constructed roads (Primary and secondary) and non-constructed roads were identified in the above mentioned locations and

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http://dx.doi.org/10.21746/aps.2016.06.004

quadrants were laid in the month of September.

Figure 1: A map showing location of sampling sites

Sampling Methodology: In order to study the differences in the composition of ground flora, random sampling technique was used. A total of 20 list count quadrant of size 1m*1m were plotted at each site to understand weeds diversity.

Data Analysis: Various diversity indices were used to interpret the floral diversity in each quadrant. A single diversity index is insufficient to describe community structure of vegetation over a large range (Beisel *et al.*, 2003), hence four different indices were used to interpret the diversity along the surveyed roads. Species richness index (McIntosh, 1967) was used as it provides a quantitative, comparable measure for diversity of an area. Species evenness index was used because evenness of the vegetation community provides important information about diversity of an area (Hayat and Kudus, 2010). Therefore, species evenness index is considered as one of the important diversity indices. (Bibi and Ali 2013; Hill, 1973; Turchi *et al.*, 1995; Leinster and Cobbold, 2012). Shanon - Weiner index (Shanon and Weaver, 1949) is commonly used to compare diversity between various habitats. (Clarke and Warwick, 2001; Hutchinson, 1970). Simpson's index was used as it provides details about diversity and evenness of a community. Unlike Shanon - Weiner index this index is more sensitive towards evenness than richness. Therefore, it was used to compare the variations. Sorensen's similarity index is a statistical measure used for comparing the similarity of two samples (Sorensen, 1948). Sorenson's measure is regarded as one of the most effective presence/absence similarity measures (Sorensen, 1948; Wolda, 1981). The index is mainly used for identification of species composition in each of the two sites and the species shared between them (Novotny and Weiblen, 2005). The value of the index varies between 0 to 1. Zero indicates no similarity while 1 indicates maximum similarity. The indices were calculated using following formulae:

Relative frequency:
Relative frequency = Number of sampling units of occurrence / Total number of units sampled (Soodan and Kumar, 2006)

Relative density:
Relative density = Number of individuals in a quadrat / Total number of individuals of all the species (Soodan and Kumar, 2006)

Shannon Weiner index:
Shannon – Wiener index (H') = – $\sum Pi \log_n Pi$ (Shanon and Weaver, 1949)
Where Pi = Number of individual of one species / Total Number of all species

Species richness:
SR =log S (Krebs, C.J., 2013)
Where S = total number of species

Species evenness index:
Evenness Index = H'/ SR (Heip, Herman and Soetaert, 1998)
Where H'= Shannon – Wiener diversity index; SR = Species Richness

Simpson's Index of Diversity:
$\lambda = Ni (Ni - 1)/ N (N - 1)$ (Heip, Herman and Soetaert, 1998)
Where, λ = Simpson's diversity index, Ni = Number of individuals of species; N = total number of individuals of a community

Sorensen's Similarity Index:
Sorenson's Similarity index= 2C/a+b (Wolda, 1981)

Where, C= number of common species; a= number of species in community 1; b= number of species in community 2 .

Results and Discussion

Weeds Along Constructed Road:

A total of 41 different species of weeds belonging to 24 families were found along the constructed road. Members of families Boraginaceae, Cleomaceae, Lytheraceae, Menispermaceae, Oxalidaceae, Plantaginaceae and Portulacaceae were seen only along constructed road. To understand most frequent and denser species relative frequency and relative density was calculated. Graphical representation of top ten dominant species along constructed road is shown in figure 2 and figure 3. It was observed that *Impatiens balsamina* L. and *Celosia argentea* L. were most frequent species and showed high density in many quadrants. Impatiens *balsamina* L. was most frequent species with the relative frequency value as 0.0031 followed by *Celosia argentea* L. having relative frequency 0.0023. Third most frequent species with the relative frequency value 0.0021 was *Blumea lacera* (Burn.f.) DC. Four species *viz. Alternanthera sessilis* (L.) R.Br. ex DC., *Cassia tora* L., *Cyanotis cristata* (L.) D. Don. and *Vernonia cinerea* (L.) Less. showed equivalent relative frequency of 0.0018. *Euphorbia hirta* L. exhibited little low relative frequency of 0.0015 as compared to the four species *viz. Alternanthera sessilis* (L.) R.Br. ex DC., *Cassia tora* L., *Cyanotis cristata* (L.) D. Don. and *Vernonia cinerea* (L.) Less. *Achyranthes aspera* L. and *Aerva lanata* (L.) Juss. had lowest relative frequency value of 0.0013.

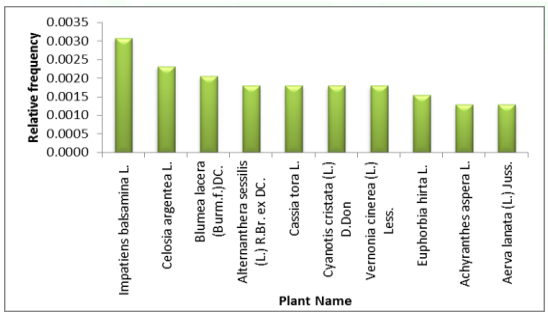

Figure 2: Relative frequency of most dominant weeds along constructed road

Denser species in terms of relative density was *Impatiens balsamina* L. (relative density 0.116) followed by Celosia *argentea* L. (relative density 0.077), *Phyllanthus niruri* L. (relative density 0.064), *Achyranthes aspera* L. (relative density 0.061), *Alternanthera sessilis* (L.) R.Br. ex DC. (relative density 0.061), *Blumea lacera* (Burm.f.) DC. (relative density 0.052), *Vernonia cinerea* (L.) Less. (relative density 0.049), *Cassia tora* L. (relative density 0.045) and *Tridax procumbens* (L.) L. (relative density 0.041). With the value of 0.033 *Cyanotis cristata* (L.) D. Don showed lowest density.

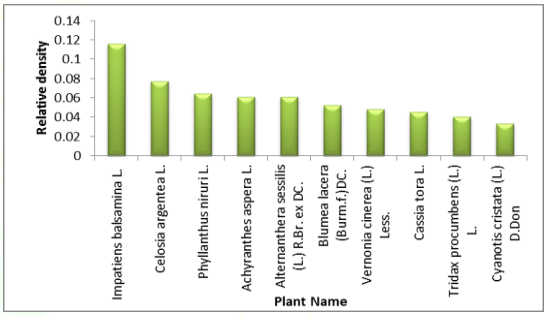

Figure 3: Relative density of most dominant weeds along constructed road

Weeds along non constructed road:

Along non constructed roads 57 species of weeds belonging to 20 families were seen. Members of family Araceae, Cyperaceae, Malvaceae, Onagraceae, Orobanchaceae, Sapindaceae, Zinziberceae and Colchicaceae were seen only along non constructed road. Figure 4 and figure 5 represents most dominant 10 species along non constructed road. It was seen that *Cassia tora* L. and *Tridax procumbens* (L.) L. are the most frequent species with the relative frequency values 0.036 and 0.032 respectively. These were followed by Boerhavia diffusa L. and Celosia argentea L. with the relative frequency value 0.029. 3 species *viz. Borreria articularis* (L.f.) F. N. Williams, *Curcuma pseudomontana* J. Graham and *Tephrosia purpurea* (L.) Pers. exhibited same relative frequency value of 0.025, while the lowest relative frequency in the dominant ten species was shown by *Impatiens balsamina* L., *Ludwigia perennis* L. and *Setaria viridis* (L.) P. Beauv. In terms of relative density *Tridax procumbens* (L.) L. was most dense species (relative density 0.077) occurring on the field followed by *Celosia argentea* L. (relative density 0.044), *Curcuma pseudomontana* J. Graham (relative

density 0.038), *Setaria viridis* (L.) P. Beauv. (relative density 0.035), *Cassia tora* L. (relative density 0.033), *Cyperus rotundus* L. (relative density 0.030), *Senecio bombayensis* N. P. Balakr. (relative density 0.030), *Desmodium triflorum* (L.) DC. (relative density 0.028), *Phyllanthus niruri* L. (relative density 0.028) and *Alternanthera sessilis* (L.) R.Br. ex DC. (relative density 0.027).

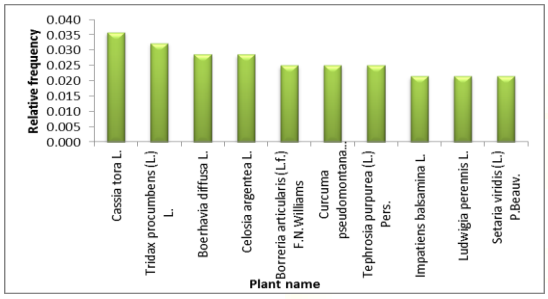

Figure 4: Relative frequency of most dominant weeds along non constructed road

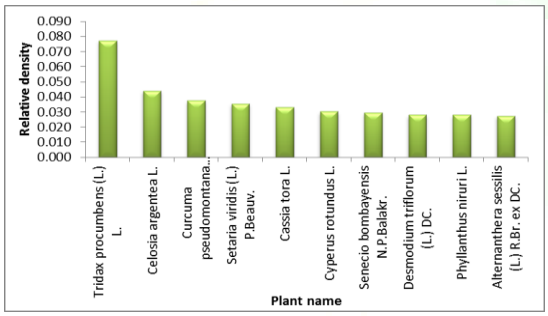

Figure 5: Relative density of most dominant weeds along non constructed road

Variation in diversity:

Figure 6 and 7 shows the variations in the diversity along the constructed and non constructed road. The Shannon Wiener Index and Simpson's Index clearly showed that at all four locations, diversity at roadside of a non constructed road was more as compared to the constructed road. The trend of species richness at various locations was different. At the Palghar, Boisar and Kelwe location higher values of species richness were recorded at constructed roadside as compared to non constructed road. At Saphale location species richness of non constructed roadside was high as compared to constructed roadside site. The value of Simpson's index varied as the species richness of the community varied at different locations. Species evenness values for various locations in all sampling sites showed slight deviation indicating absence of single species dominance.

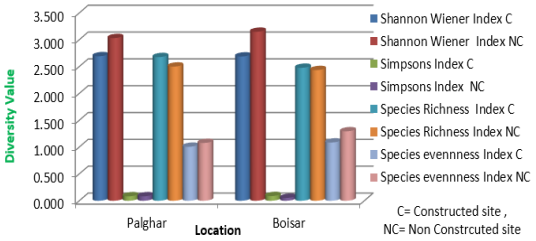

Figure 6: Presentation of calculated diversity values for species recorded at two locations viz. Palghar and Boisar

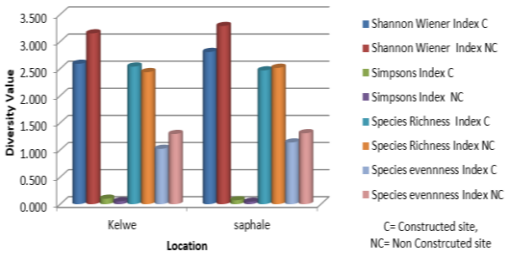

Figure 7: Presentation of calculated diversity values for species recorded at two locations viz. Kelwe and Saphale

Sorensen's similarity index was calculated for the two sites *viz.* occurring near roadside of a constructed road and occurring near roadside of a non-constructed road. The value was found to be 0.143 indicating minimal similarity between the two communities.

Table 1: Shannon Weiner, Simpson's, Species richness and evenness values recorded at constructed and non constructed sites of Palghar and Boisar

Diversity Index	Palghar		Boisar		Kelwe		Saphale	
	C	NC	C	NC	C	NC	C	NC
Shannon Wiener Index	2.692	3.031	2.688	3.149	2.588	3.149	2.806	3.285
Simpsons Index	0.082	0.082	0.087	0.053	0.100	0.053	0.072	0.044
Species Richness Index	2.677	2.500	2.477	2.435	2.537	2.435	2.467	2.513
Species evenness Index	1.006	1.077	1.085	1.293	1.020	1.293	1.137	1.307

C= Constructed site, NC= Non constructed site

Conclusion

Two types of weed community *viz.* occurring near roadside of a constructed road and occurring near roadside of a non-constructed road were selected for the current study with the aim to know the differences in their composition. The study revealed the fact that the composition of the ground flora is very much different at different sites. There were certain plants occurring in both communities but community structure of the population varied significantly. Although species richness of constructed roadside community was found more at 3 different locations; when considered in terms of evenness and types of species occurring at a particular site, it was found that diversity of the community occurring near non constructed road was found to be more as compared to the community occurring near constructed road. Palghar is a forthcoming suburb of Mumbai and is developing at a faster rate. Modifications in the landscape due to infrastructural changes may hamper the species richness in this area. This work is a data base that can be used in future for conserving the biodiversity and in achieving the sustainable development.

Acknowledgement

Authors are thankful to Dr. Farooqui, Principal, Rizvi College, Bandra for his unrelenting support and Mr. Siddesh Gajare for assistance on field.

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Cite this article as:
Nitesh Joshi, Prachiti Mule, Ambika Joshi. Study of roadside weed diversity along the constructed and non constructed roads in Palghar, Maharashtra, India. *Annals of Plant Sciences* 5.6 (2016): 1363-1367.
DOI:http://dx.doi.org/10.21746/aps.2016.06.004

Source of support: Nil
Conflict of interest: None Declared