STUDY ON ECOLOGICAL ASSESSMENT PARAMETERS FOR ATTARSUMBA RANGE, GANDHINAGAR FOREST DIVISION, GUJARAT, INDIA

Tanmay Singh, Ira Khan

ABSTRACT

The frequency, density and abundance are important ecological parameters for a species and indicate its status in respective plant community. The frequency indicates the homogeneity of dispersion of the individuals of a species in the community. Density is the number of individuals of a species in an area or volume. The density is determined by actual count for each species in the community. It is primarily a characteristic of the species population. Abundance of a species in the community represents its relative distribution in it. It is related to density but is a qualitative estimate. The object of the study was to know the frequency, density, abundance of different species occurring in the area and to study the behavior of a species when it occurs in association with other species. In Attarsumba range, most dense and frequent species is Acacia tortiles (Forsk) hyne. Acacia senegal Willd, Azadirechta indica A Juss, Zyziphus nummularia (Burm f) W & A and Dichrostachya cinerea (L) W & A are also frequent and dense species of this range and in good abundance in forest area.

Index Terms: *Gandhinagar Forest Division, Ecological Assessment, Frequency, Density, and Abundance etc.*

1. INTRODUCTION

Biodiverasity is fundamental to ecosystem functioning. Extrinsic or abiotic factor, such as climate and geophysical conditions, help to determine the boundaries of ecosystems (Colwell and Less 2000; Gaston 2000). The Frequency, density and abundance are important ecological parameters for a species. Frequency refers to the degree of dispersion of individual species in an area and is usually expressed in terms of present in a quadrate either placed randomly or in a desired pattern (Singh *et al*, 2002). It means how many time we come across the species when we visit a particular area. It also means in how much samples it occurs. If we lay random samples of equal size in the area and a species occurs everywhere it is said to be more frequent and *vice versa.* More frequency of a species, is an indication that species is able to capture more on the ground. It is able to use more type of habitats in the area as compared to other species. More frequency of a species shows that it is more successful in terms of survival over the other species. The study of frequency of different species in area may give an indication of cooperative distribution. It can indicate the species which are more widely spread over the area and also of the species that are favored over other in terms of spatial distribution by nature in an area. The species having high frequency of occurrence can be said to have high success in exploiting maximum kinds of habitats in an area (Anonymous 2007).

The density indicates number of plants per unit of area. The unit is normally hectare. If density of a species is high, it means that total number of its plants per hectare in an area is high. Abundance is the study of number of individuals or different species in a community per unit area (Singh *et al*, 2002). The abundance gives an idea of average of number of plants of a species per hectare in its area of occurrence only. It thus gives an idea of gregariousness of a species.

The object of the study was to know the frequency, density abundance of different tree species occurring in the area and to study the behavior of a species when it occurs with other species.

1.1 Distribution of the areas

The total forest area covered by this Division about 11263.31 ha, out of which 6390.11 ha is reserved forest, 44.92 ha is protected forests and the remaining 4828.28 ha forests, areas is yet to be setteled. The same forest area of 4828.28 ha has been notified under Section 4 of Indian Forest Act 1927 (Anonymous 2002).

The forest included under this division is distributed over 18 villages of Kapadvanj Talika in Kheda district and 5 villages of Dehgam Taluka in Gandhinagar distrct (Anonymous 2002).

Table – 1: The district and taluka wise distribution of forest area

District and Taluka	Geographical Area (ha)	Forest Area (ha)	Forest Area %
Gandhinagar (Villages-5)			

Dehgam	61,950 44.11% 30.24%	886.51 35.40%	1.43
Kheda (Villages-18)			
Kapadvanj	78,480 55.89% 69.76%	2,045.20 64.60%	2.61
Total (Villages-23)			
Total	1,40,430 100% 100%	2,931.71 100%	4.04

The range wise distribution of different categories of forest areas revealed that most of the forest in this range is in Sec-20 (Table 2) with maximum distribution in Attarsumba range (Anonymous 2002).

Table - 2: D**istribution of different categories of forest area in Attarsumba range**

Range	Forest Area (ha)			
	Sec-20	Sec-29	Under Sec-4	Total
Attarsumba Range				
Kapadvanj	2,000.3	44.92	-	2,045
Dehgam	886.5	-	-	886.5

1.2 The forests

According to the revised classification of forest type by Champion and Seth (1968), part of this forests falls under group 5 Ie Tropical Dry Deciduous Forests. The forests are mostly confined to hills and riverbank - ravines, where a variety of species occurs changing with edapho - climatic conditions.

2. MATERIALS AND METHOD

2.1 Material Used for field

Map of villages, Magnetic compass for confirming the directions, roadometer**,** Rope 20 m length for measuring length on the ground, Scale for reading distances on maps, drawing lines (eg base line, cruise lines on map), Format for data collection, various flora for plant identification (Shah, 1978; Cooke, 2006; Deshpande, 1993; Patel, 1984; Jasrai *et al*, 2010), Pen for writing**,** Pad for taking notes**,** Digital camera for Photography**.**

2.2 Material Used for data compailation

Laptop used for analysis of the data.

2.3 Methodology

For tree species survey:

In range, area of each village was sampled by strip enumeration methodology. 20 meter wide strips at right angle to base line were laid, which were across the forest till the boundary of the village. They were 200 meter apart. So total area covered was 10 %. The data for every 250 meter length in the strip was recorded separately in the format forms. Thus data was available for all 20 meter wide and 250 meter long strip section is for the village forest. We have considered these sections as quadrate of 20 meter x 250 meter size. They can be called as belt transects as they appear belt like in shape. Total number of such transects falling in a village were calculated from the enumeration exercises. The record of occurrence of different species in such quadrates was thus available for all sampled villages. Species wise occurrence and total number of plants were calculated for all quadrates, so as to find frequency of occurrence, density and the abundance of a species.

All tree and Shrub forms were analyzed. The data for % frequency and % density was also calculated for analyzed all tree and shrubs.

Formula used to calculate percentage frequency, density and abundance of tree species are as follow:

Number of quadrate in which

Frequency = species is present X 100

Total number of quadrate

Total number of trees in all

Density = quadrates

Area of one quadrate X Total number of quadrates

Total number of trees in all

Abundance = quadrates

Area of one quadrate X Total

Number of quadrates in which species occurred

(Area of one quadrate = 1 hectare)

% Frequency = Frequency of occurrence of a species X 100

Total frequency of all species

% Density = Density of species X 100

Total Density of all species

3. RESULTS AND DISCUSSION

3.1 Ecological assessment of trees

The frequency, density and abundance of species in Attarsumba range were calculated according to formula explained in the methodology. The % of frequency and the % density was also calculated for better understanding of the behavior of species in the area. To understand the species performance in the area according to their frequency, density and abundance, the data is presented in figures as

I. Abundance and density of most frequent species of tree forms

II. Abundance and frequency of tree species with highest density

III. Density and Frequency of most abundant tree forms (Fig.1)

Figures for frequency are high and density and abundance for all species are low in general in this range. Frequency of *Acacia tortiles* (Forsk) hyne is the highest followed by *Acacia senegal* willd, *Azadirechta indica* A Juss, *Zizyphus nummularia* (Burm f) and *Holoptelia integrifolia* (Roxb) P etc The frequency of *Acacia tortiles* (Forsk) hyne is also high with more density and abundance. All species which are present with high frequency have the density and abundance is low being (Fig.1).

In range 50 % of the places of occurrence are occupied by the following species (% of the places of occurrence for each species in the range are shown against the species) : *Phoenix sylvestris*, 32.98; *Acacia tortiles* (Forsk) hyne, 6.6; *Ficus hispida* L, 4.01; *Acacia senegal* Willd, 3.62; *Zizyphus nummularia* (Burm f), 3.39 and *Carissa congesta* Wt,3.36. The 50 % population in Attarsumba range is occupied by following species (% population of each species is shown against them) *Acacia tortiles* (Forsk) hyne, 19.28; *Zizyphus nummularia* (Burm f), 8.92; *Grewia flavescens* Juss, 8.19, *Capparis sepiaria* L, 6.54; *Dichrostachya cinerea* (L) W & A, 5.61 and *Holoptelia integrifolia* (Roxb) P, 4 respectively.

The forest shows a wide occurrence of thorny species like *Acacia tortiles, Acacia senegal* willd, *Dichrostachya cinerea* (L) W & A and *Zizyphus nummularia* (Burm f)*.*

Invasion by exotic grasses is concerning because they often increase fire frequency and egatively impact native vegetation (Torell et al. 1961; Hughes et al. 1991; D'Antonio and Vitousek 1992; Brooks et al. 2004; Milton 2004). The ability of T. caput-medusae to out-compete native vegetation and alter fire regimes to the detriment of native vegetation (Hironaka and Sindelar 1975; D'Antonio and Vitousek 1992; Davies and Svejcar 2008; Young and Mangold 2008) suggest the declines in native plants observed in this study were probably caused by increasing *Tillandsia caput-medusa* E Morren abundance.

In Tharawada-Gandher Reserve Forest of Kachchh, Gujarat, *Enicostema axillare* (13.17 %) was found to be the most frequent species of medicinal plant in the study Area. Another medicinal plant species with high relative frequency were *Cynodon dactylon* (P) Pers (10.97%), *Grewia tenex* (Forsk) Fiori (10.03%) *Commiphora wightii* (Arn) Bhandari (9.71%) and *Euphorbia caducifolia* Haines (6.58%). Among medicinal plant species, *Enicostema axillare* (Lam) A Raynal showed highest density (90000 individual/ha) followed by *Cynodon dactylon* P) Pers (82500 individual/ha) and *Achyranthes aspera* var. *argentea* (Lam) C B Clarke (62500 individual /ha). (Patel *et al*, 2013)
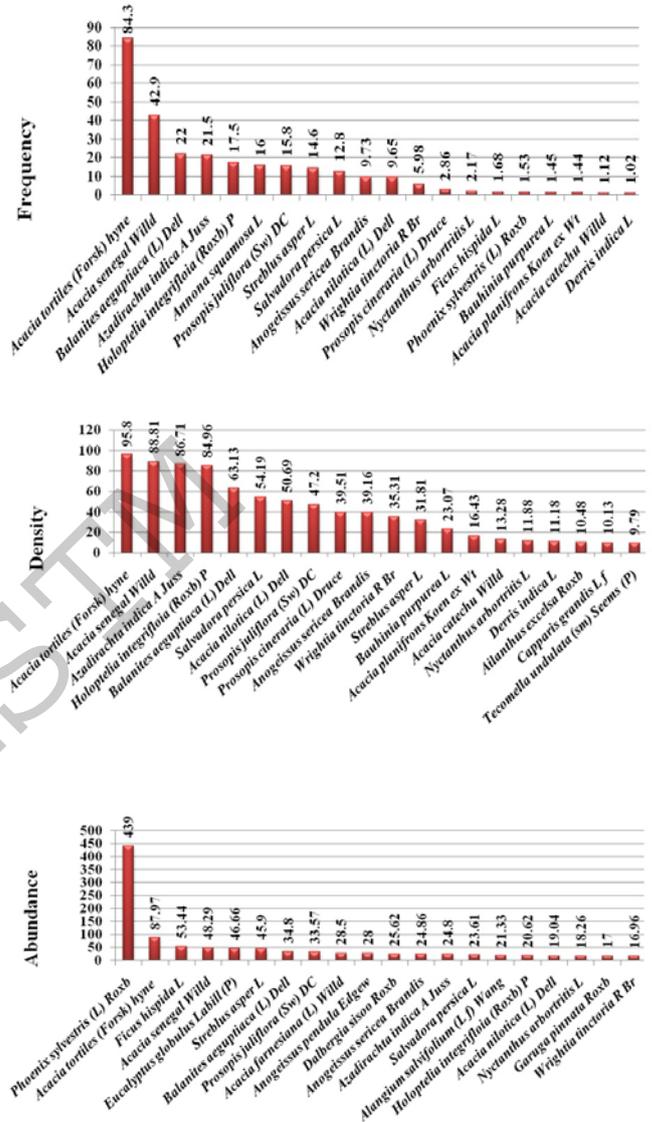
Species

Figure -1: A bulky amount Frequency, Density and Abundant Tree forms of Attarsumba range

In Gujarat, in minig forest, One of the parameters considered to select plant species was the slope gradient (Badrinath *et al,* 1994). Two shrubs (*Nyctanthus arbor-tristies* Linn and *Grewia abutilifolia* Vent ex Juss) and three grasses (*Setaria tomentosa* (Roxb) Kunth, *Themeda* sp. and *Dactyloctenium aegyptium* L) were found abundant on the slopes. (Diwakar *et al*, 2005)

Pilania et al, 2014 surveyed in Littale ran of Kachchh in western India, In herbs,Density wise *Suaeda nudiflora* was dominating followed by *Echinochloa colona* (L) Link, while *Commelina diffusa* Burm f and *Cyperus bulbosus* Vahl was found. Abundance of *Digera muricata* (L) Mart at site 2 and *Eragrostis ciliaris* (L) R Br at site 1 were more while minimum abundant species was *Commelina diffusa* Burm f. In tress, *Prosopis juliflora* (SW) DC was dominating followed by *Salvadora oleoides* Decne, while *Acacia nilotica* L was found to be recessive at study area. 100% frequency of any species was not obtained. Maximum 50% was found for *Prosopis juliflora* (SW) DC. Abundance of *Prosopis juliflora* (SW) DC at each site was maximum while minimum abundant species was *A.*

4. CONCLUSION

In present the study, at Attarsumba range, in GFD we found most frequnt and dense speceis was follwed by *Acacia tortiles* (Forsk) hyne and *Acacia senegal* Willd. Both species become invasive in Attrsumba range. We should control *Acacia tortiles* (Forsk) hyne and *Acacia senegal* Willd because these species were responsible for the degradation of other species in Attrsumba range. *Phoenix sylvestris* (L) Roxb was most abundace in Attarsumba range.

ACKNOWLEDGEMENTS

REFERENCES

[1] R. Agarwal, A. K.Verma and R. N. Tripathi, "Working Plan For The Forests Of Vadodara District (Chhotaudepur Division), Volume I – II." Government Press, Vadodara. 2003

[2] Anonymous, "Working Plan of Gandhinagar Forest Division." Working Plan Circle, Vadodara. 2002

[3] Anonymous, "Statuses of Forest cover in Gandhinagar Forest Division", GEER Foundation, Gandhinagar–382009. 2009

[4] V. J. Chacko, "A Manual on Sampling Techniques for Forest Surveys," The Survey of India, Dehradun. 1965

[5] T. Cooke, "Flora of the Presidency of Bombay Vol. I-II Reprint," Bishen Singh Mahendra Palsingh, Dehradun. 2006

[6] Deshpande *et al,* "Flora of Mahabaleshwar and Adjoining," Maharashtra, Vol I- II. Botanical Survey of India, Howrah. 1993

[7] A. Kumar, "Botany In Forestry And Environment, Kumar Media (P) Ltd.," Gandhinagar. 2001

[8] R. L.Patel, "Forest Flora of Gujarat State (2nd Edition)," Forest Department, Gujarat State, Baroda.1984

[9] G. L. Shah, "Flora of Gujarat State, Vol. I, II", S P University, Vallabhvidhyanagar, Gujarat. 1978

[10] A. P. Singh and K. Pushkar, "Life sciences, Upkar prakashan," Agra, pp.215-217

[11] H.S. Singh and B. H. Patel, "Biodiversity study in Ratanmahals wildlife sanctuary", GEER foundation, Gandhinagar, Gujarat. 2002

[12] K.P. Srivastava, "Academic's Dictionary of Botany", Academic (India) Publishers, New Delhi. 2003

[13] S. N. Tyagi, B. D. Oza and P.M. Joshi, "Forest Resource Survey Chhotaudepur Forest Division (Vadodara district), Series-3 (Ecological assessment)", Working Plan Circle, Vadodara, Forest Department, Gujarat State, 2007

[14] R. K. Colwell and D. C. Less, "the mid-domain effect: geometric constrain on the geography of species richness". Trends in Ecology and Evolution, 15: 70-76. 2000

[15] R. Patel, A. K. Roy Mahato, V. Vijay Kumar and R. V. Asari, "Status of the medicinal plants in Tharawada-Gandher Reserve Forest of Kachchh", Gujarat and the ethnomedicinal practices of local communityJournal of Pharmacognosy and Phytochemistry, Vol. 1 Issue. 4 2013 www.plantsjournal.com, Page | 4

[16] D. Sharma and S. F. Wesley "Sunderraj, Species selection for improving disturbed habitats in Western India", Current Science, vol. 88, no. 3, pp.462-467, 2005

[17] S. D. Badrinath, A. Chakraborty and S. Khan, "The impact of mining on the environment – problems and solution". Proc. Int. Symp., Oxford and IBH, New Delhi, pp.159–172, 1994

[18] P. K. Pilania, P.M. Vaghasiya, N.M. Panera, M.K. Mirani and N.S. Panchal, "Ecological study at morbi district near little rann of kachchh in western india" International Journal of Advanced Research, Volume 2, Issue 4, pp.5-13, 2014

[19] J. J. James, K.W. Davies, R. L. Sheley and Z. T. Aanderud, "Linking nitrogen partitioning and species abundance to invasion resis-tance in the Great Basin. Oecologia Vol. 156 pp.637–648, 2008

[20] K. Young, J. Mangold "Medusahead outperforms squirreltail through interference and growth rate", Invasive Plant Sci Manag 1:73–81, 2008

[21] P. J. Torell, L. C. Erickson and R. H. Haas RH, "The medusahead problem in Idaho". Weeds 9:124–131, 1961

[22] F. Hughes, P. M. Vitousek and T. Tunison "Alien grass invasion and fire in the seasonal submontane zone of Hawaii". Ecology 72:743–746, 1991

[23] C. M. D'Antonio, P. M. Vitousek "Biological invasions by exotic grasses, the grass/fire cycle, and global change". Annu Rev Ecol Syst 23:63–87, 1992