

Qualitative and quantitative estimation of rare and dominant tree species in an urban diversity setting of Vallabh Vidyanagar campus, Gujarat

by

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### Abstract

The estimation of rare and dominant species is important for many conservation strategies and priorities. The rank-abundance plot can be used to visualize species abundance distributions and thus helps in categorization of species. In this plot, the numbers of individuals of each species are arranged in descending order, and the proportion of the total number of individuals for each species is then plotted on the log scale against the species rank. The analysis of graph showed that the most dominant species found in the Vallabh Vidyanagar area of Gujarat are *Peltophorum pterocarpum* and *Azadirachta indica* sharing first and second rank in the plot followed by the rare and ecologically sensitive species shown in the extreme tail of the graph.

Key words: Abundance, Rank-abundance plot, Dominant and rare species

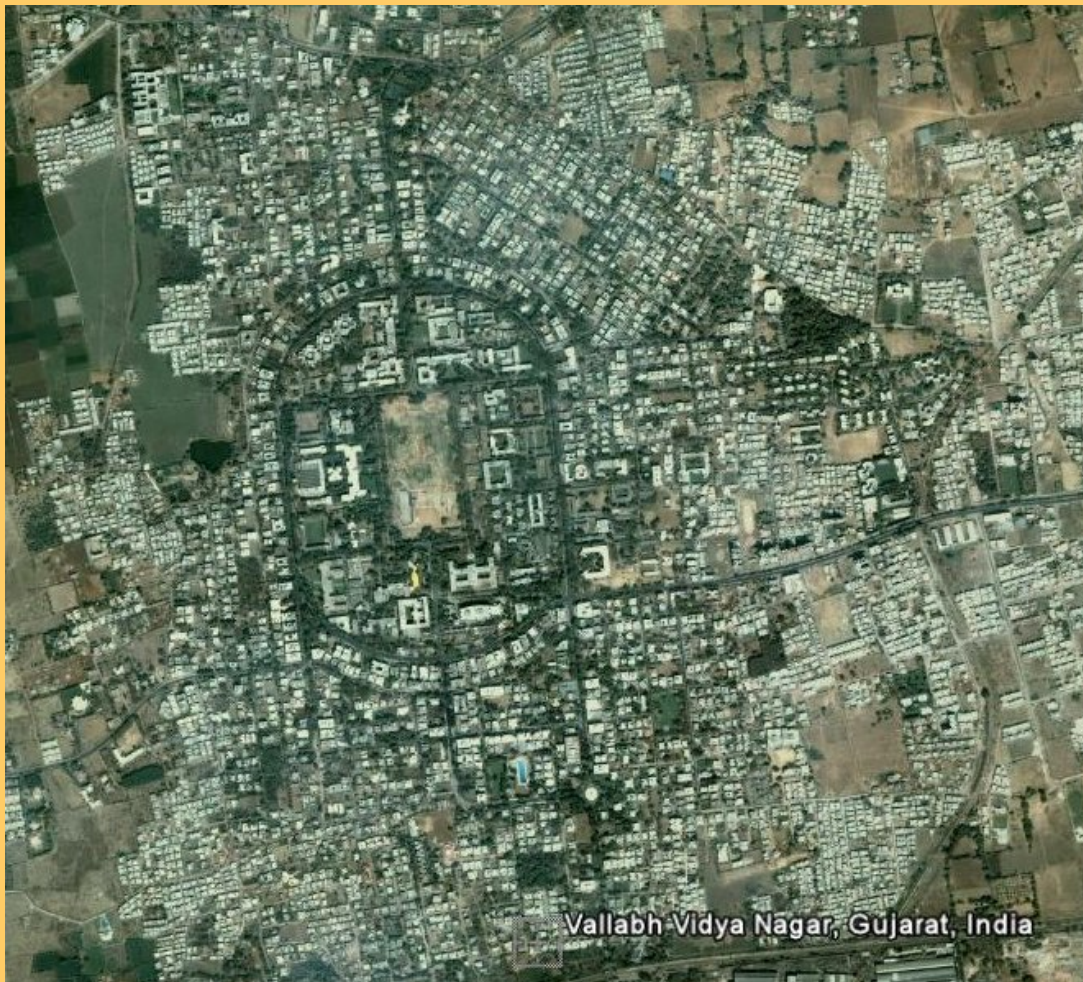
### Introduction

The concepts of evenness, diversity and dominance have been used traditionally regarded as basic parameter of community structure in interspecific competition. The analysis of species-abundance patterns within communities has a long and venerable history in ecology (McGill et al., 2007). Species diversity is studied by ecologists who are interested in understanding the mechanisms and effects of certain ecological

phenomena, such as pollution, environmental disturbances, etc. It is a function of the number of species present (i.e. species richness or number of species) and the evenness with which the individuals are distributed among these species (i.e. species evenness, species equitability, or abundance of each species) (Pielou 1969; Spellerberg 1991). The degree of overlap of the two distributions corresponds to species evenness whereas the degree of separation of the two distributions corresponds to species dominance. Thus, species dominance may be regarded as the complement of species evenness (or vice versa)(Camargo, 1995). Abundance-rank diagram is a simple approach to demonstrate the species number, species abundance and species diversity in an integrated manner (Bhatt and Sanjit, 2005). The shape of the rank/abundance plot can provide an indication of dominance or evenness. Steep plots signify assemblages with high dominance and shallower slopes indicate higher evenness (Magurran, 2003). Ecologists are encouraged to use rank abundance curves to visualize and analyze species abundance patterns (Nekola et al., 2008). The simple random sampling was more appropriate to estimate the total number of trees than the stratified random sampling in urban area (Alvarez et al., 2005).

### **Study area**

This study was conducted in Vallabh Vidyanagar town (central coordinate 72 55 05.64 E and 22 33 28.60 N) of Anand district in Gujarat state. It has an average elevation of 39 metres (127 feet). It is bounded by Kheda District to the north, Vadodara District to the east, Ahmedabad District to the west, and the Gulf of Cambay to the south.



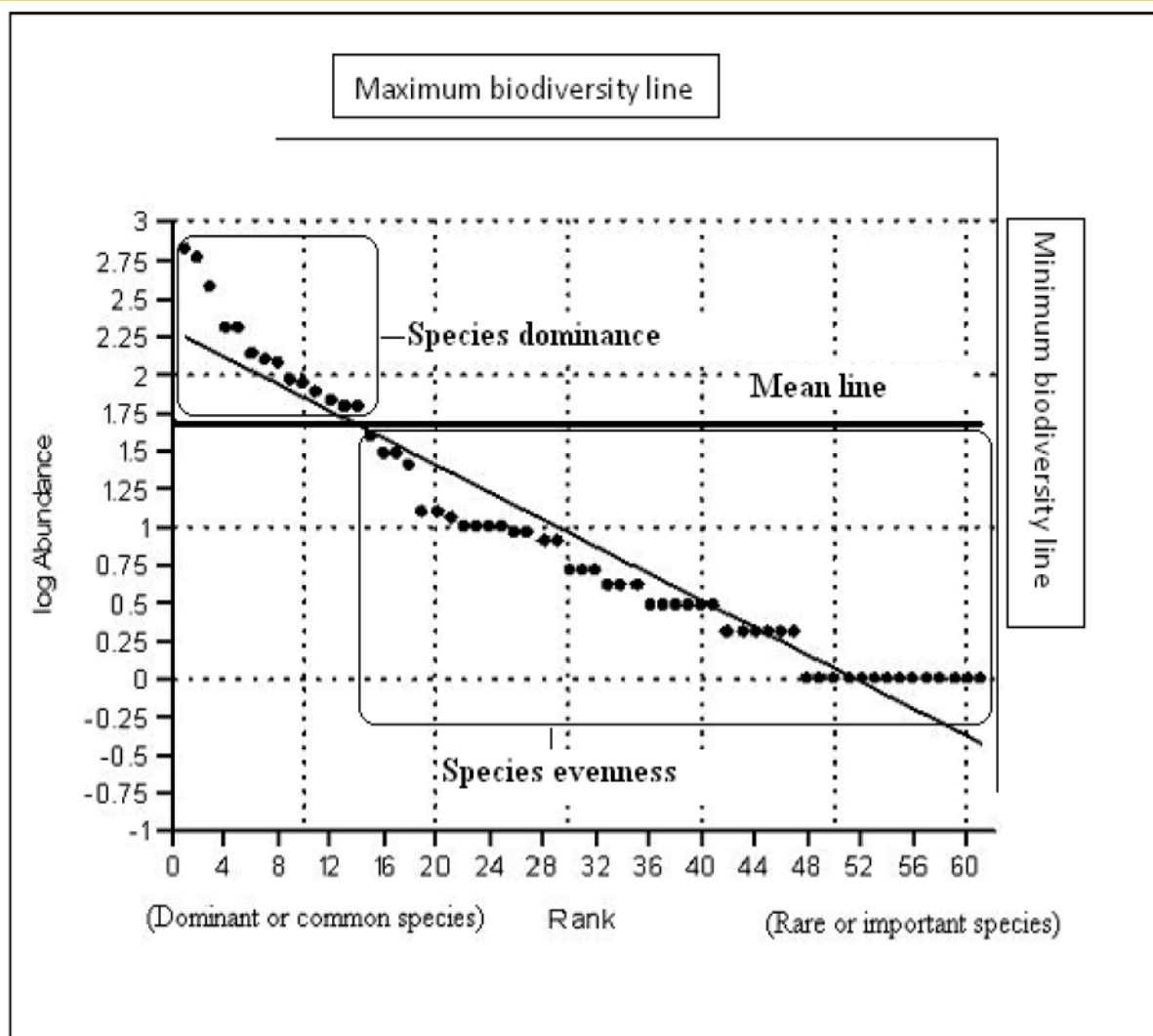
**Fig.1** Layout of the study area

### **Methodology**

The simple random sampling method was used to estimate the total number of trees in per kilometer sidewalk of the Vallabh Vidyanagar campus. Every tree with a diameter at breast height >20cm was identified and, its species were recorded. For a rank/abundance plot, the numbers of individuals of each species were sorted in descending order and the proportion of the total number of individuals for each species was then plotted on the log scale against the species rank. A total of 61 species was recorded in the campus with 1061 individuals, planted by the local bodies, institutes and trusts.

## **Result & Discussion**

The species rank abundance plot is a line diagram, where y-axis represents number of individuals and the x-axis represents species rank. Species ranks are based on the number of individuals for each species. The species that has the largest number of individuals is ranked first and the species that has the least number of individuals is ranked last. The slope of resultant best fit line in the plot represents species diversity qualitatively which is used to compare the two hypothetical species diversity lines (maximum diversity line and minimum diversity line). Thus, the change in slope of the best fit line decides the biodiversity status of the area. If y-intercept is kept constant, higher slope would imply less biodiversity as it would show its affinity towards the minimum diversity line and vice versa would be the case for maximum diversity line. In the present study, the outcome of the sampling of each species was expected to be 51 ( $\log_{10}51=1.70$ ) but the observed value showed a large deviation from the expected value, resulting in formation of two categories i.e. species dominance and species evenness. The graph of the study area shows that maximum species come under species evenness category shown in the larger box in the plot and smaller box shows species dominance category. This indicates a high biodiversity in the region. The intermediary species may have to strive in near future and come under rare or dominant category depending upon the prevailing ecological conditions. The species abundance curve shows the presence of 14 rare species that have less than two individuals in the study area and the dominance is shown by few abundant species that may act as an ecological indicator of the city changing ecosystem. Rare and ecologically sensitive species found in the region are shown in the extreme tail of the graph. These species share the lower ranks in the plot because of their equality in existence in the area (fig.2). The detail of all species with their rank and category is shown in Annexure I.



**Fig.2 Log-abundance species rank plot for the various tree species**

## Conclusion

The rank abundance plot can be considered as a promising approach for estimation of rare and dominant species and extended to the natural ecosystems where conservation of rare species should be given a priority as they are more vulnerable to extinction. This technique would be helpful in maintaining the diversity and balance of the ecosystem even in the urban campus where it can be used to quantify the planted species.

## Acknowledgement

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## References

- Bhatt D. and Sanjit L. 2005. How relevant are the concepts of species diversity and species richness. *Journal of Biosciences* 30. 5: 557–560
- Camargo J. A. 1995. Measuring species evenness and other associated parameters of community structure. *Oikos*, 74, 3: 538-542

Ivan A. A., Giuliana D. V., Henrique S. B., Ana M. L., and Hilton T. Z. 2005. Comparison of two sampling methods for estimating urban tree density. *Journal of Arboriculture*. 31. 5: 209-214

Magurran, A.E. 2003. *Measuring biological diversity*. Blackwell, Oxford.

McGill B.J., Etienne R.S., Gray J.S., Alonso A., Anderson M.J., Benecha H.K., Enquist B.J., Green J.L., He F., Hurlbert A.H., Magurran A.E., Marquet P.A., Maurer B.A., Ostling A., Soykan C.U., Ugland K.I., White E.P. 2007. Species abundance distributions: moving beyond single prediction theories to integration within an ecological framework. *Ecological Letter* 10: 995–1015

Nekola J. C., Sizing A. L., Boyer A. G., Storch D. 2008. Artifacts in the log-transformation of species abundance distributions. *Folia Geobotany* 43: 259–268

Pielou, E.C. 1969. *An introduction to mathematical ecology*. Wiley, New York.

Spellerberg I. F. 1991. *Monitoring ecological change* (Cambridge: Cambridge University Press).

#### Annexure I

| RANK | SCIENTIFIC NAME                | FAMILY          | COMMON NAME                  | CATEGORY |
|------|--------------------------------|-----------------|------------------------------|----------|
| 1    | <i>Peltophorum pterocarpum</i> | Caesalpiniaceae | Golden flame                 | D        |
| 2    | <i>Azadirachta indica</i>      | Meliaceae       | Morgosa tree, Neem           | D        |
| 3    | <i>Kigelia pinnata</i>         | Bignoniaceae    | Sausage Tree, Balam khira    | D        |
| 4    | <i>Mimusops elengi</i>         | Sapotaceae      | Bullet wood, Maulser         | D        |
| 5    | <i>Cassia siamea</i>           | Caesalpiniaceae | Kassod                       | D        |
| 6    | <i>Cassia roxburghii</i>       | Caesalpiniaceae | Red cassia                   | D        |
| 7    | <i>Samanea saman</i>           | Mimosaceae      | Rain Tree                    | D        |
| 8    | <i>Cassia fistula</i>          | Caesalpiniaceae | Golden Shower, Amaltus       | D        |
| 9    | <i>Pongamia pinnata</i>        | Fabaceae        | Indian Beech, Panigrahi      | D        |
| 10   | <i>Albizia lebbek</i>          | Fabaceae        | Siris tree, Saras            | D        |
| 11   | <i>Mangifera indica</i>        | Anacardiaceae   | Mango                        | D        |
| 12   | <i>Delonix regia</i>           | Fabaceae        | flame tree, Flamboyant       | D        |
| 13   | <i>Parkia biglandulosa</i>     | Fabaceae        | Badminton Ball Tree          | D        |
| 14   | <i>Ficus bengalensis</i>       | Moraceae        | Banyan tree, Barh            | D        |
| 15   | <i>Callistemon lanceolatus</i> | Myrtaceae       | Bottle brush                 | ID       |
| 16   | <i>Ceiba pentandra</i>         | Bombacaceae     | Kapok tree, silk cotton tree | ID       |
| 17   | <i>Polyalthia longifolia</i>   | Anonaceae       | Ashok                        | ID       |
| 18   | <i>Alstonia scholaris</i>      | Apocynaceae     | Milky pine, Dita             | ID       |
| 19   | <i>Dalbergia sissoo</i>        | Fabaceae        | Indian Rosewood, Shisham     | ID       |
| 20   | <i>Ficus racemosa</i>          | Moraceae        | Indian Fig                   | ID       |
| 21   | <i>Ficus glomerata</i>         | Moraceae        | Cluster fig tree; Gular      | ID       |
| 22   | <i>Aegle marmelos</i>          | Rutaceae        | Wood Apple, Bael             | ID       |
| 23   | <i>Prosopis cineraria</i>      | Fabaceae        | Khejri ,Jhand                | ID       |
| 24   | <i>Streblus asper</i>          | Moraceae        | Tooth Brush Tree             | ID       |
| 25   | <i>Syzygium cumini</i>         | Myrtaceae       | Black Plum, Jaman            | ID       |

|    |                                |                 |                                   |    |
|----|--------------------------------|-----------------|-----------------------------------|----|
| 26 | <i>Ficus religiosa</i>         | Moraceae        | Bodhi Tree, Peepal Tree           | ID |
| 27 | <i>Melia azedarach</i>         | Meliaceae       | Chinaberry tree, pride of India   | ID |
| 28 | <i>Bauhinia purpurea</i>       | Caesalpiniaceae | Mountain Ebony, Kachnar           | ID |
| 29 | <i>Gliricidia sepium</i>       | Fabaceae        | Mother of cocoa, Quickstick       | ID |
| 30 | <i>Cordia dichotoma</i>        | Boraginaceae    | Bird Lime Tree, Indian cherry     | ID |
| 31 | <i>Millingtonia hortensis</i>  | Bignoniaceae    | Indian cork tree, Akash neem      | ID |
| 32 | <i>Plumeria rubra</i>          | Apocynaceae     | Nosegay, Frangipani               | ID |
| 33 | <i>Acacia nilotica</i>         | Fabaceae        | Gum Arabic, Babul                 | ID |
| 34 | <i>Morus alba</i>              | Moraceae        | White Mulberry                    | ID |
| 35 | <i>Pithecellobium dulce</i>    | Fabaceae        | Manila Tamarind, Monkey Pod       | ID |
| 36 | <i>Erythrina variegata</i>     | Fabaceae        | Indian Coral Tree, Tiger claw     | ID |
| 37 | <i>Holoptelea integrifolia</i> | Ulmaceae        | Monkey Biscuit Tree, Indian Elm   | ID |
| 38 | <i>Leucaena leucocephala</i>   | Fabaceae        | White leadtree                    | ID |
| 39 | <i>Sapindus laurifolia</i>     | Sapindaceae     | Soapnut, Reetha                   | ID |
| 40 | <i>Spathodea campanulata</i>   | Bignoniaceae    | African Tulip Tree, Fountain Tree | ID |
| 41 | <i>Tabebuia rosea</i>          | Bignoniaceae    | Pink trumpet tree, Pink Poui      | ID |
| 42 | <i>Cordia sebestena</i>        | Boraginaceae    | Cordia, Geiger tree               | ID |
| 43 | <i>Eucalyptus citriodora</i>   | Myrtaceae       | Lemon scented gum                 | ID |
| 44 | <i>Manilkara hexandra</i>      | Sapotaceae      | Ceylon Iron Wood, Milk tree       | ID |
| 45 | <i>Roystonea regia</i>         | Arecaceae       | Royal palm                        | ID |
| 46 | <i>Tectona grandis</i>         | Verbenaceae     | Teak                              | ID |
| 47 | <i>Terminalia Arjuna</i>       | Combretaceae    | Arjuna                            | ID |
| 48 | <i>Ailanthus excelsa</i>       | Simaroubaceae   | Maharukh                          | R  |
| 49 | <i>Anogeissus sericea</i>      | Combretaceae    | Androk                            | R  |
| 50 | <i>Casuarina equisetifolia</i> | Casuarinaceae   | Whistling Pine                    | R  |
| 51 | <i>Crescentia alata</i>        | Bignoniaceae    | Gourd Tree, Kamandal Tree         | R  |
| 52 | <i>Drypetes roxburghii</i>     | Euphorbiaceae   | Putranjiva, Lucky Bean Tree       | R  |
| 53 | <i>Emblica officinalis</i>     | Euphorbiaceae   | Amla, Indian Gooseberry           | R  |
| 54 | <i>Ficus elastica</i>          | Moraceae        | Rubber tree                       | R  |
| 55 | <i>Gmelina arborea</i>         | Verbenaceae     | Gamhar, White Teak                | R  |
| 56 | <i>Gravellia robusta</i>       | Proteaceae      | Silver Oak                        | R  |
| 57 | <i>Jacaranda mimosifolia</i>   | Bignoniaceae    | Jacaranda, Black poui             | R  |
| 58 | <i>Mitragyna parvifolia</i>    | Rubiaceae       | Kaim, Keli-Kadam                  | R  |
| 59 | <i>Polyanthia angustifolia</i> | Anonaceae       | Dwarf mast tree                   | R  |

|  |                    |               |                  |   |
|--|--------------------|---------------|------------------|---|
| 60   | Tamarindus indica  | Caesalpiaceae | Imli             | R |
| 61   | Zizipus mauritiana | Rhamnaceae    | Indian plum, Ber | R |
| D=DOMINANT; ID= INTERMEDIARY DOMINANT; R= RARE |                    |               |                  |   |

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