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APPLICATION OF BIOINFORMATICS IN THE STUDY OF DIVERSITY OF THE TREE SPECIES IN MELGHAT SANCTUARY, MELGHAT TIGER RESERVE, MAHARASHTRA

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ABSTRACT

Biodiversity stands for all living things on earth. It refers to the range of variations among a set of entities and is commonly used to describe the variety and variability of living organisms in terms of genetic diversity, species diversity and ecological diversity. In the present study, bioinformatics tools were used in the study of morphodiversity of trees using photographic collection of plants specimens along with their descriptions. The study on 1016 compartment dealt with the data collection for Vegetation-Spot potential through Google maps photographic monitoring method to evaluate the potentially important data in identification of forest land. Specimen Browser System: SBS was applied as a tool for accessing botanical specimen collections and this information was used in linking sources and destinations. It was an opportunity to apply technology that would enable us to unlock the wealth of biodiversity information that existed in the forest of Melghat.

Key Words: Biodiversity, Morphdiversity, MTR, Bioinformatics**,** Vegetation Monitoring Plot, WWW

INTRODUCTION

Biodiversity stands for all living things on earth. It refers to the range of variations among a set of entities and is commonly used to describe variety and variability of living organisms in terms of genetic diversity, species diversity and ecological diversity. In simple terms, Biodiversity is the vast variety of natural plant and animal life existing in any region. The biodiversity is usually studied now by taxonomist who takes great pains in collecting, identifying, documenting and describing the elements of diversity. Present study was based on data recording, field survey and collection of specimens. It was seen that at ground level, tree density was quite good, while tree population was sparse with low vegetation growth at upper middle area of the hills where the vegetation was exposed directly to the sunlight. The area of compartment 1016, research plot was having both type of areas i.e. disturbed and undisturbed. Some part of the compartment was close to core area and rest was under buffer zone. Distribution of the trees species and their diversity appeared to be strongly related to environmental factors. Study of about 40 trees species was completed by collecting all the required information available with respect to morphodiversity. The tools for accessing botanical specimen collections which was allowing the rapid input of specimens with dynamic zooming facility. Aerial digital satellite maps provided accurate and real picture of geographical distribution of the compartment 1016 so as to expose this hidden area to the world peoples. The map clearly indicated that this area was located under Central Forest Land Area situated in Satpura hills of India which was meeting place of ghats, which divided MTR in well defined northern and southern parts. The

compartment was digitally mapped along with its original form. It showed overall picture of forest, recognizing fields under cultivation, water resources, river, dam, stream, rocky land, open area, dense forest, core area of forest and forest fire affected locations.

Review of Literature

Wattenberg and Breckle (1995) studied tree species diversity of a premontane rain forest in the Cordillera De Tilaran, Costa Rica. The study plot consisted of 25 squares of 20×20 m, located at an altitude of about 1000 m. Dominance and abundance of tree species was critically discussed. About 94 species of trees (DBH≥ 10 cm) from 40 families of Angiosperms were recorded. The canopy of the study-plot reached a height of 40m. Valencia *et al.,* (2004) mapped and studied tree species distributions and local habitat variation in the Amazon. The largest number of species was mid –sized canopy trees with maximum height 10-20m and under strorey treelets with maximum height of 5-10m. Total diversity was 1104 species, including 11 previously undescribed species, of which four were Lauraceae and two Burseraceae. Linares-Palomino (2005) studied spatial distribution patterns of tees in a seasonally dry forest in the Cerros de Amotape National Park, northwestern Peru in six one hectare plots. Aim of the paper was to examine the spatial structure of characteristic tree species of a seasonally dry forest and to discuss the results in the light of the biological and anthropogenic factors that could produce them. *Eriotheca ruizii* (K. Schum.) A. Robyns (Bombacaceae), *Bursera graveolens* (Kunth) Triana & Planch. (Burseraceae), *Caeslpinia glabrata* Kunth (Leguminoase) and *Cochlospermum vitifolium* (Willd.) Spreng. (Cochlospermaceae), were largely present in dry forest. Musavi *et al.,* (2006) worked on mapping of biotic pressure and its impact on prey densities in Melghat Tiger Reserve, Maharashtra. The Melghat Tiger Reserve in Maharashtra was under immense biotic pressure from villages both within and adjacent to it. Distribution of pressure from 10 major biotic parameters on the forests of MTR was assessed and mapped. Combined biotic pressure from grazing, fuelwood collection, looping and illicit felling of trees and grass cutting affected 75% of compartments of MTR. Kharwal *et al.,* (2007) studied distribution characteristics of the tree species in central Himalaya, India. Lauraceae represented the highest number of plants species (13 species) followed by Euphorbiaceae (12 species) and Moraceae (10 species) in evergreen plant forms. With contrast to this, the maximum numbers of plant species in dry deciduous tree were Anacardiaceae (9 species) followed by Juglandaceae, Morigeaceae (8 species each) and Sapindaceae (6 species). Chao *et al.,* (2007) evaluated the spatial distribution patterns of trees in a lowland rainforest in the 5.88 ha Lanjenchi plot of the southernmost Taiwan. Among the 88 species with more than 15 individuals, 87.5% had an aggregated distribution pattern, and 9.1% species were randomly distributed.

MATERIALS & METHODS

Compartment 1016, research plot

The study area, compartment 1016, research plot, Melghat Sanctuary, Melghat Tiger Reserve Maharashtra located under East Dhargad Circle and is situated in between Gullarghat village and the Narnala Fort.

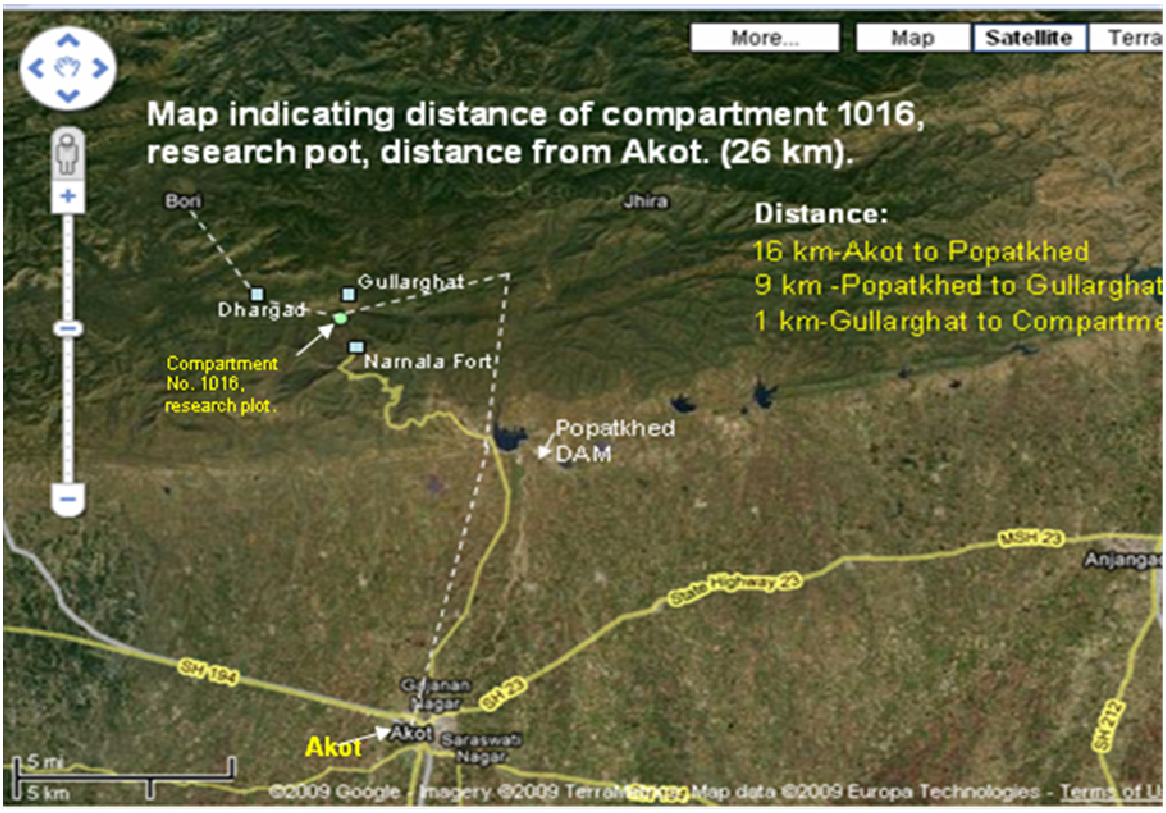

Figure: 1.1

Position of Compartment of 1016, Melghat sanctuary, Melghat Tiger Reserve, Maharashtra, India

There are total 715 compartments or vegetation monitoring plots (VMP) in MTR. These plots have been monitored and observed, periodically. The East Dharghad Circle is consisting of 18 plots and compartment 1016, research plot is one of them. The compartment has occupied 7.03 hectare area. It comes under survey number 29, 30, 38. There is a presence of small water stream in the area of compartment. The compartment is spread in North and South direction. Some part of the compartment and research plot is having hilly, slopes and water stream at basal area. In the present study, 100×100m plot was designed. The vegetation cover was studied, plants counted, and species enlisted. Accurate data of tree size and number was prepared. The compartment 1016 was having both types of areas i.e. undisturbed and the disturbed. They were studied for the occurrence of tree vegetation.

OBSERVATIONS & RESULTS

Survey and collection Compartment 1016, research plot

The current research study deals with the survey and distribution of trees species of compartment 1016 research plot, Melghat Tiger Reserve. With the support of forest staff of East Dharghad Circle, a field survey was carried out. During this survey, Melghat Sanctuary was found to be a suitable area for study. The compartment was situated in between Gullarghat village and Narnala Fort. The research plot was located on 30 minutes walking distance towards south of Gullarghat village. The research plot was showing maximum variability in vegetation type and topography. The distribution of the tree species in compartment 1016 in general and research plot (100×100m) in particular were studied. The northern side of research plot (100×100m) was hilly with a steep slope towards southern direction, where slope ended, at the ground level water stream was flowing from East

to West direction with good vegetation at both the sides of the stream. This forest was of dry mixed deciduous type hence there was always fear of forest firing in summer. The number of trees showed a leaf fall during summer season and many of them had timber value. It was observed that the Teak (*Tectona grandis* Linn.) was the predominant species of the forest area. Present study was based on data recording, field survey and collection of specimens. It was seen that at ground level, tree density was quite good, while tree population was sparse with low vegetation growth at upper middle area of the hills where the vegetation was exposed directly to the sunlight. The area of compartment 1016, research plot was having both type of areas i.e. disturbed and undisturbed. Some part of the compartment was close to core area and rest was under buffer zone. Distribution of the trees species and their diversity appeared to be strongly related to environmental factors. Study of about 40 trees species was completed by collecting all the required information available with respect to morphodiversity, e.g. specimen sample collection, photographs, description, illustrations, height and girth data and bark features.

Morphodiversity of Trees

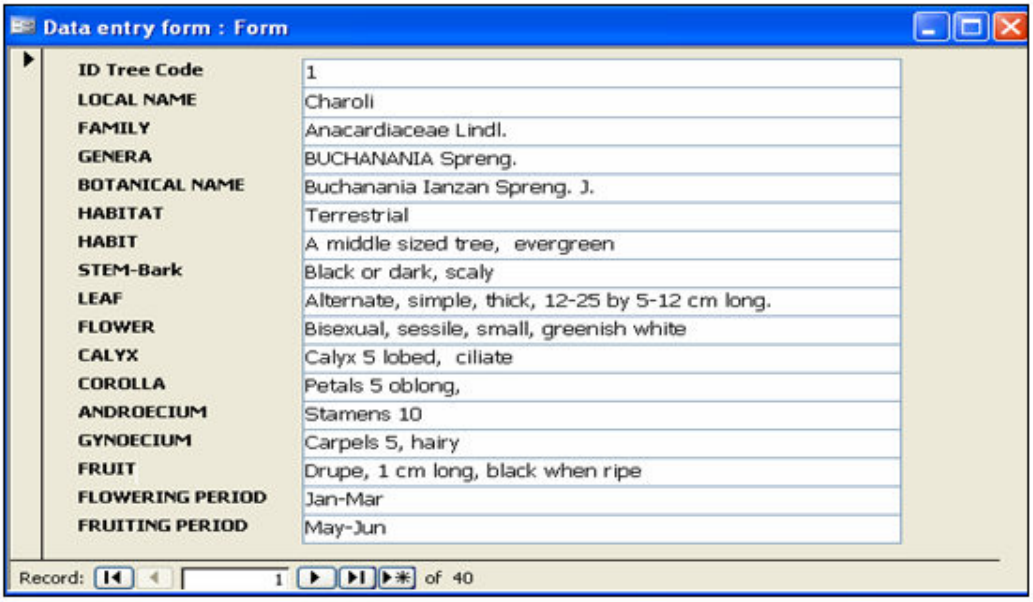

Figure. 1.2
Plant Description of Buchanania Ianzan Spreng. J.

Figure: 1.3
Compartment 1016, Research plot, (100×100m) MTR

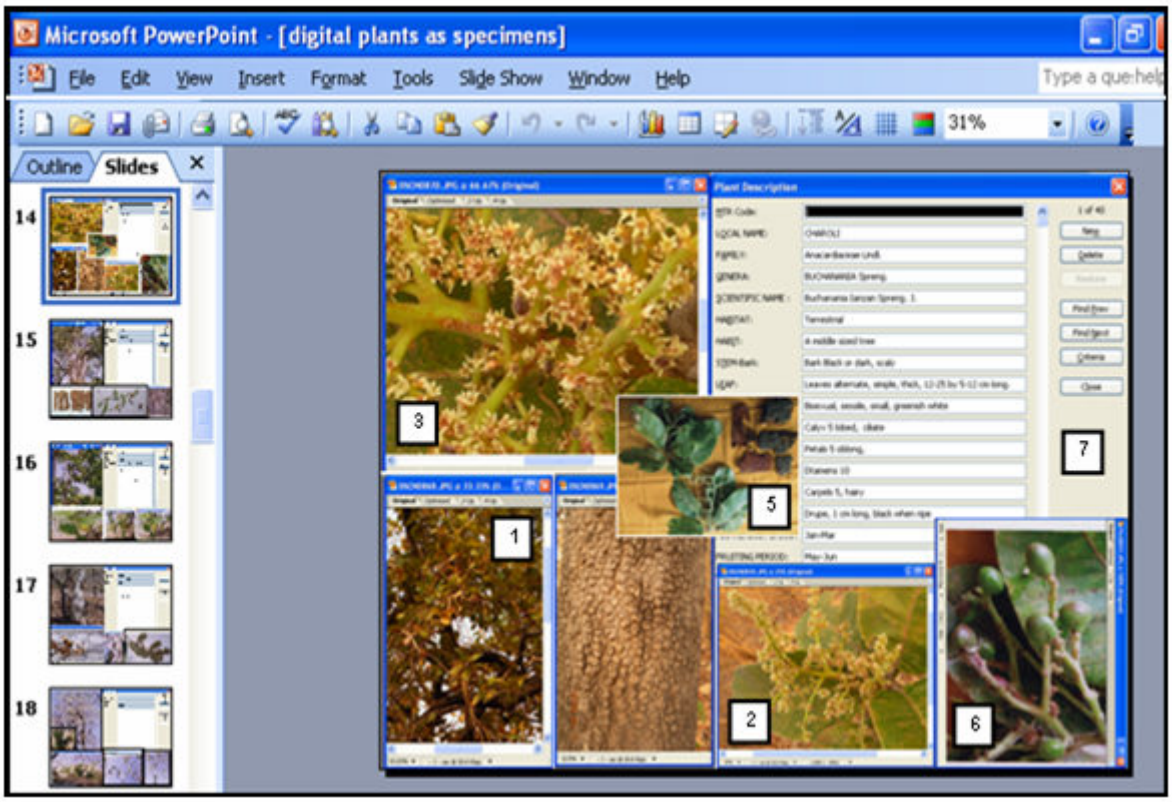

Figure. 1.4
Specimen images of Buchanania Ianzan Spreng. J.

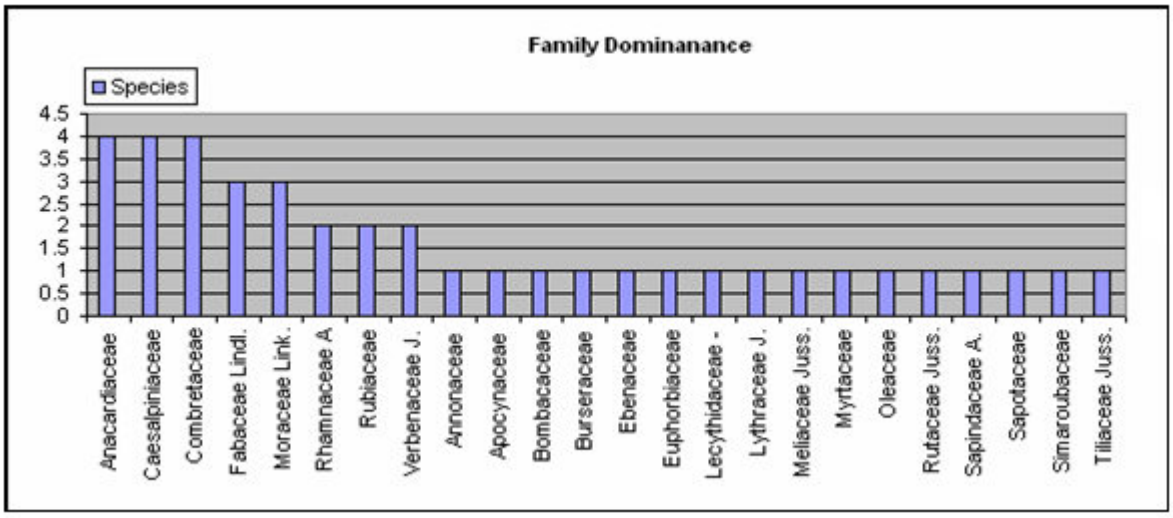

Figure. 1.5
Family Dominance Chart of Compartment 1016

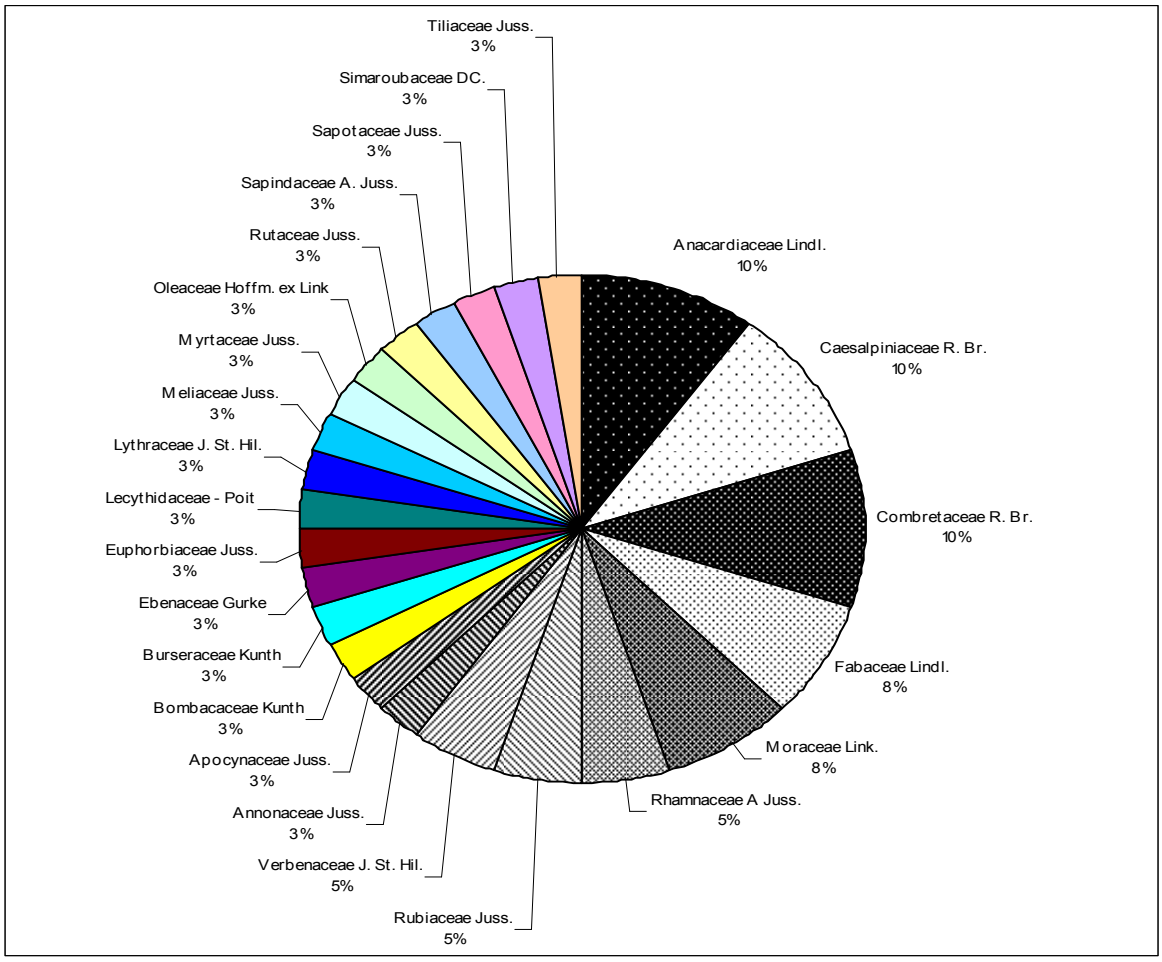

Figure. 1.6
Family Dominance with species percentage

DISCUSSION

Survey and Collection

Like other dry deciduous forest conditions, the current research study with the survey of the area of the compartment 1016, research field along with the distribution of trees species was carried out during study period. The research compartment was a part of East Dharghad Circle of Melghat forest which was under strong forest cover; however dense patches of vegetation predominately occurred throughout the forest; trees showed heavy leaf fall during summer season and exhibits dry deciduous forest conditions. The distribution of the trees species and their diversity appeared to be strongly related with environmental factors. Patel (1968) wrote "Forest Flora of Melghat;" the forests of Melghat are mostly of the dry mixed deciduous type wherein the Teak (*Tectona grandis* Linn.) was the predominant species. The vegetation varied considerably with the change in altitude, aspect and rain fall. As these factors were very variable, even within the limits of compartments averaging about 2.5 sq km. several sub-types usually merge gradually into one another but occasionally were sharply defined where there was a sudden change in aspect or altitude. Earlier Dhore and Joshi (1988) wrote "The Flora of Melghat Tiger Reserve". The forest of Melghat as they experienced, was of dry deciduous type, where teak was the dominant tree species widely spread throughout the forest.

Pant (2003) has carried out ecological analysis of the Satpura conservation area landscape

through stratified field sampling and Remotely Sensed data. Diversity of plant species tend to decrease in old growth stands, steep slopes, very disturbed area i.e. areas around villages or recently felled coups, dry areas, areas that experienced fires in the recent past etc. Areas in valley flats, riparian areas, remote and less disturbed areas etc. showed a high diversity. The compartment number 1016 was under great biotic pressure because of the presence of villages Gullarghat and Dharghad. The whole area was affected by grazing, which badly influenced on the regeneration rate of newly growing plants; and the seeds became ruptures due to the cattle feeding. The peripheral area was also occupied for cultivation practices by the local residents; it caused the reduction in forest tree vegetation. The flowers, fruits, seeds and bark of different trees were collected by local residents and the wood was cut down for fuel need. Musavi *et al.,* (2006) observed that the Melghat Tiger Reserve in Maharashtra was under immense biotic pressure from villages both within and adjacent to it. Combined biotic pressure from grazing, feulwood collection, lopping and illicit felling of trees and grass cutting affected 75% of compartments of MTR. Thus there was need for providing adequate protection to the region so that habitat in this area could be improved. The most common dominant tree species in the compartment 1016, research plot area were *Tectona grandis, Lagerstroemia parviflora, Phyllanthus emblica, Anogeissus latifolia, Desmodium oojeinensis, Boswellia serrata, Wrightia tinctoria, Madhuca indica*, *Buchanania lanzan,* and *Diospyros melanoxylon.* Sahu *et al.,* (2007) carried out phytosociological study of tropical dry deciduous forest of Boudh district, Orissa, India. The predominant tree species *M. indica*, *B. lanzan*, and *D. melanoxylon* were common species found in both the forest areas. Orissa forest recorded total 100 sample plots (4 ha) area represented by 187 species which contains 91 trees species, 10 shrubs, 12 climbers and 74 herbs whereas compartment 1016 represented 40 trees species belonging to 34 genera and 24 families. Girth class having 10-30 cm gbh contributed to about 68.13% species richness in Boudh district forest while most of the tree species found in the range 30-60 cm girth class in research plot of 1016 compartment.

Prakasha *et al.,* (2007) studied tree species composition, diversity and dominance along disturbance gradient in tropical dry deciduous forest of Bhadra Sanctuary. Three dry deciduous forests of Bhadra wildlife sanctuary, Karnataka were categorized as Naturally Disturbed Forest (NDF), Disturbed forest (DF) and Partially Disturbed Forest (PDF) across a disturbance gradient. The disturbance included grazing by the domestic and wild animals, removal of the grasses by the native people, cutting shrubs and tree branches for fuel. Similarly, dry deciduous forests of Melghat sanctuary was divisible into several protected areas known as compartments which were existed within core, semi core and buffer areas. The compartment 1016, research plot was one of the protected area (PA) which was disturbed by local residents of Gularghat village showed less dense vegetation while the protected area which were found in semi core or core areas showed dense vegetation. Both dry deciduous forests of Bhadra sanctuary and Melghat were found disturbed by local residents due to cattle feeding, cuttings of trees, fuel wood collection, resulted in deforestation. Field survey of compartment 1016 research plot was based on data recording and collection of specimens. The vegetation varied considerably with the changes in altitude, aspect and rainfall. Stream existed in the compartment area which was flowing northeast to west direction. Number of dry deciduous tree species were recorded and among them teak was the predominant species. The lower girth and height of trees indicated dry deciduous forest conditions. Therefore most convincingly it might be stated that the climatic conditions favored to develop very high density of dry deciduous tree species in this region. Areas of the compartment adjacent to Gullarghat and Dharghad were under heavy biotic pressures which were invaded by the inhabitants and grazing cattles.

CONCLUSION

The distribution of the trees species and forest cover of compartment 1016 was not uniform all over. Vegetation of the forest area of the compartment adjacent to villages Gullarghat and

Dharghad was found thin and sparcy. The reasons were constantly invading of the forest area by tribal inhabitants for their livelihood and secondly uncontrolled grazing of the cattles nearby cultivated fields. Hence the forest was under great biotic pressure; it was important that management authorities should handle this issue as a priority work. Within widely distributed dry deciduous leafless trees during summer there were a few evergreen trees, the most prominent being *Terminalia* sp., *Madhuca* sp., *Buchanania* sp., *Diospyros* sp., *Lagerstroemia* sp., *Butea* sp. and *Ixora* sp. Out of 456 plant population the highest representation was of *Tectona grandis* (273); though smaller in number *Bridelia airy-shawii* P.T.Li, Phyt. Sin. (41) and *Wrightia tinctoria* R. Br. Var rothii (G. Don) Hook. (40) represented second and third respectively.

REFERENCES

1. Chao WC, Wu SH, Lin HY, Hsieh CF, Chao KJ. 2007. Distribution Patterns of Tree Species in the Lanjenchi Lowland Rain Forest. Taiwania 52 (4): 343-351.
2. Chege J, Byterbier B. 2005. Vegetation Structure of Four Small Forest Fragments in Taita Hills, Kenya. Journal of East African Natural History 94(1): 231-234.
3. Clark NA, Wynne RH, Schmoldt DL, Winn M. 1998. Digital Terrestrial Photogrammetric Methods for Tree Stem Analysis. Integrated Tools Proceedings 16-20.
4. Cui H. 2008. Converting Taxonomic Descriptions to New Digital Formats. Biodiversity Informatics 5: 20-40.
5. Dhore MA, Joshi PA. 1988. Flora of Melghat Tiger Reserve. Directorate, Project Tiger Melghat, Paratwada – 444805, Maharashtra (India) 1-248.
6. Dobbertin MK, Grissino-Mayer HD. 2004. The Bibliography of Dendrochronology and the Glossary of Dendrochronology: Two New Online Tools for Tree-Ring Research. Tree Ring Research 60(2):101-104.
7. Kharwal G, Rawat YS, Pangtey YS. 2007. Distribution Characteristics of the Tree Species in Central Himalaya, India. International Journal of Botany 3(2): 226-228.
8. Linares-Palomino R. 2005. Spatial Distribution Patterns of Trees in a Seasonally Dry Forest in the Cerros de Amotape National Park, northwestern Peru. Rev. Peru. Biol 12 (2): 317-326.
9. Musavi A, Mathur PK, Qureishi Q, Sawarkar VB. 2006. Mapping of Biotic Pressure and its Impact on Prey Densities in Melghat Tiger Reserve, Maharashtra. International Journal of Ecology and Environmental Sciences 32(4): 327-343.
10. Pant A. 2003. Ecological Analysis of the Satpura Conservation Area Landscape through Stratified Field Sampling and Remotely Sensed Data. Map India Conference on Forestry & Biodiversity from http://GISdevelopement.net
11. Prakasha HM, Nanda A, Krishnamurthy YL. 2007. Tree Species Composition, Diversity and Dominance along Disturbance Gradient in Tropical Dry deciduous forest of Bhadra Sanctuary. Indian J. Ecol. 34(1): 8-14.
12. Patel RI. 1968. Forest Flora of Melghat. International Book Distributors 1-380.
13. Valencia R, Foster RB, Villa G, Condit R, Svenning JC, Hernandez C, Romoleroux K, Losos E, Magards E, Balslev H. 2004. Tree Species Distributions and Local Habitat Variation in the Amazon: Large Forest Plot in Eastern Ecuador. Journal of Ecology 92: 214-229.
14. Wattenberg I, Breckle SW. 1995. Tree Species Diversity of a Premontane Rain Forest in the Cordillera De Tilaran, Costa Rica. Ecotropica 1: 21-30.