



QUANTITATIVE ASSESSMENT OF SPECIES RICHNESS AND DIVERSITY IN PALI KATGHORA FOREST DIVISION AND ACHNAKMAR SHIVTARAI FOREST DIVISION

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Abstract

The investigation was carried out in Chhattisgarh, India in katghora forest division and bilaspur forest division. Each division evaluate the quantitative assessment of species richness and diversity of tree species. The katghora and bilaspur forest division total 16 and 15 sample plots randomly laid out a total number of 17 tree species were recorded. While the maximum IVI value is *shorea robusta* (103.57) site Bariumrao and minimum IVI value *Semecarpus anacardium*, *Butea monosperma* and *Tectona grandis* were (6.72) site Pali.

Key words: Species diversity, *Shorea robusta*, IVI assessment.

Introduction

The forest is a complex ecosystem consisting mainly of flora (tree, herb, shrub) and fauna (microorganism to large animal like tiger, elephant etc.) the forest in which place the interaction between the plants, animal their environment and support an infinite of life forms. The forest is found large number of plant and animal their variety is to conserve most of the biodiversity. The term "Biodiversity" is a relatively recent phrase which originated as a contraction of the term 'biological diversity' (Wilson, 1988) and has received various definitions; in 1987 and explanation of biological diversity began simply as 'the variety and variability among living organisms and the ecological complexes in which they occurs (OTA, 1987). Chhattisgarh state lies between 17°46–24°8 N latitude and 80°15–84°24 E longitude. As per Champion & Seth Classification, the state has ten forest types that belong to two forest type groups, viz. Tropical Moist Deciduous (47.89%) and Tropical Dry Deciduous. (51.65%) the state is tropical forest is most of richness of biodiversity. Sal (*Shorea robusta*) and Teak (*Tectona grandis*) are the two major tree species found in the state. Out of the total forest area 59772 sq. km of the state of Chhattisgarh, sal tree forest covered its 24244.878 sq. km (40.56) percent area.

Study site

The selected experimental sites under the study was Shivtari, (N-22°21'45" E81°55'45") Achankmar Tiger Reserve Bilaspur forest division and Chaitma, Pali (N-22°21'39" E82°20'14"), range in Katghora forest division Bilaspur (C.G). The average temperature in Bilaspur is 26.8°C. Precipitation here averages 1259 mm.the average temperature in katghora is 26.2°C. About 1447 mm of precipitation falls annually.

Methodology

The stratified random sampling approach was followed for quantitative assessment of tree species in the present study. Sampling was done in all the strata *i.e.* trees, shrubs and grass. The size of the quadrat for sampling of trees, shrubs and grass was determined by species-area-curve method (Misra, 1968; Mueller-Dombois and Ellenberg, 1974). A 20×20m quadrat for trees (>30 cm dbh), two 5 × 5 m quadrats for shrubs and four 1 × 1 m quadrats for grass were laid at each sample site. In each quadrat, the circumference at breast height (dbh) of all the trees with >30 cm was measured. Trees with >30 cm dbh were taken as shrubs. The individuals of shrub species were noted in the two 5 × 5 m quadrats. For herbs, the number of species in the four 1 × 1 m quadrats was recorded. A total of 16 and 15 plots were randomly laid in the dry sal forests, respectively.

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Table 1. Quantitative assessment of trees at site Bariumrao.

Species	Frequency (%)	Density	Abundance	RF	RD	RA	IVI	Species Richness
<i>Shorea robusta</i>	100	6.4	6.4	8.92	57.14	37.51	103.57	15.86
<i>Buchanania lanzan</i>	60	1	1.66	5.35	8.92	9.73	24	34.17
<i>Diospyrous melanoxyton</i>	80	1.2	1.5	7.14	10.71	8.79	26.64	30.69
<i>Semecarpus anacardium</i>	40	1	2.5	3.57	8.92	14.65	27.14	34.17
<i>Terminalia tomentosa</i>	40	0.6	1.5	3.57	5.35	8.79	17.71	50.06
<i>Helictoris isora</i>	40	0.6	1.5	3.57	5.35	8.79	17.71	50.06
<i>Anogeissus latifolia</i>	20	0.2	1	1.78	1.78	5.86	9.42	-
<i>Terminalia bellirica</i>	20	0.2	1	1.78	1.78	5.86	9.42	-

The primary data recorded on number of individuals in a species and girth was analysed for secondary attributes like density and frequency, following standard phyto-sociological methods of Misra, (1968). Relative values were calculated following the method of Curtis, (1959) and Kent and Coker, (2001).

$$RD = \frac{\text{Total number of individual of a particular species in all quadrat}}{\text{Total no. of individual of all the species in all quadrat}} \times 100$$

$$RF = \frac{\text{Number of quadrat in which species occurs}}{\text{Total number of all the species in all quadrat}} \times 100$$

$$\text{Relative abundance} = \frac{\text{Abundance of a particular species}}{\text{Sum of abundance of all the species}} \times 100$$

Simpson’s Index of Dominance

The following equation was used to calculate Simpson’s index put forth by Simpson, (1949).

$$D = \sum \left(\frac{n}{N} \right)^2$$

$$D = \sum_{i=0}^n Pi$$

n = the total number of tree of a particular species.

N= the total number of tree of all species

Where,

D = Simpson index of dominance.

Pi = the proportion of important value of the ith species.

(Pi = ni / N, ni is the important value index of all the species). As D increases, diversity decreases and Simpson’s index was therefore usually expressed as 1-D or 1 / D.

Shannon-Wiener Index (H')

Shannon - Wiener Index (Shannon and Wiener, 1949) is widely used index for comparing the diversity between various habitats (Clarke and Warwick, 2001) and considered very useful in describing the ecological trends of forest (Lewis *et al.*, 1988; Magurran, 1988).

$$H' = - \sum (pi \times \ln (pi))$$

H' = Shannon - Wiener Index

Σ = Summation

ln = Natural logarithm

N = Number of all individuals

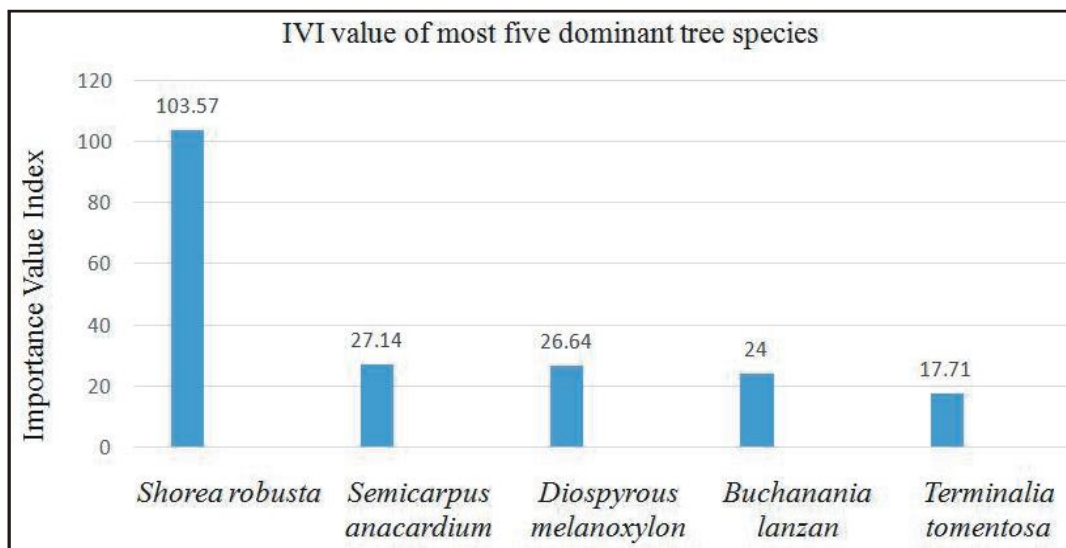


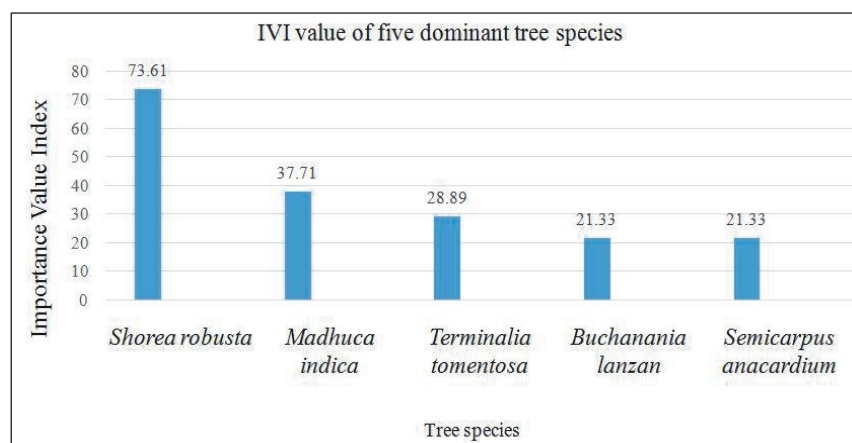
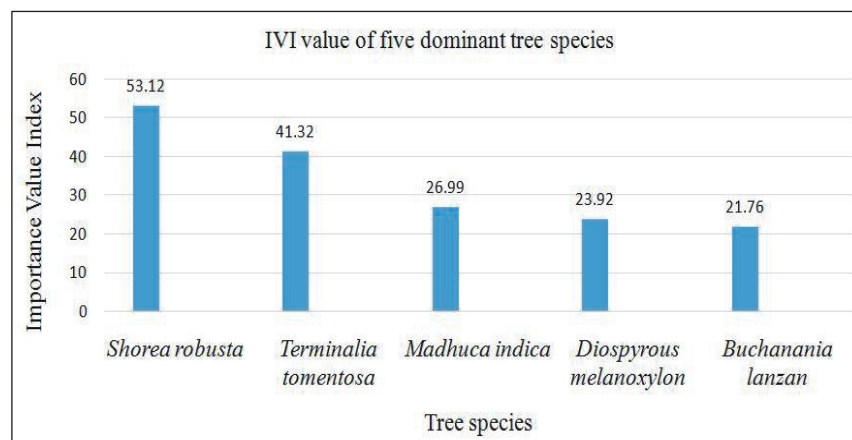
Fig. 1: IVI value of five dominant tree speceis of Bariumrao.

Table 2. Quantitative assessment of trees at kerakacchar.

Species	Frequency (%)	Density	Abundance	RF	RD	RA	IVI	Species Richness
<i>Shorea robusta</i>	100	6.8	6.8	5.6	38.6	29.41	73.61	24.57
<i>Madhuca indica</i>	80	3	3.75	4.5	17	16.21	37.71	32.12
<i>Buchanania lanzan</i>	60	1.4	2.33	3.4	7.9	10.03	21.33	44.70
<i>Semecarpus anacardium</i>	60	1.4	2.33	3.4	7.9	10.03	21.33	44.70
<i>Terminalia tomentosa</i>	80	2.2	2.75	4.5	12.5	11.89	28.89	36.28
<i>Diospyros melanoxylon</i>	60	1	1.66	3.4	5.6	7.17	16.17	54.05
<i>Anogeissus latifolia</i>	60	1.2	2	3.4	6.8	8.65	18.85	48.55
<i>Ougeinia oojensis</i>	40	0.6	1.5	2.2	3.4	6.48	12.08	79.19

Table 3. Quantitative assessment of trees at Pali.

Species	Frequency (%)	Density	Abundance	RF	RD	RA	IVI	Species Richness
<i>Terminalia tomentosa</i>	83.3	3	3.6	6.09	21.9	13.33	41.32	28.02
<i>Madhuca indica</i>	33.3	1.33	4	2.43	9.75	14.81	26.99	38.95
<i>Buchanania lanzan</i>	83.3	1.3	1.6	6.09	9.75	5.92	21.76	38.95
<i>Semecarpus anacardium</i>	16.6	0.16	1	1.21	1.21	3.70	6.12	-
<i>Aegle marmelos</i>	33.3	1	3	2.43	7.31	11.11	20.85	45.20
Goinja	16.6	0.33	2	1.21	2.43	7.40	11.04	116.85
<i>Tectona grandis</i>	16.6	0.16	1	1.21	1.21	3.70	6.12	-
<i>Anogeissus latifolia</i>	66.6	1	1.5	4.87	7.31	5.55	17.73	58.42
<i>Shorea robusta</i>	83.3	4	4.8	6.09	29.26	17.77	53.12	50.32
<i>Butea monosperma</i>	16.66	0.16	1	1.21	1.21	3.70	6.12	-
<i>Diospyros melanoxylon</i>	33.3	1.16	3.5	2.43	8.53	12.96	23.92	116.85

**Fig. 2:** IVI value of five dominant tree species of Kerakacchar.**Fig. 3:** IVI value of five dominant tree species of Pali.

n_i = Number of individuals in species

p_i = the proportional of individuals in species ($p_i = n_i / N$)

Margalef's index of richness

The richness of species of the vascular plants or Margalef's index of richness was calculated by using the method as outlined by Margalef (1974).

$$D_{mg} = \frac{S - 1}{I_n} N$$

Where,

D_{mg} = Margalef's index of richness.

S = Total number of species.

N = Total number of individuals.

Results

Katghora Forest Division

In selected site bariumarao *shorea robusta* was focus highest frequency (100%), density (6.4), abundance (6.4), Relative frequency (8.92), Relative density (57.14) and IVI (103.57) and species richness (15.85) all parameter followed by *Buchanania lanzan*, *Diospyros melanoxylon*, *Semecarpus*

Table 4: Quantitative assessment of trees species at Shivtari.

Species	Frequency (%)	Density	Abundance	RF	RD	RA	IVI	Species Richness
<i>Shorea robusta</i>	100	2.6	2.6	9.61	25	20.12	54.73	19.88
<i>Diospyrous melanoxyton</i>	100	2	2	9.61	19.2	15.47	44.28	22.14
<i>Tectona grandis</i>	60	0.8	1.33	5.76	7.69	10.29	23.74	36.78
<i>Butea monosperma</i>	60	1	1.66	5.76	9.61	12.84	28.21	31.68
<i>Buchanania lanzan</i>	100	2	2	9.61	19.2	15.47	44.28	22.14
<i>Terminalia tomentosa</i>	60	1.2	2	5.76	11.53	15.47	32.76	28.46
<i>Anogeisus latifolia</i>	60	0.8	1.33	5.76	7.64	10.29	23.69	36.78

Table 5: Quantitative assessment of trees at Shripara.

Species	Frequency (%)	Density	Abundance	RF	RD	RA	IVI	Species Richness
<i>Shorea robusta</i>	100	5	5	7.69	38.46	33.53	79.68	19.88
<i>Terminalia tomentosa</i>	100	2.2	2.2	7.69	16.92	14.75	39.36	26.69
<i>Diospyrous melanoxyton</i>	100	2.8	2.8	7.69	21.53	18.77	47.99	24.25
<i>Buchanania lanzan</i>	60	1	1.66	4.61	7.69	11.13	23.43	39.76
<i>Syzygium cumini</i>	40	0.6	1.5	3.07	4.61	10.06	17.74	58.25
<i>Madhuca indica</i>	80	1.4	1.75	6.15	10.76	11.73	28.64	32.88

anacardium, *Terminalia tomentosa*, *Helictres isora*, *Anogeisus latifolia*, *Terminalia belerica* and minimum *Terminalia belirica* (Table 1).

The maximum IVI value recorded *Shorea robusta* in Bariumrao out of all sites were maximum IVI value (103.57). The results of the study by Shahid and Joshi, (2016) were supportive for the present investigation the value of IVI Sal (123.36) and (187) which was much lower than present findings.

In selected site Kerakachhar *shorea robusta* was focus highest frequency (100%), density (6.8), abundance (6.8), Relative frequency (5.6), Relative density (38.6) and IVI (73.61) and species richness (24.57) all parameter

followed by *Buchanania lanzan*, *Diospyrous melanoxyton*, *Semecarpus anacardium*, *Terminalia tomentosa*, *Helictres isora*, *Anogeisus latifolia* *Madhuca indica* and minimum *Ougeina oojeinns*.

In selected site Pali *Shorea robusta*, *Terminalia tomentosa*, *Buchanania lanzan* was focus highest frequency (83.3%) and *Shorea robusta* were highest density (4), abundance (4.8), Relative frequency (6.09), Relative density (29.26) and IVI (53.12) and species richness (50.32) all parameter followed by, *Diospyrous melanoxyton*, *Aegle marmelos*, *Semecarpus anacardium*, *Anogeisus latifolia* *Madhuca indica*, *Goinja* and minimum, *Butea monosperma* *Tectona grandis*.

Bilaspur forest division

In selected site Pali *Shorea robusta*, *Diospyrous melanoxyton*, *Buchanania lanzan* was focus highest frequency (100%) and *Shorea robusta* were highest density (2.6), abundance (2.6), Relative frequency (9.61), Relative density (25) and IVI (54.73) and species richness (19.88) and *Diospyrous melanoxyton*, *Buchanania lanzan* second highest density (2), abundance (2), Relative frequency (9.61), Relative density (19.2) and IVI (44.28) all parameter followed by, *Butea monosperma* and minimum *Tectona grandis*, *Anogeisus latifolia*.

In selected site Pali *Shorea robusta*, *Terminalia tomentosa*,

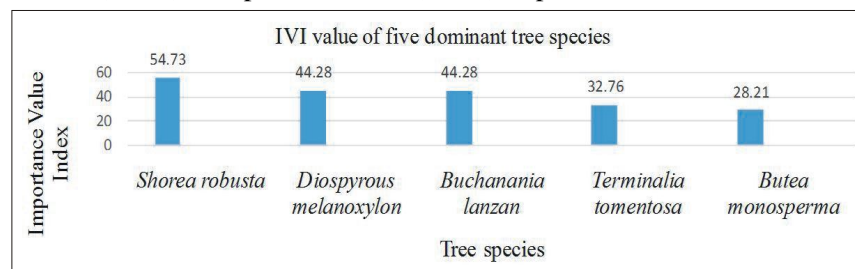


Fig. 4: IVI value of five dominant tree species of Shivtari.

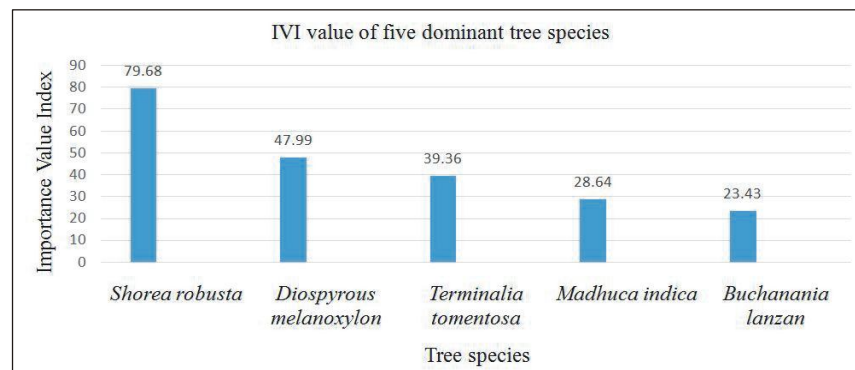


Fig. 5: IVI value of five dominant tree species of Shripara.

Table 6: Quantitative assessment of tree at Jhingatpur.

Species	Frequency (%)	Density	Abundance	RF	RD	RA	IVI	Species Richness
<i>Terminalia tomentosa</i>	100	2.6	2.6	8.62	22.41	18.74	49.77	22.22
<i>Shorea robusta</i>	100	4.2	4.2	8.62	32.30	30.28	71.2	18.72
<i>Anogeisus latifolia</i>	60	1	1.66	5.17	8.62	11.96	25.75	35.41
<i>Careya arborea</i>	80	1	1.25	6.89	8.62	9.01	24.52	35.41
Goinja	60	0.6	1	5.17	5.17	7.20	17.54	51.88
<i>Soymida febrifuga</i>	60	1	1.66	5.17	8.62	11.96	25.75	35.41
<i>Buchanania lanzan</i>	80	1.2	1.5	6.89	10.34	10.81	28.04	31.81

Table 7: Shannon wiener diversity index, Evenness and Species richness in Katghora forest division and Bilaspur forest division.

Division	Site	Shannon wiener diversity index	Evenness	Species richness
Katghora forest division	Bariumrao	1.46	0.70	0.34
	Kerakacchar	1.81	0.87	0.20
	Pali	1.98	0.83	0.16
Bilaspur forest division	Shivtarai	1.87	0.96	0.15
	Shripara	1.59	0.89	0.23
	Jhinghatpur	1.74	0.89	0.20

Diospyrous melanoxyton, was focus highest frequency (100%) and *Shorea robusta* were highest density (5), abundance (5), Relative frequency (7.69), Relative density (38.46) and IVI (79.68) and species richness (19.88) and *Madhuca indica* second highest density (1.4), abundance (1.75), Relative frequency (6.15), Relative density (10.76) and IVI (28.64) all parameter followed by, *Buchanania lanzan* and minimum *Syzygium cumini*.

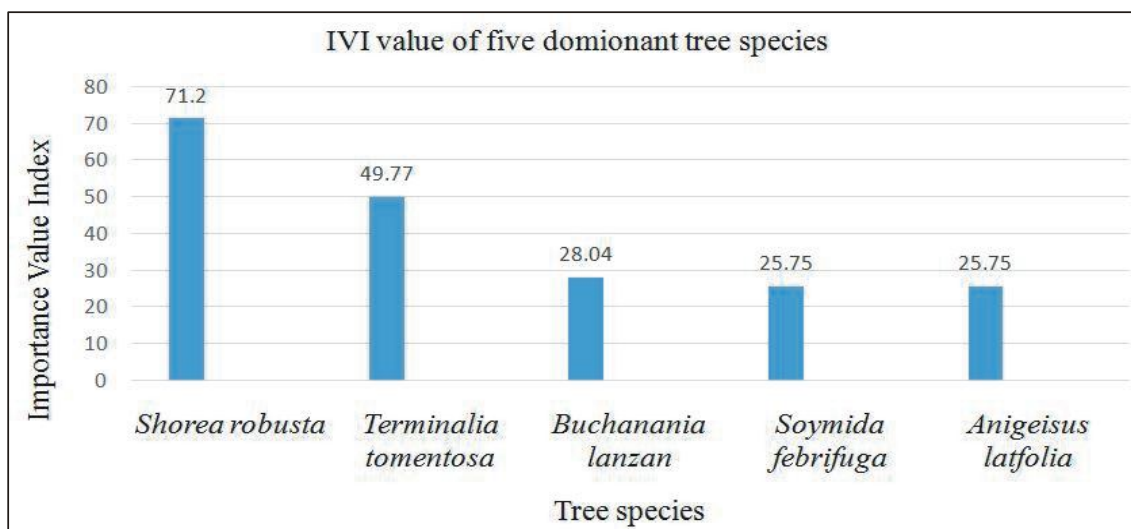
In selected site Pali *Shorea robusta*, *Terminalia tomentosa*, was focus highest frequency (100%) and *S. robusta* were highest density (4.2), abundance (4.2), relative frequency (8.62), relative density (32.30) and IVI

(71.2) and species richness (18.72) and *Terminalia tomentosa* second highest density (2.6), abundance (2.6), relative frequency (8.62), Relative density (22.41) and IVI (49.77) all parameter followed by, *Buchanania lanzan*, *Anogeisus latifolia* *Careya arborea*, *Soymida febrifuga* and minimum *Goinja*.

Discussion

The studies were carried out the all site tree species distributed in randomly and the sal tree species is dominance in all the site. The maximum IVI value recorded sal tree in all 6 sites out of site first were maximum IVI value (103.57). The results of the study by Shahid and Joshi, (2016) were supportive for the present investigation the value of IVI Sal (123.36) and (187) which showed similarity with present findings. The minimum IVI value (6.72) were observed *Semecarpus anacardium*, *Butea monosperma* and *Tectona grandis*.

The number of tree species varied from 6 to 11 for different sites of the study sites. Maximum number of the tree species belonged to the site 3 (Pali) while the minimum number was observed on site 4 (shripara) similarly Kumar *et al.*, (2005) recorded the number of tree species varying from 11 to 12 in sub-tropical forest. Anup Sarkar, (2015) were also recorded the 19 number

**Fig. 6:** IVI value of five dominant tree species Jhingatpur.

of tree species in Moraghat forest West Bengal.

In tropical forests, values of species diversity (H') are generally high, between 5.06 and 5.40 (Knight, 1975) as compared to Indian forests, between 0.00 and 4.21 (Agni *et al.*, 2000). The value of H' in tree species in present study ranged between 1.98 to 1.46, these values were similar with (Agni *et al.*, 2000) and much lower than the values reported by Knight, (1975) for tropical forests (5.06 to 5.40). The species diversity for trees among all the sites was maximum (1.98) on site Pali and minimum (1.46) on the site Bariurao. The highest diversity index indicate the site Pali more tree composition and distribution.

As per Shannon wiener index diversity were recorded *Shorea robusta*, *Diospyros melanoxylon*, *Terminalia arjuna*, *Aegle marmelos* similarly reported by Vikas, (2016) due to the species adopted narrowly drawn niche and adjusted with those niche hence the concept also support to the present study.

The biodiversity of katghora forest division and bilaspur division study were focused to analyse the floristic composition of the bilaspur region similarly several workers also studied at difference of regions of India (Jamir *et al.*, 2006; Shukla and Mishra, 2006; Patel *et al.*, 2010, Pharswan *et al.*, 2010; Thakur and Khare, 2006.

Conclusion

The present study quantitative assessment of trees *Shorea robusta* is a most dominant species in all the sites and other tree species have minimum number because the *Buchanania lanzan* associate tree of *shorea robusta* is found in all sites and the human interference minimum. And other trees species is reduction because the animal and human intervention is high.

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