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# Measuring Tree Diversity of Sitaram Peth Village of Bhadravati Taluka of Chandrapur District by Applying Whittaker's Additive Model

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***Abstract***

*Forest plays a major role for sustaining biodiversity and various ecological services. There are 12 tribal districts in the Maharashtra state, which holds about 60 percent of total forest cover of the state. And among these tribal districts, Chandrapur and Gadchiroli together shares about 46 percent of forest cover. For the better conservation and management practices, the tree diversity of these forest should be measured periodically. In the present study, the additive model of R. H. Whittaker (α, β, and γ diversity) is used to measure the tree diversity of Sitaram Peth Village Forest of Chandrapur district. The Sitaram Peth Village is among the few villages of the Chandrapur district which have received Community Forest Rights (CFR) title. Using continuous belt transact method, two belts were laid parallel to each other at two distinct sites within the village forest and named as Site-A and Site-B, respectively. In each belt, 20 quadrats of dimension 20 m* x *25 m each, were laid and sampled. Rarefaction curve with 95% confidence was applied to ensure the sampling efficiency. Then using Whittaker's additive model, the alpha (α)-, beta (β)-, and gamma (γ)-diversity of the trees were calculated. The alpha diversity at Site-A and Site-B of the Sitaram Peth Village Forest was found to be 46 and 42, respectively. The beta diversity of both the sites is 16 and gamma diversity is found to be 52. These findings indicate a high level of species richness and moderate variation between the two study sites, emphasizing the ecological significance of the Sitaram Peth Village Forest. The results support the need for regular biodiversity assessments, which can guide sustainable forest management practices under the framework of Community Forest Rights (CFR).*

**Keywords:** Alpha, beta and gamma diversity, belt transact method, rarefaction curve, Sitaram Peth

## INTRODUCTION

Forest provides various ecosystem services, like fuel, timber, food, medicine, etc. and helps to conserve soil and water. The forest contributes most to maintaining $CO_2$ level in the atmosphere and avails various opportunities in the field of research, education, tourism, culture and aesthetics. Being a most diverse ecosystem on Earth, it plays a very important role in sustaining biodiversity [1].

In terms of forest cover, Maharashtra ranks 2nd in the country with 61,952 sq. km. of recorded forest cover, i.e., about 20 % of the total geographical area of the state (ISFR, 2021). In Maharashtra, the Tribal district holds about 60% of the forest cover of the state. Among the tribal districts, Chandrapur and Gadchiroli districts together hold about 46 % of the forest cover. This itself tells the significance of forest cover in Chandrapur and Gadchiroli districts. Hence, regular measurement of tree species in this region is necessary for conservation purpose [2].

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Researchers have been using various diversity indices, like Simpson's index, Shannon–Wiener index, Margalef's diversity index, etc. Biodiversity indices produce numerical values which enable quantitative analysis of different types of species or genera or family or any functional type depending upon researcher's interest. Diversity indices represent biodiversity in terms of richness, evenness and dominance. In the present study, the Whittaker's additive model, i.e., alpha (α)-, beta (β)-, and gamma (γ)-diversity indices are applied to measure the tree species of Sitaram Peth Village Forest. It allows us to measure all the components in the same unit and is suitable for a small to medium-sized sampling area. It provides detailed data for management and conservation point of view [3].

The additive model of Whittaker's components (α, β, and γ) were first applied by Shil and Thakare (2014) [4] and Grant TA, et al. (2004) [5]. They formulate this component as, $\gamma = \alpha + \beta$. Alpha diversity is nothing but the species richness or simply the number of species present site, area or ecosystem. Beta diversity allows us to measure the unique species found in any site, area or ecosystem as compared to other sites, area or ecosystem. Whereas gamma diversity is the overall number of species found in two or more sampled sites or areas.

The present study area, i.e., Sitaram Peth Village is in Bhadrawati taluka of Chandrapur district at $20^0$ 08'67" N, $79^0$ 11'78" E.

## MATERIALS AND METHODS

Continuous belts transact method is used in the present study, as it can be applied on larger area or site and because it is systematic and fast. Belts transact method helps to detect vegetation problems, to plan management treatments, to check results of restoration efforts and helps to develop wildlife-habitat models [6]. Within the Sitaram Peth Village Forest, two sites viz; Site-A and Site-B were selected for sampling. For proper and representative sampling, at least one hectare area should be sampled in case of larger area [7]. So, the belts with 20 quadrats of dimension 25 m x 20 m each were laid at each site.

Human activities are the key factors for the degradation of forests. Hence, for better and comparative studies, the 1st site was selected nearer to the village and the 2nd site is selected deep into the forest. Belts were laid parallel to the village settlement and parallel to each other.

After plotting the quadrats, all the tree species having GBH (Girth at breast height) ≥ 30 cm were identified, counted and noted down.

To ensure that the number of sampling efforts are sufficient to be a representative sample, from the collected data the number of species against number of quadrats were plotted on Past's software for sample rarefaction curve.

Applying Whittaker's additive model [8], the alpha, beta and gamma diversity of both the sites (Site-A and Site-B) of Sitaram Peth Village Forest is calculated using following formula.

1. Alpha diversity of Site-A ($\alpha_a$) = Total number of tree species at Site-A.
2. Alpha diversity of Site-B ($\alpha_b$) = Total number of tree species at Site-B.
3. Beta diversity of Site-A and Site-B ($\beta_{ab}$) = $(\alpha_a - C_{ab}) + (\alpha_b - C_{ab})$.
4. Gamma diversity of both Sites ($Y_{ab}$) = $(\alpha_a + \alpha_b - C_{ab})$.

where $\alpha_a$ is alpha diversity of Site-A, $\alpha_b$ is alpha diversity of Site-B, $C_{ab}$ is number of common species in both sites and $Y_{ab}$ is the gamma diversity of both sites.

## CALCULATIONS AND RESULTS

Figure 1 shows the sample rarefaction curve for Site-A and Site-B of Sitaram Peth Village Forest obtained from Past software.

 

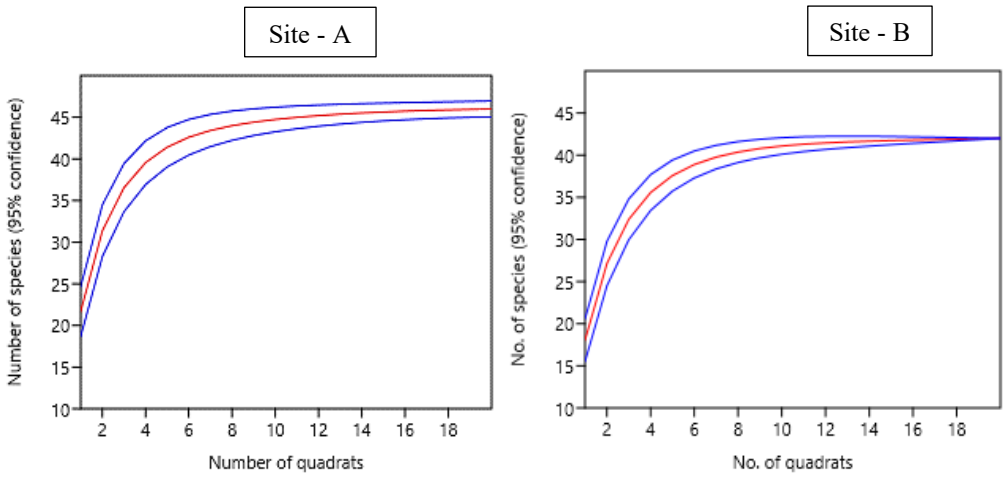


**Figure 1.** Rarefaction curve for Site-A and Site-B of Sitaram Peth Village Forest.

The sample rarefaction curve of Site-A gets flattened towards the end, which indicates that the number of sampling effort is conscientious.

The tree distribution of each species in each quadrat of Site-A and Site-B of Sitaram Peth Village Forest are given in Tables 1 and 2, respectively.

**Table 1.** Distribution of individual trees of each species in each quadrat of Site-A of Sitaram Peth Village Forest.

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Q14 | Q15 | Q16 | Q17 | Q18 | Q19 | Q20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ain | 6 | 11 | 4 | 0 | 3 | 9 | 8 | 4 | 8 | 7 | 2 | 5 | 7 | 3 | 5 | 6 | 3 | 4 | 5 | 4 |
| Amba | 4 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 4 | 2 | 0 | 0 | 1 | 0 | 0 |
| Apta | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 3 | 0 | 2 | 3 | 0 | 1 | 2 | 1 | 0 | 1 |
| Arjuna | 0 | 2 | 1 | 4 | 2 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Behada | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 4 | 0 | 0 | 1 | 0 | 0 | 0 |
| Bel | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 2 | 1 | 0 |
| Bharatti | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 |
| Bhera | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 1 | 8 | 3 | 0 | 4 | 2 | 0 | 1 | 3 |
| Bija | 0 | 2 | 1 | 1 | 5 | 2 | 0 | 3 | 2 | 2 | 4 | 1 | 0 | 2 | 7 | 4 | 4 | 0 | 1 | 2 |
| Charoli | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 4 | 5 | 2 | 1 | 2 | 0 | 3 | 0 | 0 | 0 | 1 |
| Chichwa | 2 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chinch | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dhaman | 0 | 0 | 2 | 2 | 3 | 2 | 0 | 2 | 1 | 1 | 0 | 0 | 4 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| Dhawda | 0 | 1 | 0 | 0 | 3 | 1 | 5 | 0 | 4 | 2 | 1 | 3 | 0 | 0 | 2 | 0 | 3 | 1 | 2 | 2 |
| Dhoban | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 1 |
| Dikemali | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Hirda | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 1 | 0 |
| Hiwar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 5 | 0 | 3 | 0 | 5 | 1 | 0 |
| Jambul | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kadunimb | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kakad | 0 | 0 | 1 | 2 | 1 | 1 | 3 | 2 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 1 |
| Kalakuda | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 5 | 3 | 0 | 7 | 0 | 2 | 3 | 1 | 6 | 1 | 0 | 2 |
| Kalamb | 0 | 0 | 0 | 0 | 6 | 2 | 7 | 3 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 0 | 0 |
| Kalapalas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| Karang | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |

 

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Karu | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 2 | 0 | 3 | 0 | 2 | 3 | 2 | 0 | 2 |
| Kawat | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 1 | 1 |
| Khair | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 5 | 3 | 7 | 2 | 0 | 4 | 2 | 0 | 2 | 1 | 0 |
| Kuda | 0 | 0 | 5 | 1 | 3 | 2 | 0 | 4 | 1 | 2 | 0 | 3 | 1 | 3 | 0 | 0 | 4 | 3 | 1 | 1 |
| Kumbhi | 1 | 0 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 6 | 3 | 1 | 0 | 0 | 2 | 2 | 1 | 1 | 1 |
| Kusum | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 3 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| Lokhandi | 0 | 0 | 0 | 1 | 5 | 3 | 1 | 5 | 0 | 3 | 7 | 2 | 2 | 0 | 4 | 1 | 3 | 0 | 1 | 4 |
| Moha | 1 | 3 | 0 | 0 | 6 | 2 | 0 | 0 | 1 | 0 | 0 | 2 | 3 | 0 | 0 | 1 | 0 | 2 | 3 | 0 |
| Mowai | 0 | 0 | 4 | 2 | 0 | 1 | 5 | 3 | 0 | 1 | 1 | 3 | 2 | 1 | 0 | 4 | 0 | 1 | 0 | 2 |
| Palas | 7 | 4 | 3 | 2 | 5 | 3 | 0 | 6 | 3 | 0 | 0 | 4 | 4 | 2 | 6 | 1 | 5 | 3 | 3 | 1 |
| Pandhra Phetara | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 | 0 | 2 | 4 | 1 | 3 | 0 | 1 |
| Parad | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 1 | 0 | 3 | 5 | 3 | 1 | 1 | 0 | 0 | 3 | 6 | 2 | 2 |
| Pipal | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ritha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 6 | 4 | 0 | 5 | 2 | 1 | 2 |
| Rohan | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 0 | 4 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sag | 5 | 9 | 4 | 8 | 13 | 6 | 10 | 7 | 11 | 8 | 6 | 13 | 9 | 5 | 12 | 11 | 6 | 2 | 10 | 4 |
| Salai | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 3 | 3 | 2 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 0 |
| Semal | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 0 | 1 | 0 | 0 | 1 | 1 |
| Shirish | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 2 | 2 | 0 | 0 | 0 |
| Shisam | 0 | 0 | 0 | 2 | 1 | 2 | 3 | 0 | 0 | 2 | 6 | 2 | 1 | 3 | 1 | 0 | 1 | 1 | 1 | 1 |
| Tendu | 6 | 2 | 7 | 3 | 5 | 4 | 6 | 8 | 6 | 4 | 5 | 0 | 1 | 8 | 0 | 6 | 3 | 0 | 4 | 2 |

**Table 2.** Distribution of individual trees of each species in each quadrat of Site-B of Sitaram Peth Village Forest.

| | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q6** | **Q7** | **Q8** | **Q9** | **Q10** | **Q11** | **Q12** | **Q13** | **Q14** | **Q15** | **Q16** | **Q17** | **Q18** | **Q19** | **Q20** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 1 | 3 | 0 | 0 | 0 | 0 |
| Ain | 6 | 2 | 9 | 2 | 0 | 1 | 3 | 5 | 3 | 0 | 7 | 3 | 3 | 8 | 0 | 2 | 7 | 5 | 6 | 4 |
| Apta | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 2 | 0 | 1 | 1 | 4 | 1 | 1 | 2 |
| Arjuna | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 6 | 2 | 0 | 0 |
| Behada | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 5 | 1 | 3 | 0 | 0 | 7 | 4 | 1 | 4 | 0 | 0 | 0 | 0 |
| Bharatti | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 5 | 1 | 0 | 0 | 3 | 0 | 1 | 2 |
| Bhera | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 6 | 1 | 4 | 5 | 3 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| Bija | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 1 | 1 | 6 | 5 | 2 | 9 | 4 | 2 | 3 |
| Bor | 0 | 5 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 1 |
| Charoli | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 0 | 2 | 1 | 0 |
| Chichwa | 4 | 1 | 3 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 1 |
| Dhaman | 0 | 0 | 2 | 3 | 2 | 0 | 5 | 1 | 0 | 3 | 1 | 4 | 0 | 0 | 4 | 3 | 0 | 2 | 0 | 0 |
| Dhawda | 0 | 0 | 0 | 1 | 1 | 0 | 4 | 2 | 0 | 1 | 3 | 0 | 0 | 0 | 5 | 2 | 3 | 0 | 4 | 1 |
| Dhoban | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 2 | 0 | 0 | 1 | 0 | 1 | 0 |
| Hirda | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 4 | 2 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 3 | 2 |
| Hiwar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 3 | 1 | 3 | 0 | 2 | 1 |
| Jambul | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 1 | 0 |
| Kadunimb | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kakad | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 0 | 0 | 4 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| Kalakuda | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | 4 | 7 | 2 | 9 | 0 | 3 | 0 | 2 | 2 |
| Karu | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Semal | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |

 

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kawat | 0 | 3 | 1 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Khair | 0 | 0 | 0 | 6 | 3 | 5 | 2 | 0 | 0 | 6 | 4 | 0 | 7 | 4 | 0 | 1 | 0 | 3 | 0 | 0 |
| Kirni | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Kuda | 3 | 3 | 0 | 7 | 5 | 0 | 0 | 6 | 0 | 4 | 0 | 0 | 0 | 5 | 0 | 0 | 3 | 1 | 0 | 2 |
| Kumbhi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 5 | 0 | 2 | 8 | 5 | 0 | 0 | 4 | 0 | 3 | 0 |
| Kusum | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 3 | 0 | 2 | 0 | 0 |
| Kutki | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5 | 4 | 0 | 0 |
| Lendi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 5 | 3 | 4 | 7 | 1 | 0 | 1 | 4 | 0 | 0 |
| Lokhandi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 2 | 0 | 1 | 0 | 2 | 2 | 1 |
| Moha | 1 | 5 | 2 | 0 | 6 | 3 | 0 | 5 | 4 | 1 | 2 | 0 | 0 | 1 | 0 | 6 | 1 | 2 | 0 | 2 |
| Mowai | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 4 | 0 | 2 | 0 | 1 | 3 | 1 | 2 | 0 |
| Palas | 4 | 6 | 3 | 7 | 2 | 1 | 3 | 5 | 2 | 1 | 6 | 3 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 3 |
| Parad | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 0 | 2 | 4 | 1 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 2 | 0 |
| Pipal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sag | 14 | 9 | 10 | 16 | 11 | 7 | 8 | 5 | 6 | 2 | 9 | 8 | 6 | 10 | 7 | 12 | 5 | 3 | 10 | 8 |
| Salai | 0 | 0 | 2 | 0 | 2 | 1 | 4 | 0 | 0 | 5 | 2 | 0 | 0 | 1 | 1 | 0 | 3 | 0 | 2 | 0 |
| Shirish | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 4 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 1 |
| Shisam | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 0 | 1 | 8 | 3 | 0 | 0 | 1 | 0 |
| Tendu | 3 | 5 | 1 | 7 | 2 | 1 | 0 | 3 | 1 | 1 | 4 | 3 | 6 | 2 | 1 | 0 | 4 | 1 | 0 | 3 |
| Umber | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 3 | 0 | 0 | 4 | 2 | 0 |

## CALCULATIONS FOR WHITTAKER'S ADDITIVE MODEL

Alpha (α)-, beta (β)-, and gamma (γ)-diversity of Site-A and Site-B of Sitaram Peth Village Forest.

### Site-A vs Site-B

- The alpha diversity of Site-A, $\alpha_a = 46$.
- The alpha diversity of Site-B, $\alpha_b = 42$.
- The number of common species in Site-A and Site-B, $C_{ab} = 36$.
- The number of species present only in Site-A, i.e., unique species of Site-A, $U_a = 10$.
- The number of species present only in Site-B, i.e., unique species of Site-B, $U_b = 6$.

Therefore, the beta diversity of Site-A and Site-B, ($\beta_{12}$)

$\beta_{ab} = (\alpha_a - C_{ab}) + (\alpha_b - C_{ab})$

$\beta_{ab} = (46 - 36) + (42 - 36)$

$\beta_{ab} = 16$

Therefore, Beta diversity of Site-A and Site-B is 16.

The Gamma Diversity of Site-A and Site-B,

$\gamma_{ab} = (\alpha_a + \alpha_b - C_{ab})$

$\gamma_{ab} = 46 + 42 - 36 = 52$

$\gamma_{ab} = 52$

## DISCUSSION

In the present study the Whittaker's Additive model is applied and the alpha, beta and gamma diversity of Sitaram Peth Village Forest is calculated at two sites. Total 1189 individual trees of 46

 

species were found at Site-A, and total 1133 individual trees of 42 species were found at Site-B of Sitaram Peth Village Forest. It indicates that Site-A is denser and more diverse in tree species than the Site-B. Sag, Ain, and Tendu are the predominant tree species at both the sites. The alpha diversity of Site-A and Site-B of Sitaram Peth Village Forest is found to be 46 and 42, respectively. The beta diversity of Site-A and Site-B of Sitaram Peth Village Forest is found to be 16. The gamma diversity of both the village forest is 52. Site-A has 10 unique species and Site-B has 6 unique species [9, 10].

## CONCLUSIONS

The percentage of predominant tree species at both the sites of Sitaram Peth Village Forest are below 30%. And the calculated value of beta diversity is high. These indicates that the distribution of tree species is good with high species richness and species evenness at Sitaram Peth Village Forest. We can conclude that the tree diversity status of the Sitaram Peth Village Forest is very good.

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