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Diversity and Dominance of a Tropical Moist Deciduous Forests of Ranchi, Jharkhand, Eastern India



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OVERVIEW OF THE PRESENTATION

- **Brief Introduction**
- **Study Site**
- **Grid generation and Sampling techniques**
- **Results**
- **Conclusions**

INTRODUCTION

- **Jharkhand is very rich in floristic diversity (28.82 % forests cover) because this plateau formed a link between Satpura Hill Ranges and Eastern Himalaya (Hora 1949)**
- **Tropical moist deciduous forests are distributed in states of Jharkhand, Chhattisgarh, west Odisha and on the eastern slopes of Western Ghats, India**
- **Out of 86% of tropical forests in India, 37% is moist deciduous forests (Singh et al. 2005)**
- **Champion and Seth's (1968) classified Sal forests of Jharkhand mainly into (i) Moist Peninsular Low Level Sal (3C/C2e) and (ii) Dry Peninsular Sal Forest (5B/C1c)**
- **Sal forests cover nearly 13.3% of the forested landscape (Satya and Nayaka 2005) including Uttar Pradesh, Uttarakhand and Shivalik Hills in Haryana and through the Eastern Ghats and to the eastern Vindhyan and Satpura ranges of central India**

STUDY AREA

- Study conducted in 9 blocks (Khelari, Burmu, Chano, Mandar, Ratu, Kanke, Ormanjhi, Angara and Namkum) out of 18 blocks of Ranchi district, which lies in south Chotanagpur administrative division
- Located at 23.35°N latitude, 85.33°E longitude and altitude varies from 400 m to 700 m above mean sea level
- According to The Köppen Climate Classification, climate of Ranchi is "Cwa" (Humid Subtropical Climate) and mean annual rainfall is about 1430 mm
- It has hilly topography with stony and gravelly, red and yellow, lateritic and alluvial soils
- Tropical moist deciduous and dry deciduous forests.

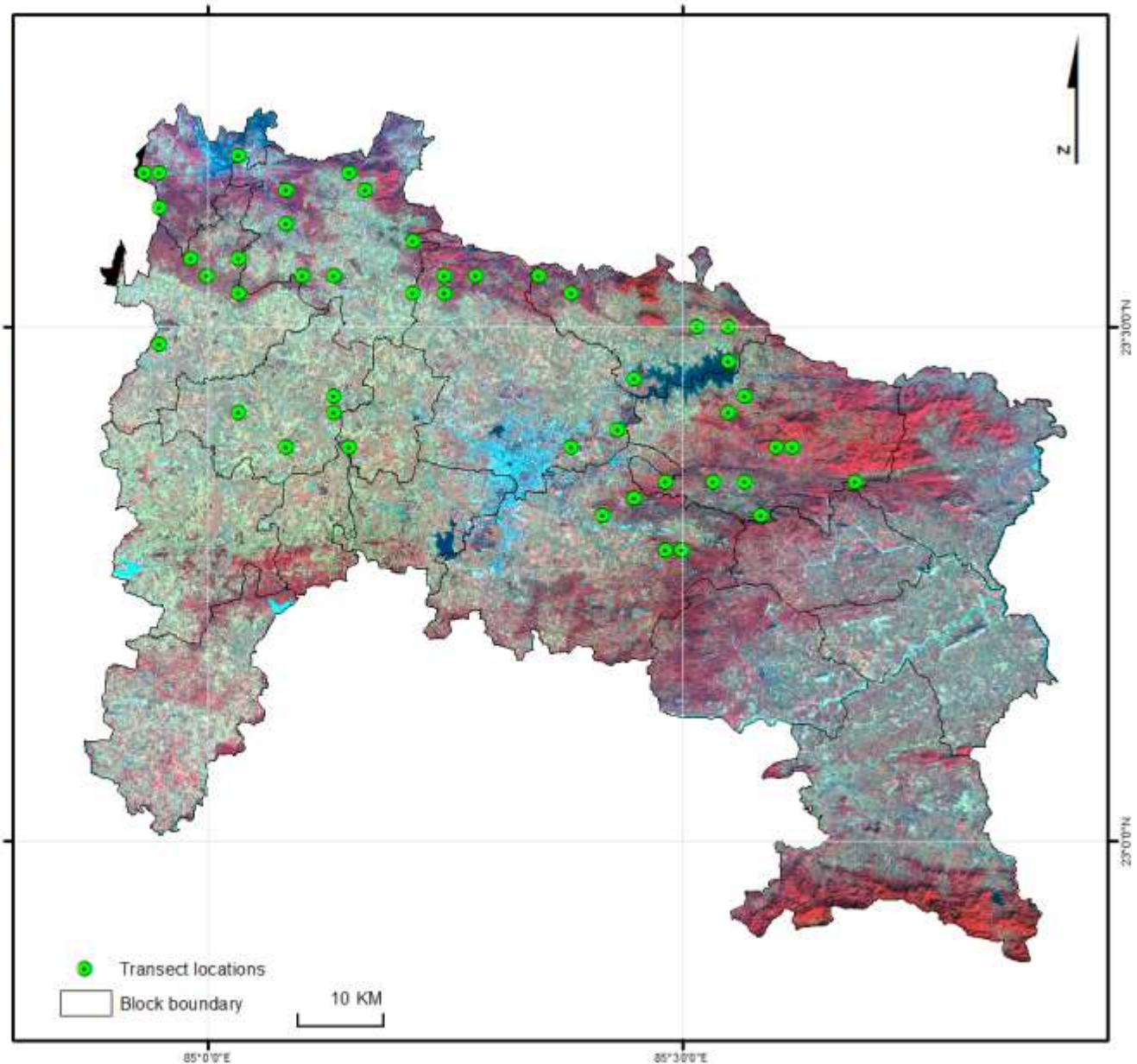
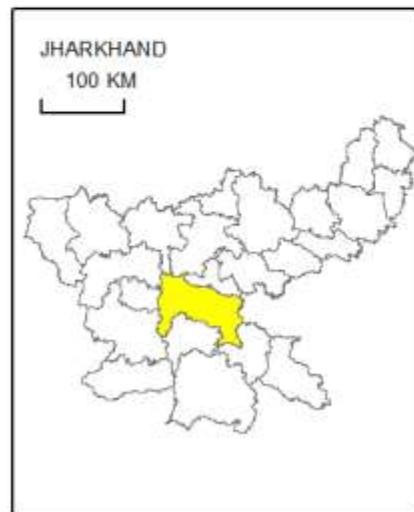
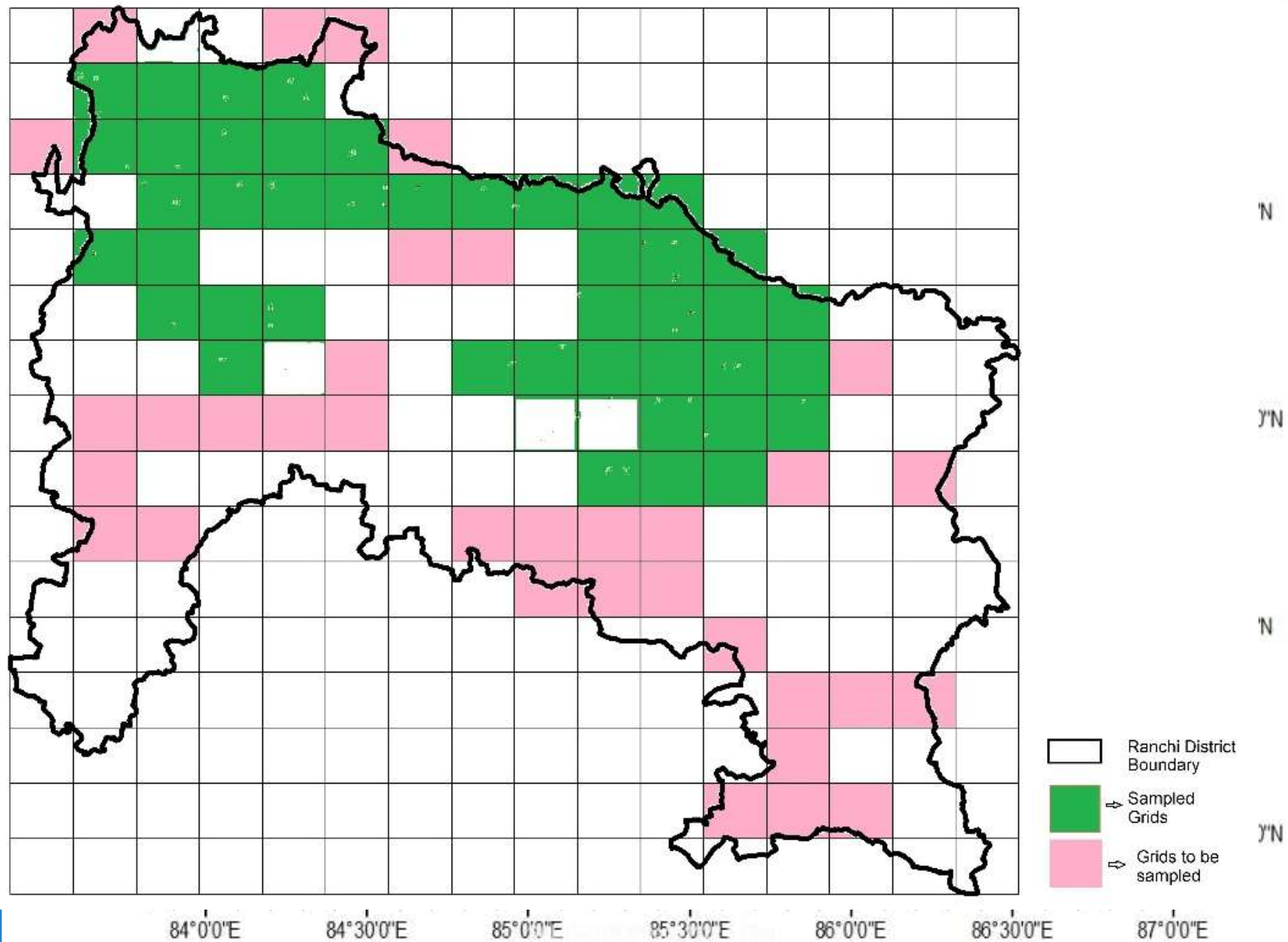


Figure: Map of the study site (Ranchi district, Jharkhand, India) showing the locations of studied transects.

Grid generation

- **All the topographical sheets of Ranchi were collected from Survey of India.**
- **Ranchi district is covered by 16 topographical sheets (73A/14, 73A/15, 73A/16, 73E/2, 73E/3, 73E/4, 73E/6, 73E/8, 73E/10, 73E/11, 73E/12, 73E/15, 73E/16, 73F/9 and 73F/13)**
- **Each topographical sheet (1:50000) is divided into 16 grids with the help of remote sensing software (ArcGIS)**
- **Size of individual grid is 4.5 x 4.5 km (20.25 sq. km.)**
- **Total no. of grids in Ranchi is 256 and 88 grids are under sal forests**



VEGETATION SAMPLING

- By belt transect method (Minimum one randomly selected transect per grid)
- Size of the transect is 50x100 m for trees
- Within the transect one 5x5m quadrat for shrub and two 1x1m quadrats for herbs and grasses

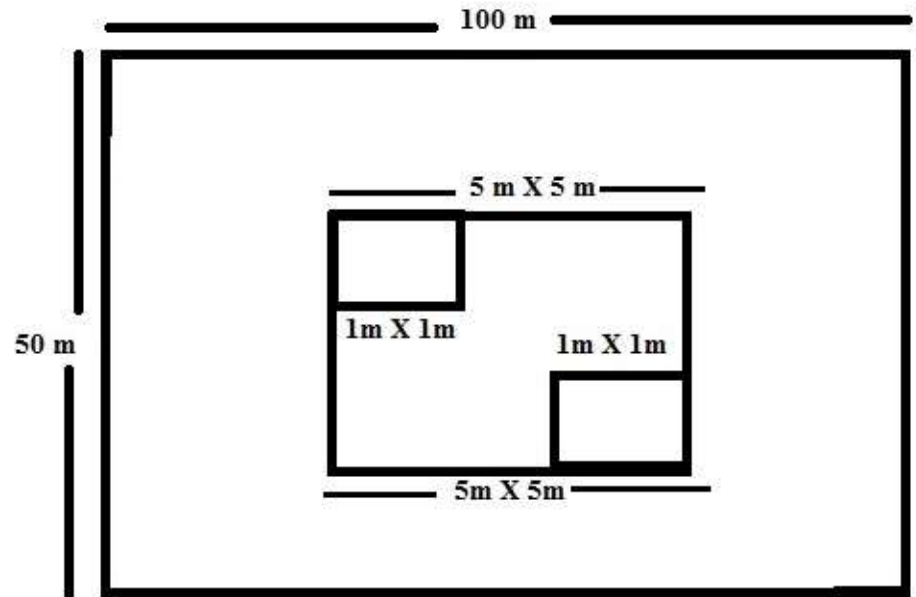


Figure: Sampling design of studied forests

FLORISTIC DIVERSITY

- A total 12812 individual of vascular plants are recorded, of which 9328 (73 %) is tree (>10 cm GBH), 1298 (10 %) shrubs and 2186 (17 %) herbs
- A total of 137 plant species belonging to 51 families, of which 20 species (18.18 %) are invasive and 90 (81.82 %) species are native to India.

Table: Community characteristics of sal forests of Ranchi, Jharkhand, Eastern India.

Community Characteristic	Tree	Shrubs	Herb
No. of families (identified species)	25	24	22
Species richness	78	25	34
Density (Individual ha ⁻¹)	397	11047	232553
Basal area of trees (m ² ha ⁻¹)	262.50	-	-
Diversity (Shannon's H')	-2.25	-2.72	-2.98
Concentration of dominance (Simpson index)	0.32	1.10	0.08
Evenness Index	-0.49	-0.76	-0.78
Species richness Index (Margalef index of richness)	10.28	4.88	5.85

- Fabaceae is the most dominant family with 17 spp. (08 spp. by Papilionaceae, 06 spp. by Caesalpinaceae and 03 spp. by Mimosaceae) followed by Rubiaceae with 08 spp. and Euphorbiaceae with 06 spp.

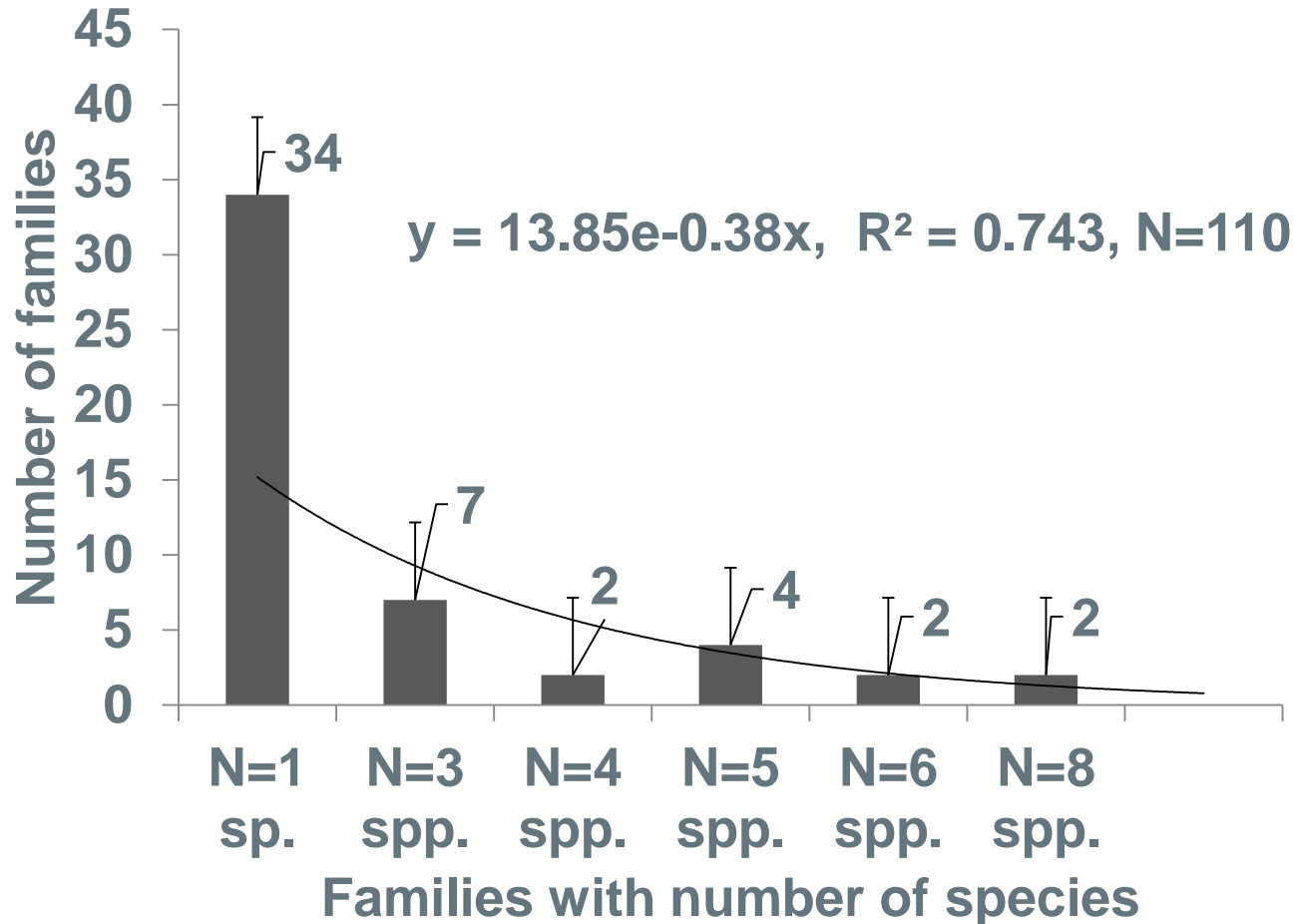


Figure: Distribution of families according to species number

Table 2: List of most dominant trees along with density, frequency, dominance and IVI

Sl. No.	Species	Family	Frequency	Density (individuals ha ⁻¹)	Dominance (m ² ha ⁻¹)	IVI
1	<i>Shorea robusta</i> Gaertn f	Dipterocarpaceae	100	313	206.10	167.29
2	<i>Diospyrus melanoxylon</i> Roxb.	Ebenaceae	72	16.2	4.66	13.04
3	<i>Buchanania cochinchinensis</i> (Lour.) Almeida	Anacardiaceae	62	11.1	5.58	11.04
4	<i>Madhuca longifolia</i> L.	Sapotaceae	47	9.1	8.18	10.05
5	<i>Lagerstroemia parviflora</i> Roxb	Lythraceae	51	6.2	4.91	8.50
6	<i>Mangifera indica</i> L.	Anacardiaceae	40	4.4	7.14	7.85
7	<i>Butea monosperma</i> (Lam.) Taub.	Papilionaceae	51	6.2	2.99	7.77
8	<i>Semecarpus anacardium</i> L. fil.	Anacardiaceae	36	3.7	2.13	5.33
9	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	38	2.3	1.04	4.77
10	<i>Cassia fistula</i> L.	Caesalpinaceae	36	1.4	1.01	4.19

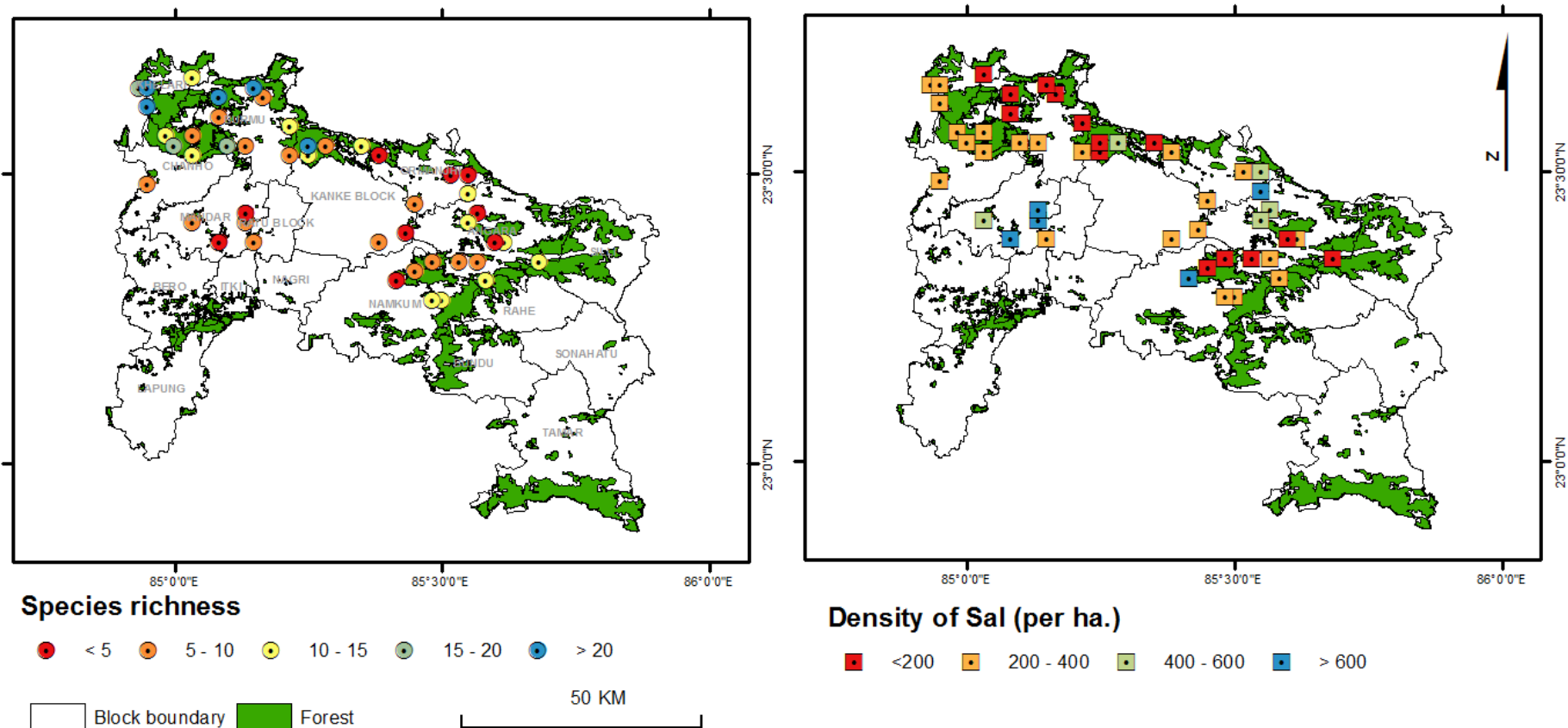


Figure: Map showing the species richness and density of Sal in different studied forests.

Rarity classes

- **Species are classified into different rarity classes on the basis of total number of individuals in all the sampled forests (kadavul and parthasarathy 1999)**
 - very rare (represented by a single individual)**
 - rare (2 to 10)**
 - common (11 to 25)**
 - dominant (26 to 50)**
 - predominant (>50)**

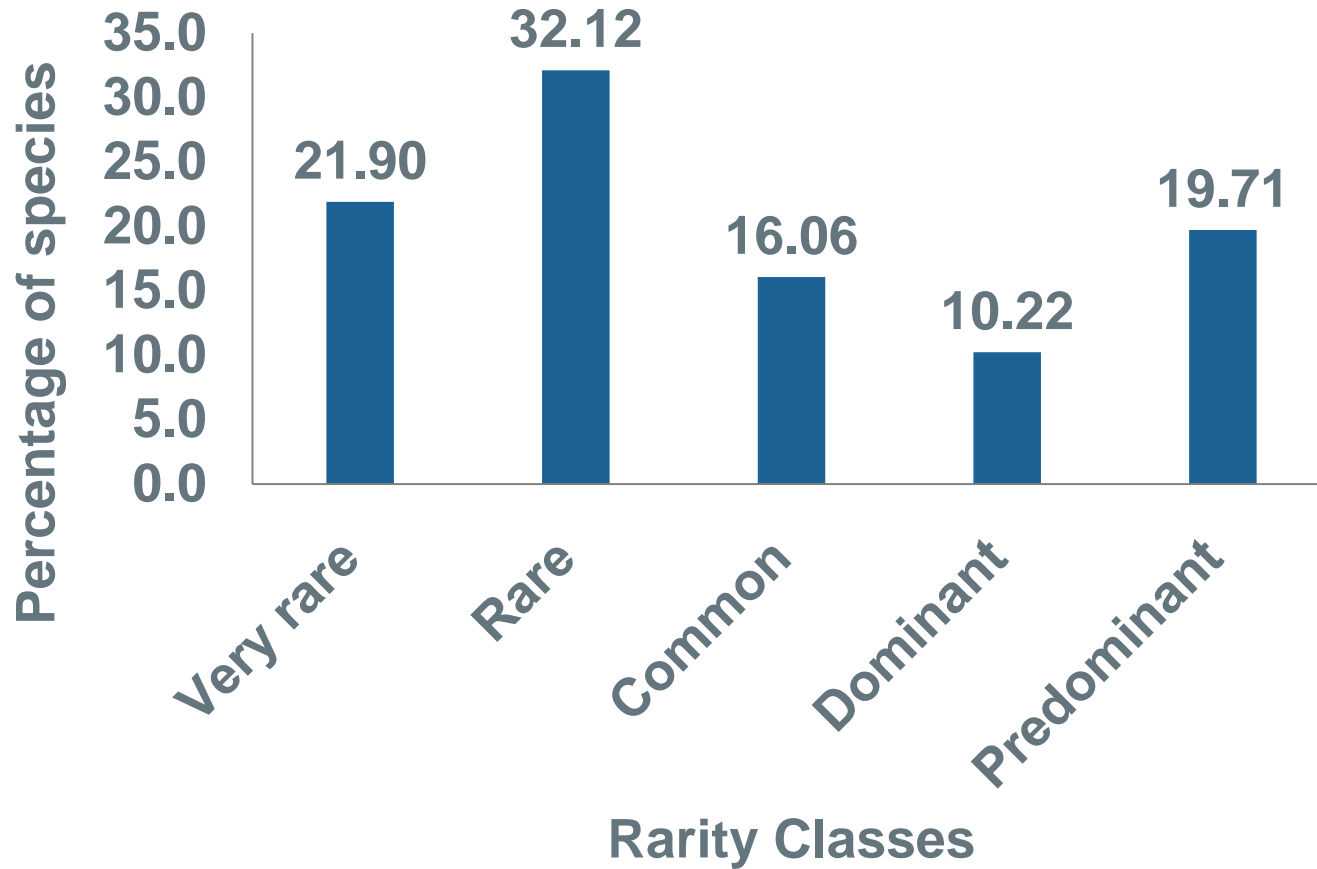


Figure: Percentage of species in different rarity classes in Sal forests of Ranchi, Jharkhand, Eastern India

Frequency distribution

- All the plant species are grouped into one of the five frequency classes based on the frequency distribution of the species according to Raunkier's law of frequency (Raunkiaer 1934):
 - FC 1/ A = 1-20 %,
 - FC 2/ B = 21-40 %,
 - FC 3/ C = 41-60 %,
 - FC 4/ D = 61-80 % and
 - FC 5/ E = 81-100 %.

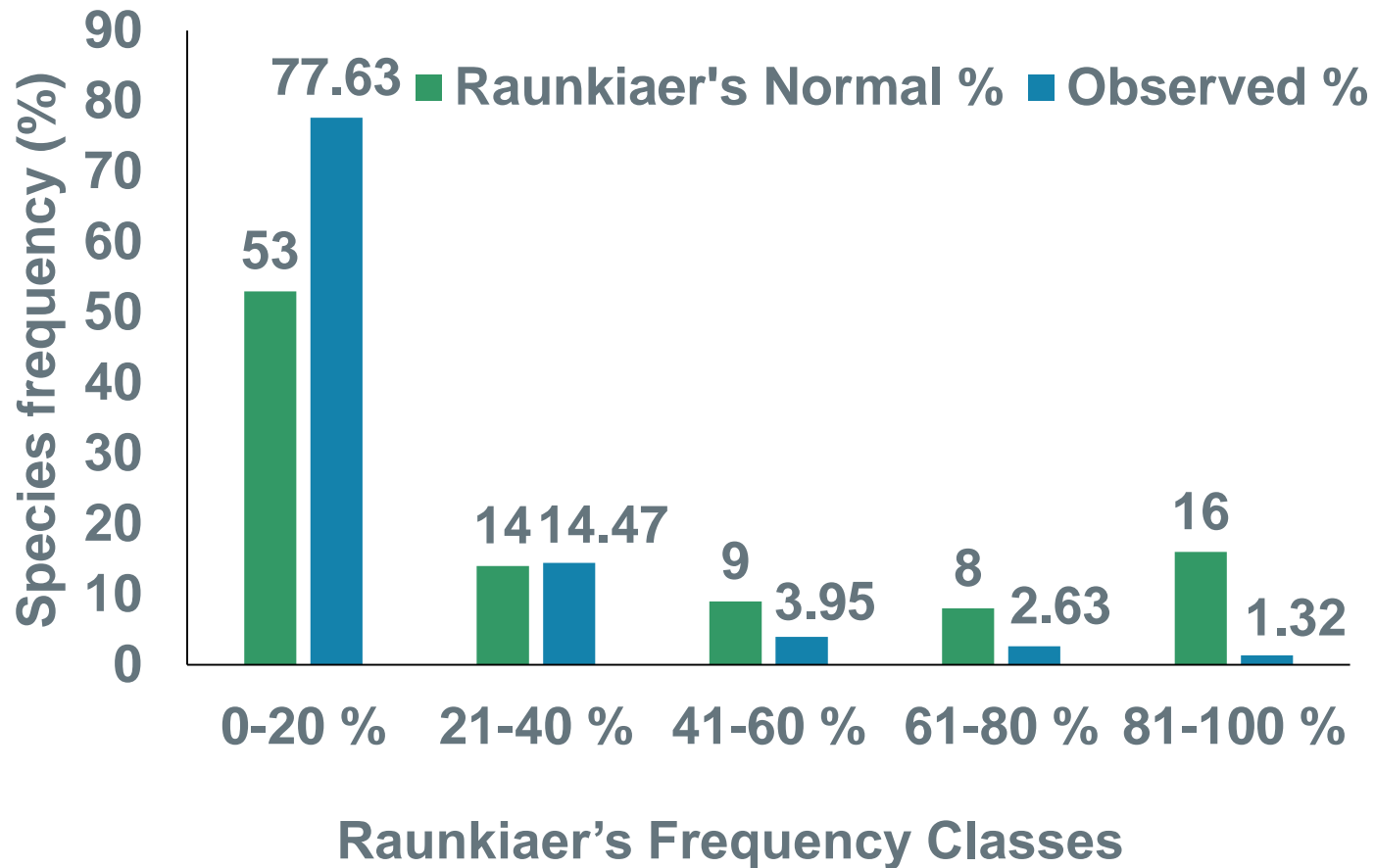


Figure: Comparison of species frequency distribution with Raunkier's normal

Life-form and Biological Spectrum

- **The life-form of each species recognized based on Raunkiaer's (1934) life form classification and are assigned a suitable life-form**
 - Phanerophytes (Ph): Buds at high up on the plant**
 - Chamaephytes (Ch): Buds close to ground**
 - Hemicryptophytes (H): Buds under soil surfaces**
 - Cryptophytes (C): Buds as bulbs and rhizomes**
 - Therophytes (Th): Seasonal seed producing plants**
- **For determination of the life-forms and analysis of the biological spectrum, Raunkiaer's system as modified by Braun-Blanquet (1951) has been followed. The percentage of each life form (biological spectrum) is calculated by using the following formula:**

% Life Form = Number of species in particular life form / Total number of species in all life forms x 100

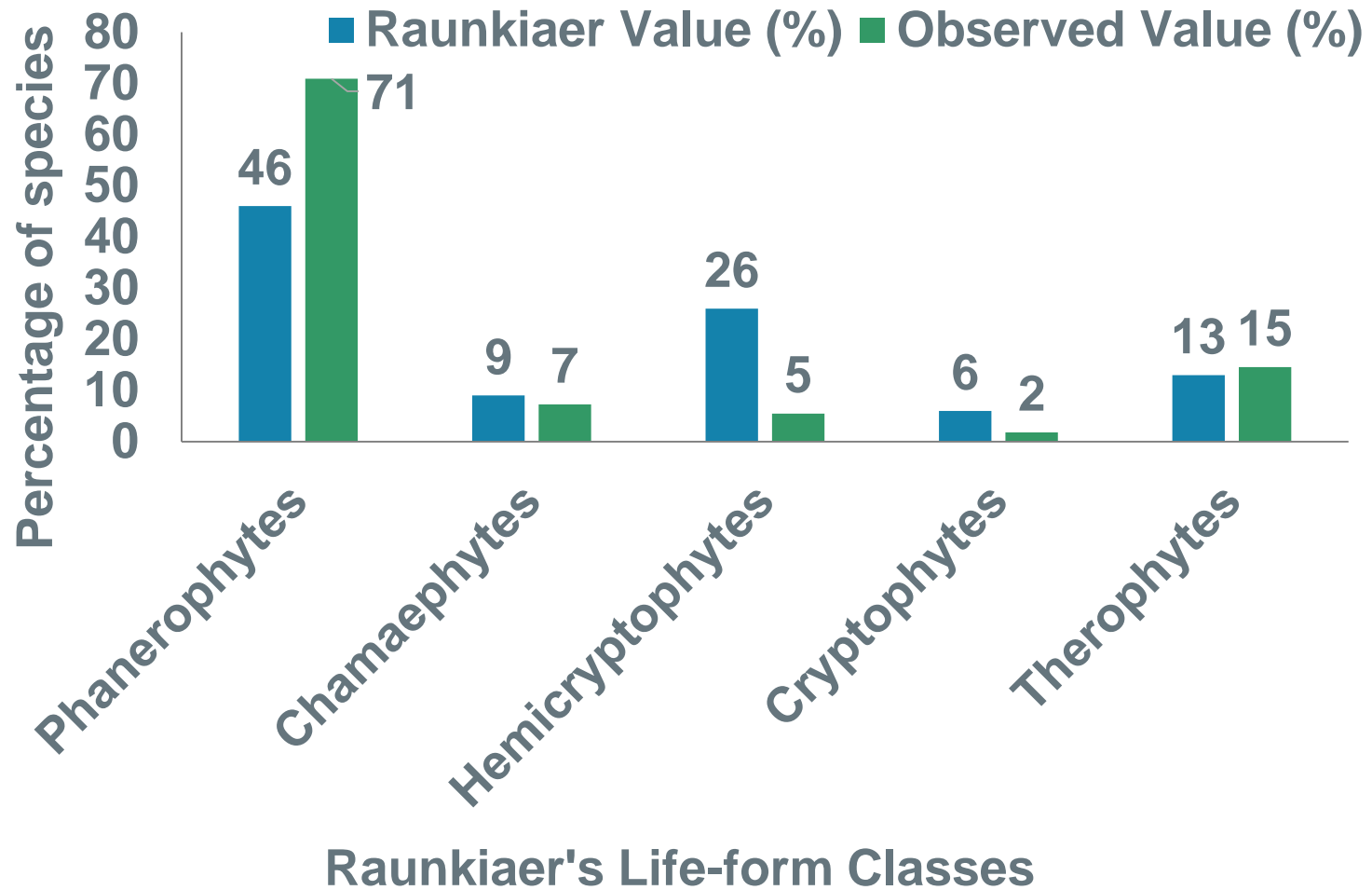


Figure: Comparison of biological spectrum of plants species with Raunkiaer's normal

Population structure was studied by grouping all the individuals into

- Seedling : (≤ 30 cm height)
- Saplings (<10 cm GBH and >30 cm height)
- Adults (≥ 10 cm GBH) into different girth classes

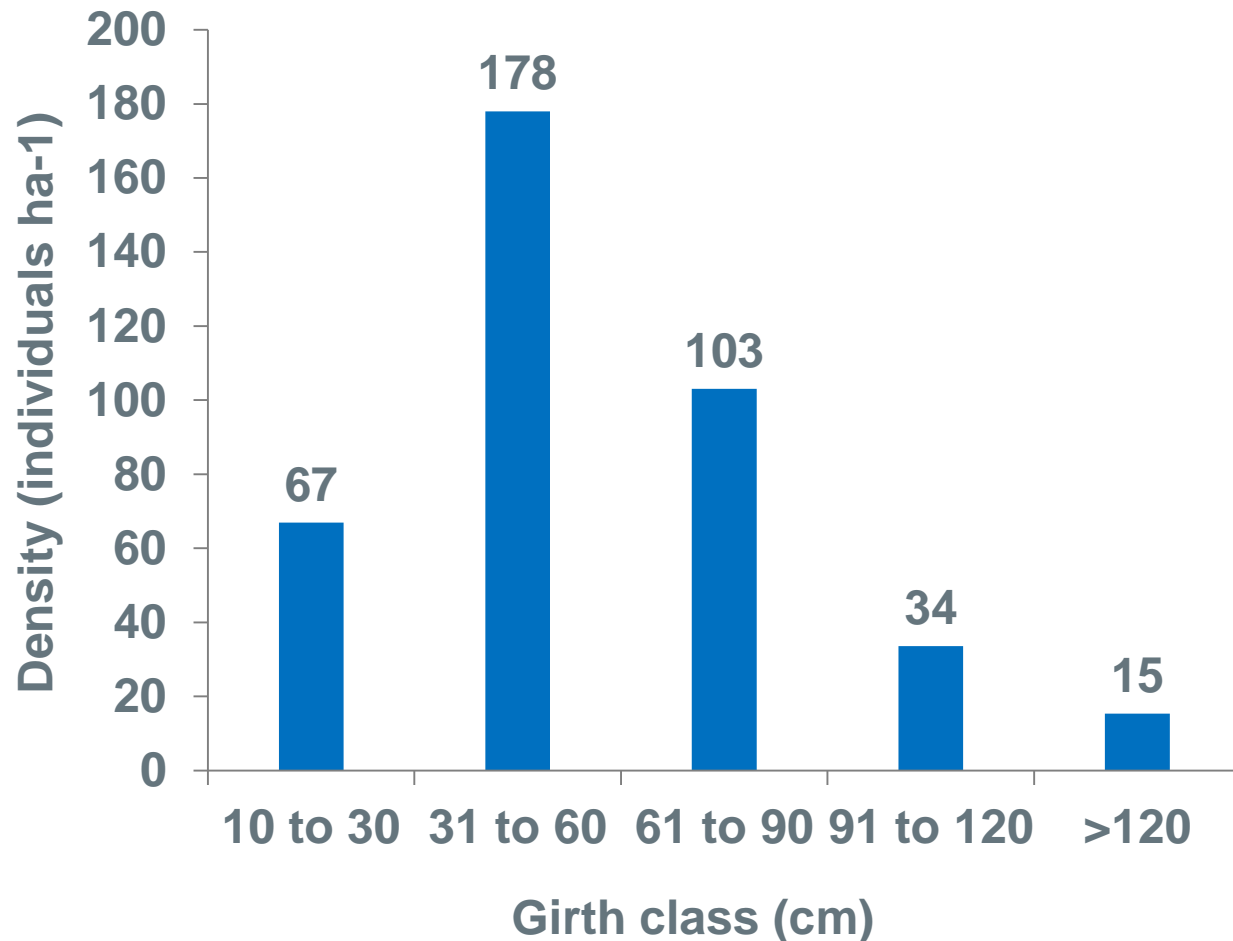


Figure: Girth class wise density (individuals ha⁻¹) of different tree species of Sal forests of Ranchi Jharkhand.

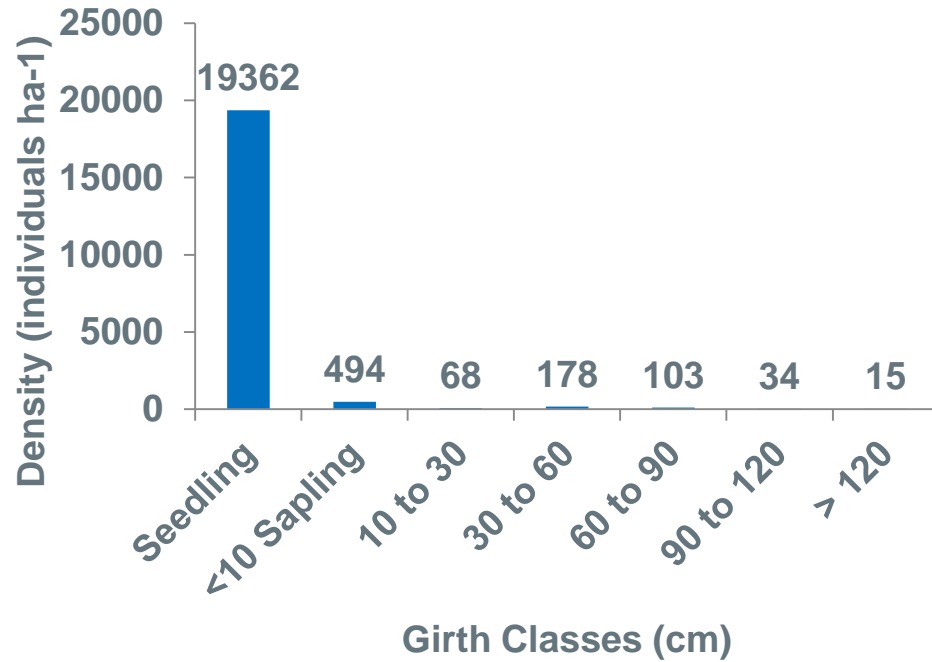


Figure: Density (Individuals ha⁻¹) of Sal in different girth classes

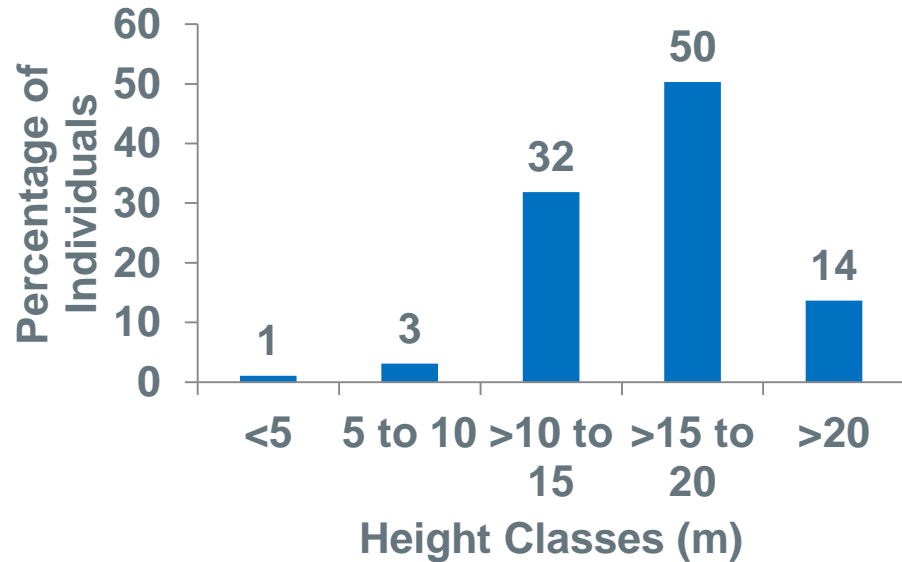


Figure: Percentage of Individuals of Sal (≥ 10 cm GBH) in different height classes in the 47 studied transects of Ranchi.

Stratification

- **Based on average height of the plant species, classified plants into different strata**
 - Emergent (>20 m),**
 - Canopy (>10-20 m),**
 - Understory (>5-10 m),**
 - Shrub (1-5 m, including saplings of the tree species)**
 - Ground (<1 m, including seedlings of both tree and shrub species)**

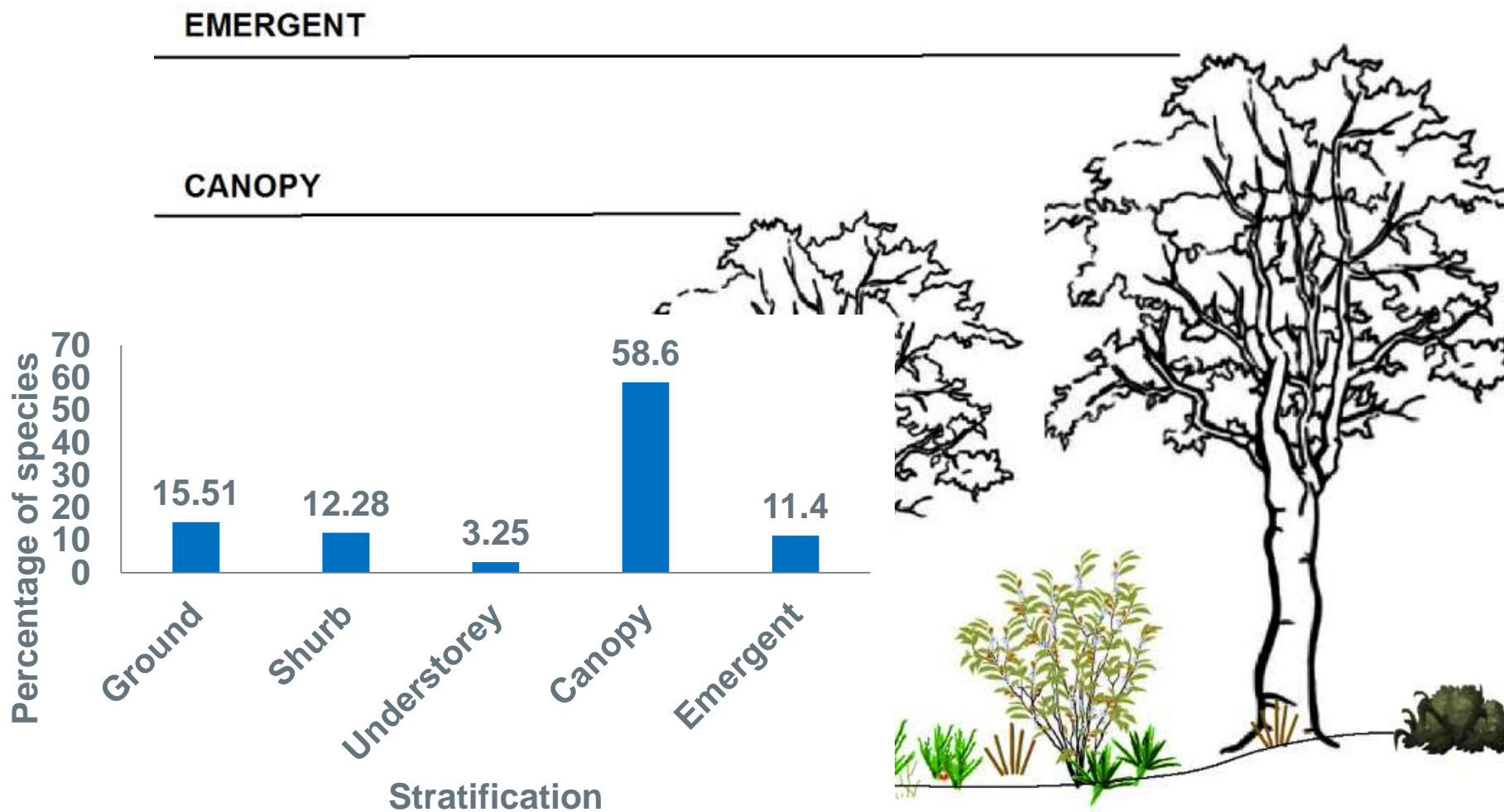


Figure: Percentage of species in different strata of the Sal forests of Ranchi

Figure: Schematic diagram of stratification in natural forest

CONCLUSIONS

- The phytosociological analysis clearly reveals that this sal forests is an extremely important ecosystem by the virtue of high richness and diversity (137 plant species).
- Some important plants of conservation concern are *Pterocarpus marsupium*, *Sterculia urens*, *Tinospora cordifolia*, *Asperagus densiflorus* and *Andrographis paniculata* etc.
- Observed percentage deviation from normal biological spectrum (with +2) in both chamaephytes (8%) and therophytes (15%) suggest that studied sal forests favorable for supporting various plants species
- In present study, species occurrence ratio were $A > B > C \geq D > E$, it does not match with Raunkiaer normal species occurrence reveals that sal forests of Ranchi is heterogeneous in nature

- On the basis of density of seedling, sapling and adults of different girth classes, *Shorea robusta* showed fair regeneration status (seedlings > trees > saplings) in the studied forests.
- But the studied forests showed good regeneration status (seedlings > saplings > trees)
- Out of the total 103 woody plant species (shrubs and trees) only 18 species (17.48 %) are regenerating which includes, *Shorea robusta*, *Alstonia scholaris*, *Lagerstroemia parviflora*, *Holarrhena pubescens*, *Sizygium cumini* etc.
- The forest management strategies should focus on the increasing demands of different timber and non-timber forest produce to conserve the plant diversity of these natural forests

Acknowledgements

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Thank You