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Phytodiversity and Natural Regeneration Potential of Sal Dominated Forests in Amarkantak Achanakmar Biosphere Reserve

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Abstract: ***Amarkantak Achanakmaar Biosphere Reserve is a predominantly tribal region; living close to forest tribals of this region are totally dependent on the forest for their daily needs. Several biotic and abiotic factors including poor regeneration, changing environment and edaphic factor along with poor regeneration affects health and establishment of phytodiversity nowadays. No systematic attempts were made to understand the dynamism of its natural regeneration and to suggest management inputs to encourage its regeneration. The present study deals with the regeneration status and population structure of two sites including core zone and buffer zone respectively of Sal dominating forest during 2015–18. Regeneration status of the forest was determined based on population size of seedlings and saplings. A total of 54 species of various families were encountered. Regeneration status in selected study sites is dissimilar. In the entire two sites, site quality It was good regenerating because of the high density of seedlings and saplings in core zone forest site. The results indicated that the average number of regeneration of seedlings per hectare worked out to be ha-^{1}, which are quite adequate in core zone than buffer zone. Other associates showed different growth patterns. Efforts are needed to conserve the forest for their diversity and existence.***

Keywords: Regeneration, Population structure, Core zone, Seedlings

1. Introduction

The number of population in the forest community and its future vigor is dependent on regeneration capability of plant species. The status of plant population and the persitance of existing species in future forest compostion are subject to abundant determine of various life period of an plant groups. Along these lines, a population of adult, sapling and seedling of plant species is elementary for enhanced carrying out and maintenance of a rational biological system.

In present site the regeneration studies, consider are in essential for forest restoration and their preservation. Understanding population structure and regeneration status of forest species is a significant for the help of both charecteristics and control forest.

The immeasurable majority of the population and regeneration think about for various sort of forest stay behind in central India were accounted for by different employee from the environment of Madhya Pradesh and Chhattisgarh together with reports from different pieces of the nation like northern India, Eastern Ghats, Western Ghats, and different locales of south India like Tamil Nadu.Andhra Pradesh and so onward. Nevertheless, not very many examinations on plant population structure and Regenerationy status of plant species in biosphere reserve were acunted for from middle Indian area. From this day forward, the present examination was embrace to break down the population structure and Regenerationy example of tree types of Amarkantal achanakmar Biosphere with the purpose that possible future synthesis of latent plant types of this biosphere of Madhya Pradesh and Chhattisgarh can be set up. The discoveries of the examination will include records quantitative information on population structure and Regenerationy status of plant types of Biosphere of Madhya Pradesh and Chhattisgarh specifically and tropical forest in general.

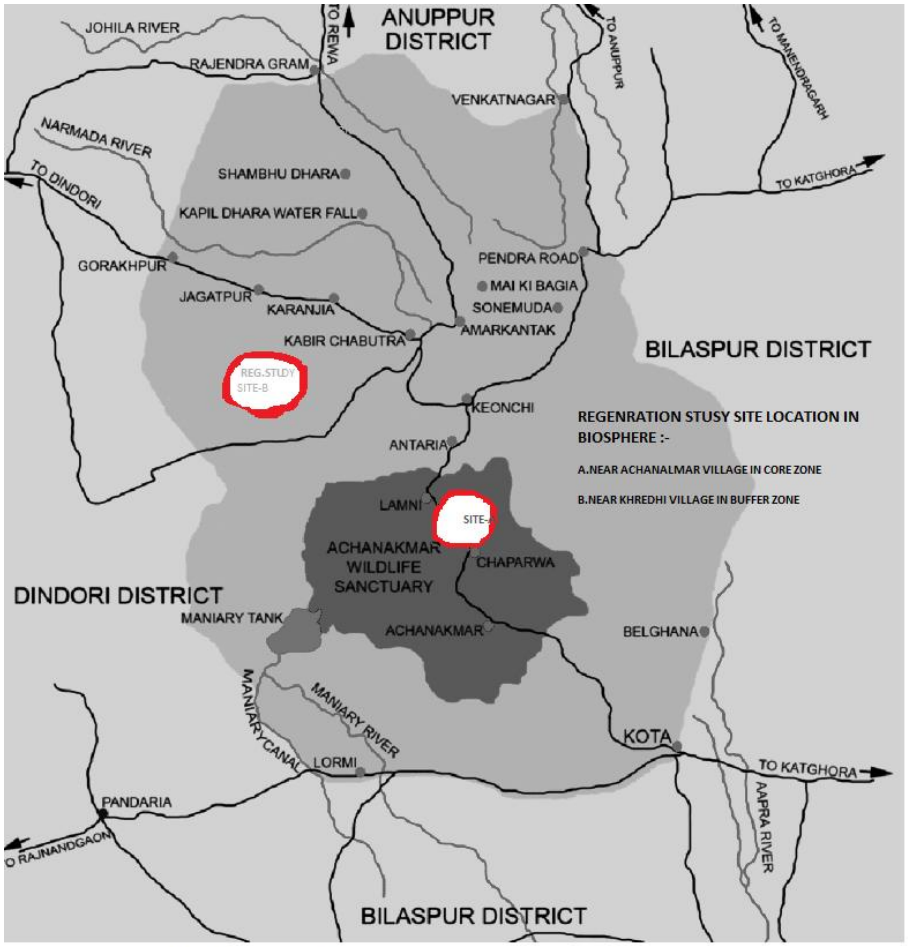
The purpose behind inadequacy to recover space in absence of practical seed creation, creepy crawly and being predation, difficult microclimatic condition, overgrazing, normal surroundings changes, and natural interruption. Successful Regenerationy guarantee whole deal sensibility of a Forest (Malik 2016). Regenerationy is fundamental in a Forest since it chooses future species piece and stocking. Exactly when the Regenerationy of any species is restricted to a particular extent of region conditions, the level of those conditions is an imperative determinant of that species' topographical scattering (Grubb 1977). The absence of adequate backwoods Regenerationy is a subject claimed by the two foresters and researchers (Mishra and Singh 2017), and there is a necessity for woods Regeneration and assurance (Vieira 2012). Regeneration and condition recuperation likewise depend upon Regenerationy limit (Pandey 2001), which plays a prompt and significant occupation in woods development and the official.

2. Study Sites

Achanakmar-Amarkantak Biosphere Reserve lies between 21^{0} 15' - 22^{0} 58' north lat. and 81^{0} 25'-82^{0} 5' longitude. It is all around associated by street from Bilaspur and Raipur in Chhattisgarh and Anuppur and Pendra street railroad station in Madhya Pradesh. Pendra Road, Belgahana and Kota are on the move zone and transport can be masterminded from these regions moreover.

A large portion of the domain of the anticipated Achanakmar-Amarkantak BR are either thick or open or corrupted and clear woods with made assorted variety together with horticulture fields in the middle. The save woods inside the BR is concerning sixty six of the generally

speaking land territory of the BR. Zonation of anticipated BR is determined to existing Indian life Protection Act and no new confinement are compulsory. It has intended to coordinate learning on eco-topographical angles, socio political economy of local networks, extent of decent variety and classes of Individuals United Nations office utilize it. The zonation wherever the ensure interior region, is covered by cushion zone clarify the phytobiological and socio reasonable autonomy among the regions.



REGENRATION STUDY SITES MAP LOCATION

3. Material and Methods

Plants Populations compositions of species was studied from 2016-2017 by cbh (Circumference at Breast Height, for instance 1.37 m over the ground) has been used to simply orders the subsistence sorts of the plants into three classes (for instance adults≥ 30 cm, sapling 10-30cm and seedling ≤ 10 cm). Individuals having ≥ 30 cm CBH were estimated as adults, Individuals species having ≤ 10 cm boundary border were considered as seedlings and those having the midway position with respect to these limits were considered as saplings (Knight, 1963). Phytosociological parameters of adults , sapling and seedling were determined as given by Mishra (1968).. For the examination, 100 quadrats of 10m x 10m were set down self-assertively in the survey examination site, covering a area of 1 ha region. The measure size of quadrats was settled dependent on species area curve (Mueller-Dombois and Ellenberg, 1974).

All the plant species practiced in each quadrat was recognized individuals were compute and every individual was estimated. Identifiable proof of seedling and sapling species depended on their ordered character with reference to adult species. The quantity of individuals and perimeter of every individual species practiced in every quadrat were utilized for supplementary quantitative examination.

The status of Regenration of plant species was settled and assurance subject to Plant populations size of seedlings, saplings and adults modified from Khan et al., Shankar and Khumbongmayum et al.). We seek after (Uma Shankar, 2001) to figure Regenration status with in different arrangements of tree living thing stages like (I) great (GR): if number of seedlings > saplings > adults regeneration,(ii) reasonable (FR): if number of seedlings > or < saplings < adults, (iii) poor (PR): if the species include exactly at sapling living structures, there are no seedlings (Number of saplings may be progressively, less or equal that of adults), (iv) no Regenration (NR): if Individuals of species are accessible just in adults structure and (v) new Regenration or not abundants (NA): Individuals of species have no adults just involve in seedlings or saplings. The thickness (100 m^{-1}) of adults, saplings and seedlings is considered to determine Regenration potential.

There are three life stages (adult grown-ups, saplings, and seedlings) of different select plant species in our Regeneration purposeful to teasing to their imaginable future species sythesis. The status of the Regeneration of plant species showed noteworthy contrast in the demography of seedling and sapling in study site of amarkantak achanakmar biosphere territory.

The general structure of the biosphere in the examination zone chosen plant species for Regeneration status involves 54 plant types of 49 genera in having a place various families. Plant population density(ha-^{1}) in three distinct stages has been appear in table.Table-1 &2)

4. Result and Discussion

Table 1: Phytodiversity floristic composition and Plant Regeneration staus at selected site-A

Species Selected for regeneration study	Regeneration Study Area-I (Core Zone Near Achanakmar Village) Density (ha^{-1}) and Status			
	Adults	Sapling	Seedling	Regeneration Status
1.* Acacia *nilotica (L)	1.21	-	-	No regeneration
2.* Adina *cordifolia	3.2	-	-	No regeneration
3.* Aegle *marmelos	18.72	*48.28*	903.23	Good
4.* Alangium *salvifolium Forsk.	25.23	14.50	693.1	Fair
5.* Andrographis *paniculata (L.)	1.21	137.93	724.14	Good
6.* Arisaema *flavom Forsk.	0.34	8.30	-	Poor
7.* Bahunia *variegata Roxb.	18.72	*48.28*	903.23	Good
8.* Bambus*a sp.	0.34	33.1	1931.03	Good
9.* Barleria *prattensis Roxb.	0.17	275.86	-	Poor
10.* Bauhinia *vahlii (L.)	1.72	41.38	706.9	Good
11.* Boswellia *serrata Roxb.	7.6	*9.3*	-	Poor
12.* Buchanania *lanzan	20.30	17.50	493.1	Fair
13.* Butea *monosperma	1.21	137.93	724.14	Good
14.* Caesalpinia *crista	1.03	195.86	2241.38	Good
15.* Cassia *fistula L.	30.34	16.55	793.1	Fair
16.* Cordia *macleodii	0.69	63.45	-	Poor
17.* Costus *speciosus	29.34	21.55	593.20	Fair
18.* Curculigo *orchioides	0.69	2.76	-	Poor
19.* Curcuma *amada	31.20	17.75	493.15	Fair
20.* Curcuma *aromatica	27.40	19.10	393.10	Fair
21. Diascoria sp.	4.48	11.03	-	Poor
22.* Digitalis *purpurea	-	-	68.97	Not Abundant
23. Dillenia *pentagyna*	-	52.41	-	Not Abundant
24.* Dioscorea *alata	1.03	13.79	-	Poor
25.* Diospyros *melanoxylon	7.41	477.24	2500	Good
26. Diospyros Montana(L.)	6.10	376.20	477.50	Good
27. Feronia limonia Forsk.	2.17	3.79	258.62	Fair
28. Ficus bengalensis L.	1.72	-	-	No Regenration
29. Ficus recemosa	3.1	-	-	No Regenration
30. Ficus variens	8.2	132	301	Good
31. Gloriosa superb	7.59	8.28	-	Poor
32. Haldinia cordifolia	-	-	-	Nil
33. Hemidesmus indicus	2.5	89	112	Good
34. Holerrhena antidysentrica	3.23	46	92.25	Good
35. Lagerstroemia parviflora	-	80	879.31	Not Abundant
36. Madhuca indica	22.17	17.79	258.60	Fair
37. Mallotus philippensis	20.17	13.79	5258.62	Fair
38. Mangifera indica L.	4.25	-	-	No Regenration
39. Mucuna pruriens	1.23	36	82.25	Good
40. Murraya koenigii	2.23	41	72.25	Good
41. Pterocarpus marsupium	30.34	16.55	793.1	Fair
42. Syzygium cuminii	4.23	23	52.25	Good
43. Schleichera oleosa	18.34	10.50	180.23	Fair
44. Semicarpus anacaredium	2.76	27.59	896.55	Good
45. Shorea robusta	527.59	1472.25	13724.14	Good
46. Sterculia urens	11.40	22.30	93.50	Fair
47. Terminalia arjuna	0.34	16.55	741.38	Good
48. Terminalia Belierika	29.50	26.55	712.40	Fair
49. Terminalia chebula	0.17	2.76	637.93	Good
50. Terminalia tomentosaRoxb	33.34	18.50	692.10	Fair
51. Thevetia nerrifolia	2.27	44	94.25	Good
52. Tinospora cordifolia	6.38	13.79	396.55	Good
53. Urgenia indica	-	-	-	Nil
54. Woodfordia fruticosa (L.)	1.23	21	42.25	Good
Total	**986.13**	**4223.04**	**41010.8**	

The plant species population density in three stages separately diverse very much as 986.13 ha^{-1} in adults, 4223.04 ha^{-1} in sapling, and 41010.8 ha^{-1} in seedling. Plant population densities in three different life forms (adults, sapling and seedling) at regeneration position of core zone area and buffer zone study sites were revealed in (table-32 &33). Tendency of population density in core zone was a great deal varied from buffer zone due to anthropogenic impact and harvesting pattern. The highest adult class density in core zone were record for Shorea *robusta* (527.59 plants ha^{-1}) follow by *Terminalia tomentosa Roxb* (33.34 plants ha^{-1}), Curcuma *amada* (31.20 plants ha^{-1}) and Cassia *fistula*, *Pterocarpus marsupium* respectively (30.34 plants ha^{-1}) whereas in sapling phase greatest sapling density was recorded for *Shorea robusta* (1472.25 sapling ha^{-1}) followed by Diospyros melanoxylon (477.24 sapling ha^{-1}), *Diospyros Montana(L.)* (376.2 sapling ha^{-1}) and Barleria *prattensis* (275.86 sapling ha^{-1}) and in seedling stage highest seedling density was recorded for *Shorea robusta* (13724.14 seedling ha^{-1}) follow by *Mallotus philippensis* (5258.62 seedling ha^{-1}),Diospyros melanoxylon (2500 seedling ha^{-1}) and Caesalpinia *crista* (2241.03 seedling ha^{-1}). in general population structure of plant species depending on size-class distribution yield reverse J-shaped density distribution curve in the present study site.

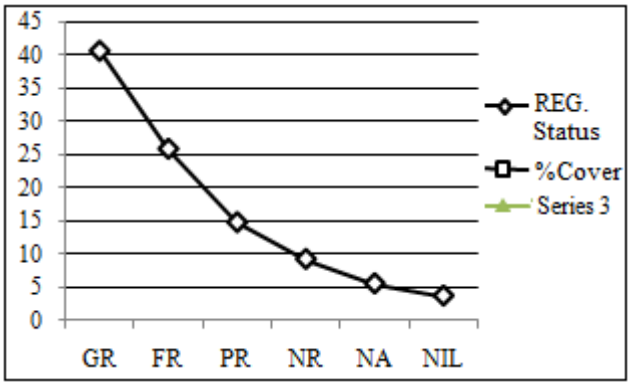


Figure 1: Showing Regenration status in core zone area study site-A

Table 2: Phytodiversity floristic composition and Plant Regeneration staus at selected site-B

Species Selected for regeneration study	Regeneration Study Area-I (Buffer Zone Near Khredhi Village) Density (ha^{-1}) and status			
	Adults	Sapling	Seedling	**Reg. Status**
1. **Acacia *nilotica (L)***	**9.2**	*0*	**0**	No regeneration
2. **Adina *cordifolia***	**NIL**	**NIL**	**NIL**	No regeneration
3. **Aegle *marmelos***	**8.72**	*28.28*	**403.2**	Good
4. **Alangium *salvifolium***	25.23	14.50	393.1	Fair
5. **Andrographis *paniculata (L.)***	1.1	13	24.24	Good
6. **Arisaema *flavom Forsk.***	0.2	6.30	-	Poor
7. **Bahunia *variegata Roxb.***	**6.4**	*8*	**13.6**	Good
8. **Bambus*a sp.***	0.2	-	-	No Regenration
9. **Barleria *prattensis Roxb.***	0.11	23	-	Poor
10. **Bauhinia *vahlii (L.)***	1.5	5	-	Poor
11. **Boswellia *serrata Roxb.***	**0.4**	*0.2*	-	Poor
12. **Buchanania *lanzan***	11.20	NIL	NIL	No Regenration
13. **Butea *monosperma***	1.7	14	28	Good
14. **Caesalpinia *crista***	1.2	18	27	Good
15. **Cassia *fistula L.***	0.29	10.2	0	Poor
16. **Cordia *macleodii***	0.5	33.40	-	Poor
17. **Costus *speciosus***	9.34	4	58	Fair
18. **Curculigo *orchioides***	0.2	3.2	-	Poor
19. **Curcuma *amada***	8.30	12.50	43	Fair
20. **Curcuma *aromatica***	20.40	8.10	83.10	Fair
21. ***Diascoria sp.***	.48	-	-	No Regenration
22. **Digitalis *purpurea***	-	-	8.91	Not Abundant
23. **Dillenia *pentagyna***	-	1.40	-	Not Abundant
24. **Dioscorea *alata***	.03	.72	-	Poor
25. **Diospyros *melanoxylon***	14	24	41.2	Good
26. ***Diospyros Montana(L.)***	**4.5**	37.10	**72.50**	Good
27. ***Feronia limonia Forsk.***	.18	.85	0.98	Fair
28. ***Ficus bengalensis L.***	2	-	-	No Regenration
29. ***Ficus recemosa***	**2.4**	-	-	No Regenration
30. ***Ficus variens***	**7.3**	12.5	**30.2**	Good
31. ***Gloriosa superb***	1.59	3.28	-	Poor
32. ***Haldinia cordifolia***	-	-	-	Nil
33. ***Hemidesmus indicus***	**1.5**	9	**11**	Good
34. ***Holerrhena antidysentrica***	**0.23**	4	**9.20**	Good
35. ***Lagerstroemia parviflora***	-	-	-	Nil
36. ***Madhuca indica***	13	0.4	0	No Regenration
37. ***Mallotus philippensis***	2	1	0	Poor
38. ***Mangifera indica L.***	**6**	-	-	No Regenration
39. ***Mucuna pruriens***	**.24**	6	**25**	Good
40. ***Murraya koenigii***	**.24**	4	**7.5**	Good

41. Pterocarpus marsupium	1	0	0	No Regenration
42. Syzygium cuminii	**1.8**	9	**3**	Fair
43. Schleichera oleosa	0	0.4	0	No Regenration
44. Semicarpus anacaredium	1.76	7.50	96.5	Good
45. Shorea robusta	32.2	144	457	Good
46. Sterculia urens	-	-	-	Nil
47. Terminalia arjuna	1	1	0	No Regenration
48. Terminalia bellirica	11	9	10	Fair
49. Terminalia chebula	0.6	4	1	Fair
50. Terminalia tomentosa	5	1.1	6	Fair
51. Thevetia nerrifolia	**.26**	4.4	**4.25**	Good
52. Tinospora cordifolia	2.38	3.79	6.55	Good
53. Urgenia indica	-	-	-	Nil
54.Woodfordia fruticosa (L.)	**1**	25	**1**	Fair
Total	219.88	515.12	8165.03	

Total of 54 preferred plant species, were studies set up in regeneration study of site-B in buffer zone area. The maximum adult density was record for *Shorea robusta*. (32.2 plants/ ha^{-1}) .The mean adult density was recorded for Dioscorea *alata*. (0.03 plants//ha^{-1}) and. The maximum sapling density was recorded for *Shorea robusta* (144 plants/ ha^{-1}) follow by Diospyros *Montana(L.)*(37.1 plants/), Cordia *macleodii* (33.4 plants/ ha^{-1}) Aegle *marmelos*,(144 plants/ ha^{-1}).The maximum seedling density was recorded for *Shorea robusta* (457 plants/ ha^{-1}) followed by Aegle *marmelos* (403.2 plants/ ha^{-1}), Alangium *salvifolium* (393.1 plants/ ha^{-1}), Semicarpus *anacaredium* (96.5 plants/ ha^{-1}).The highest adult density in regeneration study of core zone-B was recorded for Shorea *robusta* (32.2 plants/ ha^{-1}) while for regeneration study site-A in buffer zone area, the maximum adult density was recorded for Shorea *robust* follow by Terminalia *tomentosa Roxb* (33.34 plants ha^{-1}).

The adult density in both the study sites different very much and it was higher in core zone study sites than buffer zone site-B. The normal sapling density of core zone site-A was also higher than to buffer zone site. Seedling density moreover was higher in core zone than buffer zone.

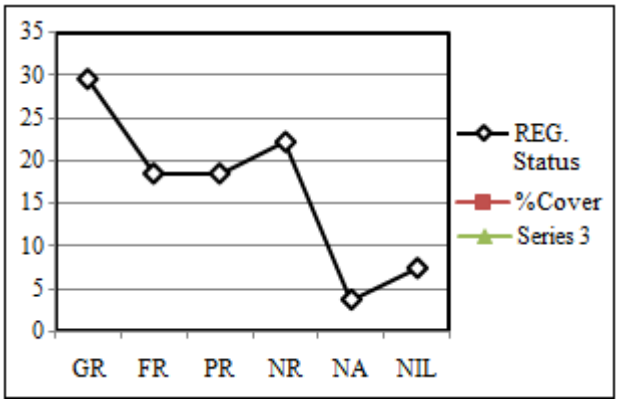


Figure 2: Showing Regenration status in buffer zone area study site

The density of seedlings and saplings is considered as a marker of the regeneration planned. The status of regeneration of species was determined dependent on population size of seedlings and saplings. The Species compostion, density and regeneration status of plant species were mulled over in two zone of Achanakmar-Amarkantak Biosphere Reserve (AABR) explicitly; zone A(Core Interior center zone) and zone B(Buffer Periphery support zone). The adult grown-up density, sapling density and seedling density was higher in zone A when appeared differently in relation to zone B. In both zone, exhibited decline switch J formed curve of regeneration status dependent on plant population of selected plant species for regeneration studies. The examination likewise clearly reveals changes influenced on the character and plant course of action of the biosphere spare in light of extending anthropogenic disrupting impact and synchronous changes in microclimate particularly in zone B of Buffer zone.

The regeneration status is concerned, maximum hierarchy of plant species was found with massive regeneration in the zone A (Core Area) than zone B (Buffer Zone) of the AABR. In the short-term, in Zone A, five plant species varieties, while as in Zone B twelve species were observed that not to regeneration. There was lower species organization, species density assorted variety, in the Zone B which is a bothered site, when contrasted and Zone A the uninterrupted site.

The present examination revealed that examination zone-A (center territory) has higher species densityand well-mannered diversity than surrounding zone think about site-B which shows that support zone (external and surrounded of center region) is being exposed to unsustainable manner collecting. Some significant economically and marketed value based plant species like Bauhinia vahlii (L.)Buchanania lanzan, Madhuca indica , Terminalia arjuna ,and Schleichera oleorosa etc.are the most exceedingly very bad affected in this practice of non convenient reaping. It is because of essence of much anthropogenic pressure brought about by the close-by tribals villagers in the cushion of biosphere.

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