INFLUENCE OF PODU CULTIVATION ON FLORAL DIVERSITY AND PRODUCTIVITY OF FOREST LANDS: A CASE STUDY OF MAREDUMILLI RESERVED FOREST OF EASTERN GHATS

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Abstract : ***A system of shifting cultivation commonly knows as podu has long been in practice in the forests of the Northern Eastern Ghats of India. This paper presents our study on influence of podu cultivation on floral diversity and productivity of forest lands with special reference to the Maredumili reserved forest area of Eastern Ghats, which is a fringe area of Papikondallu National Park, Andhra Pradesh. Studies on Vegetation and productivity where carried across the different age gradients of 0 -5, 6-10, 11-15 and 16 < above years of podu abounded lands compared to the less disturbed forest region. Results revealed the uniqueness of less disturbed forest lands in terms of both Species richness and productivity rates where podu abounded lands of age 0-5 Years showed less diversity and productivity rates. Field surveys and focus group discussions helped us in understanding the increased frequency of land Rotation cycles with intervention of Forest Rights Act in the region and in conserving the forest lands along with identification of Socio-Economic factors which influenced the Monoculture plantations in the recently abounded podu sites of the study area.***

IndexTerms - Podu cultivation, Floral Diversity, Productivity, FRA, Socio -Economics.

I. INTRODUCTION

Some of India's poorest groups, the Scheduled Tribes or *adivasis*, live in the Eastern Ghats. In Andhra Pradesh, although the *Adivasi* land itself is protected by law from outside exploitation(Oskarsson 2013), the forests maybe under threat of deterioration, one of the reasons being shifting cultivation(WildlifeManagementDivision 2002). Over the years, the *adivasis* have been practising shifting cultivation, known in local language as *podu***.** The traditional practice is to cultivate for a few years, let the land lie fallow, allowing it to regenerate and practice cultivation elsewhere before returning to the same patch of land(Ranjan & Upadhyay 1999). The earlier fallow cycle of 20 – 30 years has now reduced to 2- 3 years, owing to more land being required for cultivation(Ranjan & Upadhyay 1999). In this study, we aim to find out the influence of *podu* cultivation on the floral diversity and productivity in the forest lands of Maredumilli in Eastern Ghats. In View of the above the present study was aimed to study the following objectives to investigate the influence of podu cultivation on the native state of forest.

1. To study the influence of variation across *podu* lands and forest lands that have been abandoned for different periods of time interms of floral diversity and productivity.
2. To investigate the human interference or management influence on the conservation of forest lands.

II. Study area

Present study area falls near the middle region of Eastern Ghats, in the Maredumilli Reserved Forest area (17.3541N, 81.4243E) consisting of dry and moist deciduous forest types, coffee plantations, teak monocultures(Beehler et al. 1986), presence of large areas with bamboo and of primary interest to our study, *podu*s. The area receives an annual rainfall of 714.94mm as per 2002 records. (WildlifeManagementDivision 2002). We sampled three *podu* sites, two of which had been abandoned (i.e., not being actively used for cultivation or being managed), the third being planted with fresh crop as recently as in the last year. Additionally, we sampled a final relatively less disturbed plot in the forest, to compare floral density and productivity with the values measured in the *podu* plots.

III. Selection of sites

Selection of sites was carried with the help of primary field survey in Muddaluru, Koduru, Kutravada and Booduluru villages of Maredumalli reserved forest area and the sites where identified to measure the gradient of vegetation and productivity across varied time scale of abandoned podu lands, and identified three different time scales of 10-15 years, 5-10 years and 1-5 years podu abounded lands in the study area, comparing these with a forest area which was considered as a control site which is of relatively less disturbed site .Details of the selected sites are described in Table 1.

Table 1. Details of sites selected to measure floral diversity and basal area

Site number	Site selected	Elevation (m)	Remarks
1	*Podu* abandoned for over 10-15 years	526 - 565	Lemon, yam and *Colocasia* were being grown there over the years. They abandoned the land over 10 years ago, citing lack of fertility and herbivory

			from wild boars. Additionally, there is no patta for such lands.
2	*Podu* abandoned for over 5 – 10 years	435 - 436	They have planted cashew and are not managing it for over the last five years
3	*Podu* in use at present, last clear-felled 1 – 5 years ago	455 – 472	At the time of study, they have planted *Citrus limon*(*dabba*). The site has a few mature trees of lime and cashew which haven't been clear-felled in the land at the foothills. The site continues at an elevation, which appeared to be better managed, and a monoculture of *Cassia auriculata*
4	"Natural" forest	446 - 464	

IV. Methodology

A random stratified sampling line transition technique was used to quantify the vegetation diversity of the area where different plots were laid for trees, shrubs and herbs, as detailed in Table 2.

Table 2. Details of plot sizes and repetitions

Survey of	Plot size (m^2)	Repetition	Repetition within
Trees	5 x 20	3	Site
Shrubs	5 x 5	2	Tree plot
Herbs	1 x 1	2	Shrub plot

In each tree quadrant, the diameter at breast height (dbh; i.e. at 1.3 m above ground level) of each tree (>30 cm dbh) was measured, and individuals with dbh <=30 cm were recorded as saplings(Pande et al. 1988). Seedlings and saplings were included as herbs and shrubs, respectively.

4b. Data analysis

The data collected during the field studies were tested for significance using T-test module. Wood volume/carbon biomass of the trees was calculated using Allometric equations, and the parameters like species richness, abundance and density were computed and plotted using histogram.

V. Results :

Vegetative analysis

The study revealed a varied diversity of 18 tree species, 35 shrub species and 48 herbs across the study area of different age gradients.

5a. Density and species richness of trees

Abundance of trees across the study area didn't show any significant variations (Table 3), whereas the species richness tends to be higher in case of the forest (control site) and lower in the 1- 5 years' old *podu* site (Fig 1). The highest density of trees is observed under the 10 – 15 years' *podu* site and the lower value was reported at the 1 – 5 years' *podu* site(Fig 2).

Table 3. Richness & abundance of trees across *podu* lands and forest

Sl. No	Plot	Richness	Abundance	Density
1	10-15 Yrs	7	32	0.1067
2	5-10 yrs	4	25	0.0833
3	1-5 yrs	1	16	0.0533
4	Forest	9	21	0.0700

Fig 1. Species richness of trees across *podu* lands and forest

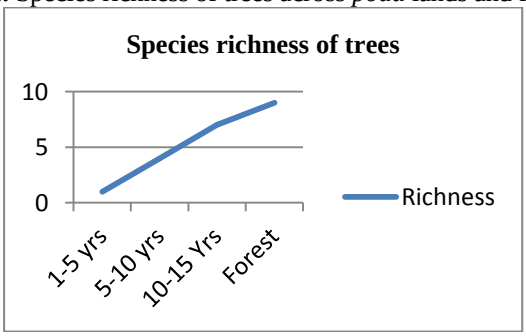
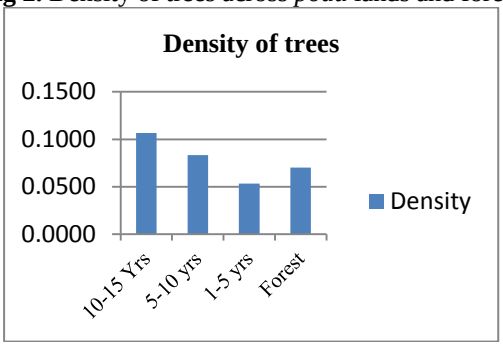


Fig 2. Density of trees across *podu* lands and forest



5b. Density and species richness of shrubs

The species richness tends to be higher in case of the 5-10 years and lower in the 1- 5 years and forest (Fig 3). The highest density of shrubs is reported under the 10 – 15 years' *podu* site and the lower value was reported at the forest plot (Fig 5).

Table 4. Richness & abundance of shrubs across *podu* lands and forest

Sl. No	Plot	Richness	Abundance	Density
1	10-15 Yrs	10	191	1.2733
2	5-10 yrs	12	186	1.2400
3	1-5 yrs	8	173	1.1533
4	Forest	8	106	0.7067

Fig 3. Density of shrubs across *podu* lands and forest

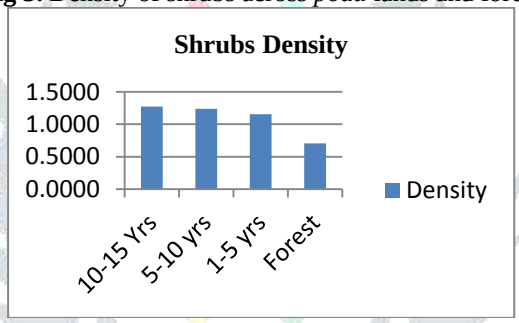
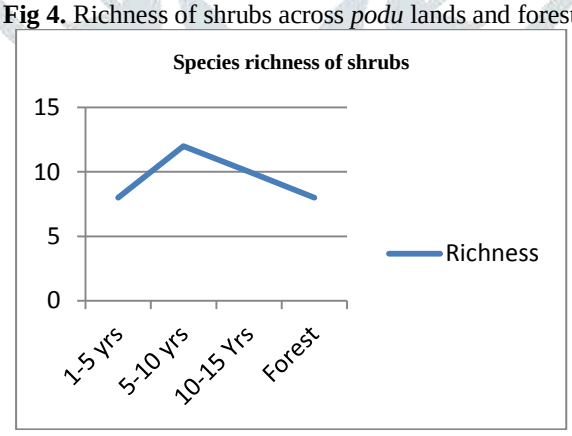


Fig 4. Richness of shrubs across *podu* lands and forest



5c. Density and species richness of Herbs

The species richness tends to be higher in case of the 1-5 years and lower in the forest (Fig 6). The highest density of Herbs reported under the 5 – 10 years' *podu* site and the lower value was reported at the 1-5 yrs podu site (Fig 3)

Table 5. Richness & abundance of herbs across *podu* lands and forest

S.No	Plot	Richness	Abundance	Density
1	10-15 Yrs	16	94	7.8333
2	5-10 yrs	11	139	11.5833
3	1-5 yrs	18	84	7.0000
4	Forest	10	105	8.7500

Fig 5. Density of herbs across *podu* lands and forest

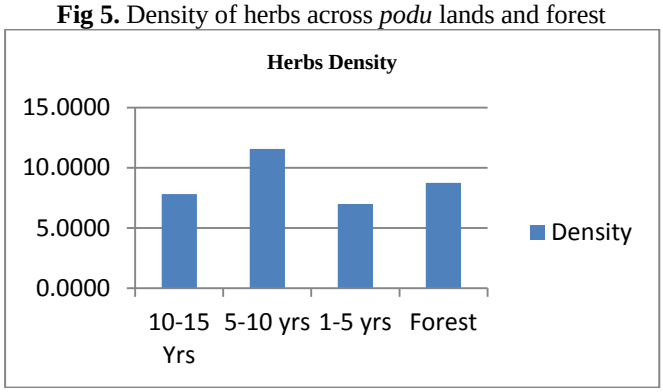
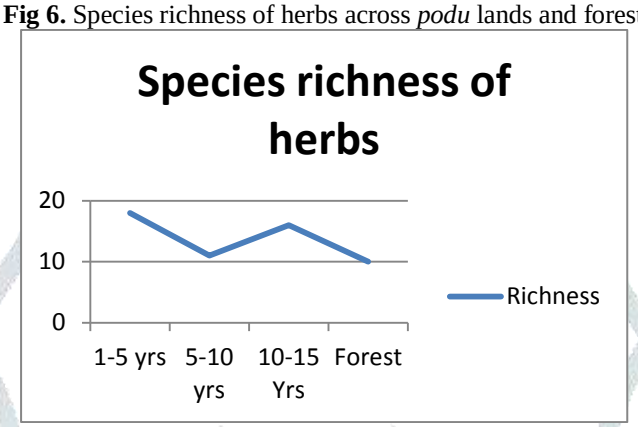


Fig 6. Species richness of herbs across *podu* lands and forest



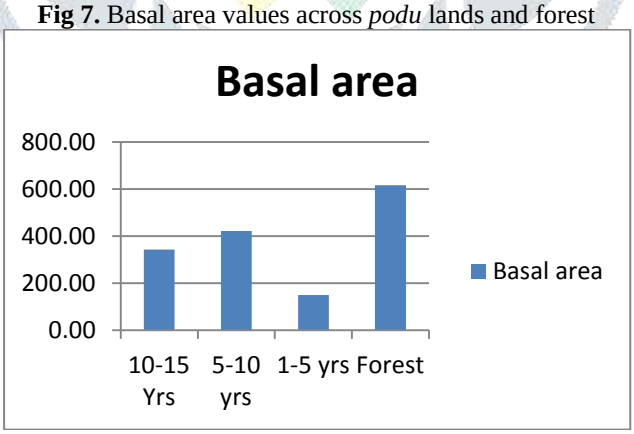
5d. Basal area Vs Age Gradient

The Basal Area showed a positive significance with increased age gradient where highest basal area was reported in forest land and lower in the 1-5 years *podu* site (Table 6).

Table 6. Basal area values across *podu* lands and forest

S.No	Plot	Species	Number	Basal area
1	10-15 Yrs	7	32	342.12
2	5-10 yrs	4	25	422.02
3	1-5 yrs	1	16	149.36
4	Forest	9	21	616.63

Fig 7. Basal area values across *podu* lands and forest



5e. T-Test Statistical analysis:

T test is employed for draw a statistical relationship between all the gradients like species richness, density, and basal areas with each other.

5f. Basal area vs Age Gradients

T-test showed a significance impact of basal area between Forest area and 1-5 years *podu* land

Table 7: T-test of Basal area vs Age Gradient

Plot	Forest	10-15 yrs	5-10 yrs	1-5 yrs
Forest	0	0.0321	0.0776	0.0006
10-15 yrs	0.0321	0	0.0658	0.0611

5-10 yrs	0.0776	0.4519	0	0.0174
1-5 yrs	0.0006	0.0647	0.0172	0

VI. Discussion

Study revealed that there is no significant deviation in abandoned *podu* lands comparing to the relatively undisturbed forest patch of Maredumilli region, but the factors like basal area and diversity followed a trend of positive relationship with the time scale, resulting in lower values of girth and natural diversity, whereas Herbs depicted a decrease in trend with increase in tree basal area and canopy.

Implementation of crop rotation and reduction in the abandonment period of *podu* land to a maximum of 2 years has encouraged the forest department to prevent additional forest lands from being converted in to agricultural lands. The interception of FRA over *podu* cultivation showed a positive relationship with both conservation and socio economic aspects of the forest and tribal communities, respectively. Institutions like ITDA and Girijan Primary Marketing Society (GPMS) play a crucial role in socio economic upliftment of the tribes in the region.

The local people are allowed to collect fuel wood outside the sanctuary, to meet their agricultural and domestic needs. GPMS holds the lease and the rights to collect a pre-determined list of non-wood forest produce. GPMS pays rent to the Government, which in turn, has fixed rates for the listed forest produce. The APGCS pays the local tribals with these rates(WildlifeManagementDivision 2002).This opens up an interesting observation regarding the *Cassia auriculata* monocultures observed in Site 3 right at the point of increase in elevation. The owner mentioned using *Cassia auriculata* as fuel-wood. However, the above insight from the management plan could explain the presence of monoculture. Also, site 1 which was abandoned over 10 years ago also indicated a higher density of *Cassia auriculata*. *Podu* seems to have achieved a different meaning, with crop rotation and abandoned plots being used for newer means of income, along with letting the land getting regenerated.

Though statistical deviations are very low in the cases of diversity and number of individuals, bells for conservation are ringing in the form of monoculture plantation techniques which was mostly used by the farmers of the region due to the large market values for *Citrus limon* and *Cassia auriculata*.

6b. Conservation relevance

Monocultures, over-harvesting of timber and non-wood forest produce are some of the main threats to tropical forests(Davidar et al. 2010), relevant to the questions discussed in this study. 247 million people in India harvest forest biomass for their subsistence or cash needs, according to a World Bank report(Davidar et al. 2010). 41% of Indian forests have lost a third of their productivity potential(Davidar et al. 2010). However, more and more studies are being done towards conserving community conserved areas, sustainable harvesting, livelihood security of communities and holistic biodiversity conservation(Kothari 2000). With *podu*s also moving further away from their traditional meaning, it means that shifting cultivation is here to stay, probably with crop rotation. A further study to find out the lesser of the "evils" in terms of selection of crops cultivated in *podu*, one might aim to answer the question whether a much diverse and abundant floral diversity can co-exist along with *podu*, so long as they ensure sustainable harvesting.

VI.Conclusion

There is no viable statistical difference between the diversity and distribution in *podu* lands compared to the forest site, but the trends of decreasing species richness of *podu* lands ring the bells for need of conservation of forest diversity being commercialised.

References

[1] Beehler, B. M., Krishna Raju, K. S. R. and Ali, S., 1986. Avian use of man-disturbed forest habitats in the Eastern Ghats. *Ibis*, 129: 197-211.

[2] Davidar, P., Sahoo, S., Mammen, P. C., Acharya, P., Puyravaud, J.-P., Arjunan, M., Garrigues, J. P. and Roessingh, K., 2010. Assessing the extent and causes of forest degradation in India: Where do we stand? *Biological Conservation*, 143: 2937–2944.

[3] Kothari, A., 2000. Conserving nature with communities. *Lessons from Real Life Experiences in South Asia*.

[4] Oskarsson, P., 2013. Dispossession by Confusion from Mineral-Rich Lands in Central India. *South Asia: Journal of South Asian Studies*, 36(2): 199-212.

[5] Pande, P. K., Bisht, A. P. S. and Sharma, S. C., 1988. Comparative vegetation analysis of some plantation ecosystems. *Indian Forester*, 114: 379-388.

[6] Ranjan, R. and Upadhyay, V. P., 1999. Ecological problems due to shifting cultivation. *Current Science*.

[7] WildlifeManagementDivision, 2002. Management plan of Papikonda Wildlife Sanctuary. Rajahmundry: Wildlife Management Division.