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Species Diversity of Agroforestry Systems in Patur Tehsil of Akola District in Maharashtra

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ABSTRACT

The present study was undertaken to assess composition and species diversity of different agroforestry practices followed by the farmers in Akola district during 2013-15. The list of 100 respondents from 10 villages of Patur tehsil were selected randomly where 10 farmers from each village were selected for the study. Exploratory design of social research, has been used.Vegetation analysis was done through quadrate sampling methods with 0.1% sample.Results revealed that the farmers are practicing eleven different agroforestry systems in their field namely: bund plantation, boundary planting, agrisilviculture, hortisilviculture, agrisilvipastoral, agrihortisilviculture, plantation along irrigation canal, kitchen garden, plantation near water sources, block plantation and scattered plantation. The result on vegetation analysis of agroforestry systems shows that total 13 Important Value Index values were listed for the trees. The IVI values ranged from 105.65 to 8.28.The lowest value was recorded for the *Acacia arabica* (19.84) while the highest value of IVI was recorded for the *Tectona grandis* (105.65), followed by *Azadirachta indica* (35.73) *Zizyphus mauritiana* (28.09) and *Mangifera indica* (22.64).*Tectona grandis* was the most frequently occurred tree species under rainfed situations (99%) The other important tree species grown in agro forestry under rainfed situations included *Acacia arabica, Acacia catechu, Butea monosperma, Dalbergia sisoo, Terminalia bellirica, Agle marmelos* and *Semcarpus anacardium.* Distribution pattern of species of given area recorded maximum 8.80 in *Dalbergia sisoo* and minimum 0.12 in *Tectona grandis.*

Key words:

Agroforestry systems, Distribution pattern, Importance Value Index, Species diversity

INTRODUCTION

Agroforestry is not a new system or concept. The practice is very old, but the term is definitely new. Nair (1993) defines Agroforestry as a land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible, and socially acceptable to the farmers.In this way, agroforestry

may be defined as the concurrent use of the land for agriculture, forestry, horticulture and also for raising livestock. It represent the optimum use of land(Negi 1999).

Maharashtra is the third largest state of India having the geographical area of 307,713 km^2, which constitute 9.4 per cent of the country's geographical area. In Vidarbha there are three ecozones namely Estern, Central and Western Vidharbha zone. The area of Akola district falls under weste in Vidarbha region of Maharashtra.

The detail knowledge of diversity of various species and careful selection of species and good management of trees crops are needed to optimize the production and positive effects within the system and to minimize negative competitive effects. (Umrani and Jain 2010). A tree based farming system as considerable potential to provide sustainable income to the farmers (Solaki and Bisaria 1999). Yet, the trees planted in agroforestry systems are excluded in formal definitions and statistics of 'forestry plantations' and overlooked in the legal and institutional framework for sustainable forest management. A paradigm shift is needed in the forestry sector and public debate to redress this oversight (Noordwijk et al.2003). The ecological and social interactions show the complexity of an agroforestry system and make it distinct from other land use system (Padhyaya et al. 2001). Because of multipurpose activity of agroforestry, it is complex in structure and involves a high degree of biodiversity (Torquebiau et al. 2002), on which sustainability also depends (John and Nair 1999).

Many models of different agroforestry systems are as followed by farmers in dryland as well as other ecosystems. The detail study on species diversity and different agroforestry components where in documentation of such traditional agroforestry systems will help in building the knowledge treasure of the science of agroforestry. It will be helpful in implementing some of the most promising agroforestry models directly on the farmer's fields. Therefore, it is essential that detail survey of traditional agroforestry systems is required to assess the present situation. Considering above, the study was conducted with the objective to study the composition of trees under different agroforestry systems in Patur tehsil of Akola district.

MATERIAL AND METHODS

The present study was conducted in Patur tehsil of Akola district in Vidarbha region of Maharashtra. Akola is a central part of the Amravati division. The district boundary latitude are20° 42' N latitude and 77° 02' E longitude . The climate is tropical with. temperature ranging from 10°C to 48°C and the annual rainfall from750 to 950 mm. The total area of Akola district in Vidarbha region of Maharashtra is 54341 km^2. The district has seven tehsils namely, Akot, Balapur, Patur, Barshitakli, Murtizapur, and Akola. Out of seven tehsil, Patur tehsil has been purposively selected for the study, because of the abundance in the vegetation in and around villages. Ten villages from Patur tehsil namely Shirla Andhare, Aastul, Pastul, Kothari (Khurd), Kothari (Budruk), Khanapur, Deulgaon, Bodakha, Malrajura and Sawarkhed were selected for the study. For the present study exploratory design of social research was used.

Agroforestry and vegetation survey was conducted to understand the different agroforestrypractices followed by farmers in their field regarding types of trees, preferred composition and diversity. For vegetation analysis, quadrate of 10x10m size were laid out with 0.1 % sample size. The vegetation analysis of the agroforestry systems in study area was carried out. In each quadrate, the name and number of each tree species were recorded. After collecting the data of various species, the value of frequency, density and abundance were determined for each species of the plant community according to the formulae given by Curitis and Mclntosh (1950) and Mishra (1968).On the basis of frequency, density and abundance, their values have been calculated with relative frequency, relative density and relative abundance, which were added for the determination of Importance Value Index (IVI) of each species.

The following formulae for the determination of relative frequency, relative density and relative abundance as given by Phillips (1959) were used:

$$\text{Relative Density} = \frac{No.of\ individuals\ of\ a\ species}{No.of\ induviduals\ of\ all\ species} X\ 10$$

$$\text{Relative Dominance} = \frac{Total\ basal\ area\ of\ a\ species}{Total\ basal\ area\ of\ all\ species} X\ 100$$

$$\text{Relative Frequency} = \frac{Frequency\ of\ the\ species}{Total\ frequency\ of\ all\ species} X\ 100$$

IVI=Relative Frequency +Relative Density+ Relative Abundance

Distribution pattern of species gives an area whether species is clumped, uniform or randomly distributed. The distribution pattern of each species of selected forest stands was analyzed by using the ratio of abundance to frequency. A value below 0.025 was considered as regular distribution, between 0.025 to 0.050 as random and more than 0.050 as contagious distribution (Curtis and Cottom1956).

$$\text{Distribution pattern} = \frac{Abundance}{Frequency}$$

The data was collected carefully, examined before tabulation and simple statistical tools/method were used.

RESULT AND DISCUSSION

The data on composition to tree in farm land in ten villages of Patur tehsil of Akola district is given Table 1 and Fig 1.*Tectona grandis* was the most frequently occurring tree species under rainfed situations (99%) and irrigated situation (1%). *Azadirachta indica* was also found in rainfed situations (26%). The other important tree species grown in agro forestry under rainfed situations included *Acacia arabica, Acacia catechu, Butea monosperma, Dalbergia sisoo, Terminailia bellarica, Aegle marmelos* and *Semicarpus anacardium.* Local grasses namely *Pennisetum purpureum* and *Dichanthium annulatum* waere observed under rainfed situations (11%). The other important fruit yielding species noticed under rainfed situation were *Tamarindus indica* and *Emblica officinalis* (6%), and *Zizyphus mauritiana* (9%) and *Mangifera indica* (5%). Whereas, *Citrus reticulata* (49%),*Punica granatum* (13%), *Citrus aurantifolia* (12%), *Mangifera indica* and *Annona squmosa* (4%), *Pisidium gujava* (3%), *Musa paradisica* (2%),were found in irrigated situations.These results are similar to the findings of Rai and Shivashankar (1994), Devaranavadgi et al (2007) and Behara and Dhir (2007). Important Value Index (IVI) values are listed for 13 species which ranges from 105.65 to 8.28 (Table 2). The lowest value was recorded for the *Acacia arabica* (19.84) while the highest value of IVI was recorded for the *Tectona grandis* (105.65). Top five Important value Index in agroforestry systems was recorded in *Tectona grandis, Azadirachta indica, Zizyphus mauritiana, Mangifera indica and Acacia arabica*. Distribution pattern of species of given area shows that distribution was maximum for *Dalbergia sisoo* (8.80) and minimum in *Tectona grandis* (0.12). Brower and Zar (1984), Behara and Dhir (2007) studied the composition of traditional agroforestry system in Odisha and reported the similar results.

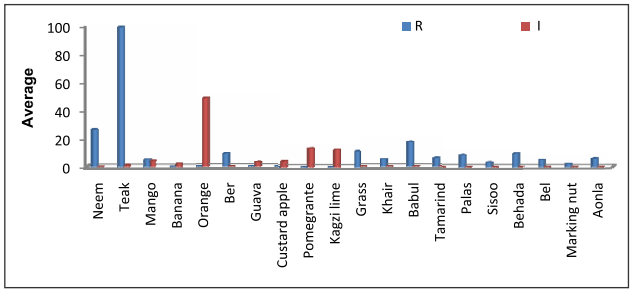

Figure 1. Composition of tress under different Agroforestry systems

Table 1. Composition of trees under different Agroforestry Systems

Percentage of respondents having components

Sr. No	Composition	Aastul		Pastul		Kothari (Khurd)		Kothari Budruk		Khanapur		ShirlaAndhare		Deulagon		Bodkha		Malrajura		Sawarkhed		Average	
		R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I
1	Neem	30		10		40		30		50		30		20		20		10		20		26	0
2	Teak	100		100		100		100		100		90	10	100		100		100		100		99	1
3	Mango		20			20				10		10		10	20							5	4
4	Banana												10		10							0	2
5	Orange		60		80		90		80		90		30		60							0	49
6	Ber			20				20		20				20						10		9	0
7	Guava						10		10						10							0	3
8	Custard apple				10				10				20									0	4
9	Pomegrante		40								10				80							0	13
10	Kagzi lime				10		30				10		60		10							0	12
11	Grass											10						100				11	0
12	Khair	20				10		10		10												5	0
13	Babul	20		10		30		20		20		10				20		30		20		18	0
14	Tamarind	30						20		10												6	0
15	Palas	10				20		10				20				10		10				8	0
16	Sisoo			20				10														3	0
17	Behada			30		10		10								20		10		10		9	0
18	Bel					20		10						20								5	0
19	Marking nut															10		10				2	0
20	Aonla			20						20		10								10		6	0

Table 2. Relative Frequency, Relative density, Relative abundance and Important Value Index of trees in agro forestry systems area.

Sr. No.	Species name	Scientific name	Relative frequency	Relative density	Relative abundance	IVI	Distribution pattern
1	Teak	*Tectona grandis*	45.59	54.5	5.56	105.65	0.12
2	Neem	*Azadirachta indica*	12.62	12.3	10.81	35.73	0.85
3	Ber	*Zizyphus mauritiana*	10.77	9.5	7.82	28.09	0.72
4	Bael	*Aeglemarmelos*	1.89	1.45	4.94	8.28	2.61
5	Babul	*Acacia Arabica*	7.58	5.67	6.59	19.84	0.86
6	Mango	*Mangifera indica*	3.77	2.81	16.06	22.64	4.25
7	Palas	*Butea monosperma*	3.14	2.34	3.39	8.87	1.07
8	Sisoo	*Dalbergia sisoo*	1.25	0.93	11.01	13.19	8.80
9	Khair	*Acacia catechu*	1.88	1.4	6.07	9.35	3.22
10	Tamarind	*Tamarindus indica*	1.93	1.14	7.72	10.79	4
11	Behada	*Terminaliabellarica*	5.13	4.22	9.68	19.03	3.70
12	Marking nut	*Semecarpus anacardium*	1.31	0.93	6.28	8.52	6.50
13	Aonla	*Emblica officinalis*	3.14	2.81	4.07	10.02	1.29
		Total	100	100	100	300	

CONCLUSION

The study shows that *Tectona grandis* was the most frequently occurred tree species under rainfed situations (99%) and irrigated situation (1%) in agroforestry whereas, *Azadirachta indica* was also found in rainfed situations (26%).

Important Value Index (IVI) values are listed for 13 species which ranges from 105.65 to 8.28 (Table 2). The lowest value was recorded for the *Acacia arabica* (19.84) while the highest value of IVI was recorded for the *Tectona grandis* (105.65). Top five Important value Index in agroforestry systems was recorded in *Tectona grandis, Azadirachta indica, Zizyphus mauritiana, Mangifera indica and Acacia arabica* Distribution pattern of species of given area shows that distribution recorded maximum under in *Dalbergia sisoo* (8.80) and minimum in *Tectona grandis (0.12).*

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