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Assessment of Trees Outside Forests in Ballia District of Eastern Uttar Pradesh, India

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ABSTRACT

A study was undertaken to assess the number of important tree species outside forests in rural areas of district Ballia, which is a commercial center and a consumption center for the tree based needs. The species selected were Teak (*Tectona grandis*), Mango (*Mangifera indica)*, Shisham (*Dalbergia sissoo)*, Mahua (*Madhuca longifolia)*, Neem (*Azadirachta indica*), Aonla (*Emblica officinalis*)) and Eucalyptus (*Eucalyptus* sp.). These species are very common species as Trees Outside Forests (TOF) in rural area of the district and out of six, Mango, Neem and Shisham are most demanded species of the region. The district Ballia has 2372 villages, out of which 23 villages (1 %) were taken for the study. The number of trees on the basis of girth classes was recorded in selected villages of respective blocks. In case of Teak, a total of 578351 trees, in Mango species, a total of 433320 trees, a total of 522848 trees in Neem, in case of Shisham, a total of 454319 trees, in Eucalyptus species, a total of 359395 trees, in case of Aonla, a total of 78202 and for Mahua, 86295 trees were enumerated in different girth classes. It was found that Mahua and Aonla trees were very less as compared to other species. Thus, introduction of these species in large areas / private land of farmer may be a viable option for minimizing demand supply gap as well as to increase the tree cover.

Key Words:

Afforestation projects, Agroforestry, Firewood species, Rural region, Timber

INTRODUCTION

It is estimated that over 90% of total wood availability for domestic and industrial use now comes from non-forest areas especially from the farm land and some from imports (Dhiman 2011). The Trees outside forests (TOFs) occur in natural and in cultivated landscapes and serve in a number of ecological and economic functions (Kleinn 2005). Trees

and other woody plants in the landscape serve also important ecological functions, particularly for the conservation of biodiversity, offering shelter and food, and nesting sites (e.g. Waltert et al. 2005); other ecological functions are erosion control, water protection and carbon sequestration (Khadanga and Jaykumar, 2018; Bhardwaj and Panwar, 2003). India with its diverse bio-geographical zone and varied agro-climatic conditions presents a unique scenario for the growth of tree species in varying situations. The TOF refers to trees on land not defined as forest or other wooded land and generally include trees on farmlands, in cities and human settlements, orchards, roadsides, pastures, banks of river, streams and canals and as shelterbelts which are less than 20m wide and 0.5 ha area (FAO 1998). It is now being increasingly argued that the role of TOF in providing food, wood and fuel to rural masses, carbon sequestration, prevention of soil erosion, biodiversity conservation, checking desertification, establishment of wildlife corridors and microclimatic stabilization, is quite substantial (Bhattarai 2000). The share of wood energy from non-forest land used for cooking in rural India is 59% while that of biomass energy is 90% (Saxena 1997). In another study, Rai and Chakraborty (2001) estimated that of the total fuel-wood requirement in India in 1996 (201 Mt), 51% (103 Mt) came from forestlands while the remaining 49% (98 Mt) came from non-forest lands.

Today, Indian agriculture faces diverse challenges and constraints due to growing demographic pressure, increasing food, feed and fodder needs, natural resource degradation and climate change (Dhyaniet al. 2013). Therefore, a management system needs to be devised that is capable of producing food from marginal agricultural land and is also capable of maintaining and improving quality of producing environment (Dobriyal 2014). Agroforestry system is one of the best known traditional practices and has an important role in reducing vulnerability, increasing resilience of farming systems and buffering households against climate related risks (CAFRI 2015), but there are several challenges that reap the benefits of agroforestry in India. The current area under agroforestry in India is estimated as 25.31 million hectares or 8.2 percent of the total reporting geographical area of the country by Dhyani et al. (2013); Dagar et al. (2014) and CAFRI (2015). As the population of India is increasing at a very fast rate; the land-holding size of farmers shrink at a very fast rate and agroforestry is the only way to optimize the farm productivity (National Agroforestry Policy 2014). It is generally well known that status of agroforestry in districts of Eastern plain region of Uttar Pradesh is in developing stage.

India's present forest policy envisages that one third of its geographical area should be covered under forest and plantation. The per capita forest in the country comes to about 0.07 ha. In U. P., forest cover including tree cover is 9.18 % of its geographical area. (FSI 2017).Thus, present study aims at collecting status of important tree species outside forests (TOFs) in rural areas of the Ballia district of Eastern Uttar Pradesh with a view to assess the availability of these Trees Outside Forests (TOF) to promote and guide the selection of these species in afforestation programmes by various agencies as well as by local people. This information may be helpful in selection of species while formulating afforestation programmes of U.P. The careful selection of these species in plantations by local people and various agencies will lead to sustainable availability of these species on long term basis.

MATERIALS AND METHODS

The study was undertaken in Ballia district located in eastern most part of the Uttar Pradesh state. The district comprises an irregularly shaped tract extending westward from the confluence of the Ganga and the Ghaghra, the former separating it from Bihar in the south and the latter from Deoria and Bihar in the north and east respectively. The boundary between Ballia and Bihar is determined by the deep streams of these two rivers. It is bounded

on the west by Mau, on the north by Deoria, on the north-east and south-east by Bihar and on the south-west by Ghazipur (Fig.1). The district lies between the parallels of 25°33' and 26°11' North latitudes and 83°38' and 84°39' East longitudes. The district has 17 blocks with 2372 number of villages.

The study on assessment of important trees outside forests in villages of district Ballia was conducted in the year 2018-2019.The species selected were Teak (*Tectona grandis*), Shisham (*Dalbergia sissoo*) Mango (*Mangifera indica*), Neem (*Azadirachta indica*), Eucalyptus (*Eucalyptus sp.*), Mahua (*Madhuca longifolia*) and Aonla (*Phyllanthus emblica*). The Ballia district is divided into six tehsils- Ballia (Sadar), Belthra Road, Bansdih, Bairia, Rasra, and Sikandarpur. A total of 1% villages were randomly selected for the study. The methodology adopted for conducting the survey was stratified random sampling to selected villages in respective tehsils. The species wise number of trees on the basis of girth class were recorded in selected villages of respective blocks.

A questionnaire was prepared and data sheets were field tested in a village. After the field-testing, the necessary changes were added and the data sheets were finalised for collecting information from the study sites. On structured questionnaire, girth class wise recording of trees was done for selected species. The villagers were assembled in a place as primary school, temple, panchayat and were asked questions regarding the selected trees existing in their village especially on farm bunds, village road side, pond side, homesteads and other locations too. By PRA technique, the villagers were asked to come along with the researchers using transect method for physical verification of species wise trees in the field. In large plantation patches, sampling method was done for recording of data.

The fieldwork was carried out as per the questionnaire in the selected areas. The observations were grouped on the basis of the 17 blocks of the district covering 1% of the total villages. In all 17 block, species wise number of trees were tabulated in respective girth classes *viz.* 0-30, 31-60, 61-90, 91-120, 121-150, 151-180, 181-210, 211-240, 241-270 and 271-300 cm. After combining data of all 17 blocks, the number of TOFs per unit village in rural area of district was assessed. On the basis of per unit village data, assessment for whole rural area of the district has been done for species wise total number of trees. The percent contribution of trees in each girth class was also estimated for respective species (Manhas et al. 2006).

Fig. 1. Map of Ballia district

RESULTS AND DISCUSSION

The tree species selected for the study were very common as Trees Outside Forests (TOFs) in rural area of the district. *Mangifera indica, Tectona grandis, Azadirachta indica* and *Dalbergia sissoo* were most demanded species of the region. The total enumerated tree species with respective girth classes in the district has been depicted in Table1 and Fig. 2 and3. The results clearly depicted complete picture of enumerated trees of selected species in the villages of different blocks of Ballia district. The most common tree species of the district included Teak (578351), Mango (433320), Shisham (454319) and Neem (522848), Eucalyptus (359395), Mahua (86295) and Aonla (78202) number of trees in different girth classes (Table 1).

Maximum Teak trees were found 31.87 % in 0-30 cm girth class, 29.93 % were in 31-60 cm and 29.67 % tree were in 61-90 cm girth class which comes under immature category of timber. Only 8.01 % of the trees and 0.50 % of trees were found in mature category of 91-120 cm and 121-150 cm girth class respectively. It clearly showed that despite of huge demand of Teak wood, its supply position is very limited. Hence, it carries a premium on its price. In present scenario, though its plantation is popular among farmers under agroforestry but more attention is required to be paid to enhance its acceptability by farmers for undertaking extensive plantation. Shisham was found 31.42 % in 0-30 cm, 24.05 % in 31-60 cm, 27.50 % in 61-90 cm, 12.25 % in 91-120 cm, 4.01 % in 121-150 cm and 0.05 % in 151-180 cm girth classes. The results clearly depicted that Shisham plantation is being taken up by the farmers on a regular basis during past years and its girth class distribution is a balanced one. It is second to Teak for timber value in popularity among farmers but farmers are not taking up its plantations in large numbers due to its mortality in water logged conditions.

In case of Mango 18.12 % trees were in 0-30 cm girth class, 20.96 % in 31-60 cm, 18.08 % in 61-90 cm, 6.01 % in 91-120 cm, 13.46 % in 121-150 cm, 5.62 % in 151-180 cm, 10.40 % in 181-210 cm girth classes and other girth classes were in less than 4 % range. The girth class distribution of Mango is very much wide and villagers were not taking up its plantations in large numbers. The young plantations were of mostly 'Kalmi' varieties which caters to the fruit value for commercial purposes while 'Biju' variety catered to the more fruit value for down trodden, timber, firewood and other intangible benefits. Out of total Neem trees, 21.57 % trees were in 0-30 cm girth class, 19.14 % in 31-60 cm, 26.44 % in 61-90 cm, 19.54 % in 91-120 cm, 9.48 % in 121-150 cm, 0.69% in 151-180 cm girth class. It is clear from the data that young plantations of Neem were not being adopted by the farmers.

In Eucalyptus, 22.31 % trees were found in 0-30 cm girth class, merely 21.30 % in 31-60 cm, 41.77 % in 61-90 cm, 9.03 % in 91-120 cm, 4.77 % in 121-150 cm. and other girth classes were negligible. The status of Eucalyptus is very criticalin the district. Thus, to maintain sustainable availability of the species in future, its young plantation should be taken up. Likewise, in case of Aonla, 33.38 % trees were in 0-30 cm girth class, 39.76 % in 31-60 cm, 23.90 % in 61-90 cm, 2.94 % in 91-120 cm. This has created more pressure for fuel wood on timber and fruit species. Its large scale plantation should be taken up.

For Mahua, 1.05 % trees are found in 0-30 cm. girth class, 2.66 % were in 31-60 cm, 11.33% in 61-90 cm, 30.10 % in 91-120 cm and 13.39% trees in 121-150 cm girth classes. The girth class distribution of Mahua is very much wide and young plantations are not taking up by the villagers. Mostly trees of Mahua were old aged and results indicated that an important species of timber was found rare in villages. Majority of the farmers have adopted Teak on their farm bunds

Table 1. Species wise total number of trees in the district Ballia

S. No	Girth class (cm)	Teak	Shisham	Mahua	Eucalyptus	Aonla	Mango	Neem	Others
1	0-30	184338	142792	908	80186	26111	78556	112814	146480
2	31-60	173122	109296	2304	76562	31094	90864	100125	118002
3	61-90	171618	124976	9778	150121	18697	78377	138259	98052
4	91-120	46364	55672	25979	32477	2300	26078	102197	94742
5	121-150	2909	18231	11559	17169	0	58332	49595	54564
6	151-180	0	245	8151	1280	0	24392	3636	2612
7	181-210	0	1270	19141	1600	0	45102	9902	32943
8	211-240	0	560	3589	0	0	11246	2400	13454
9	241-270	0	1109	3606	0	0	15693	3920	4768
10	271-300	0	168	1280	0	0	4680	546	569
Total trees		578351	454319	86295	359395	78202	433320	522848	565617

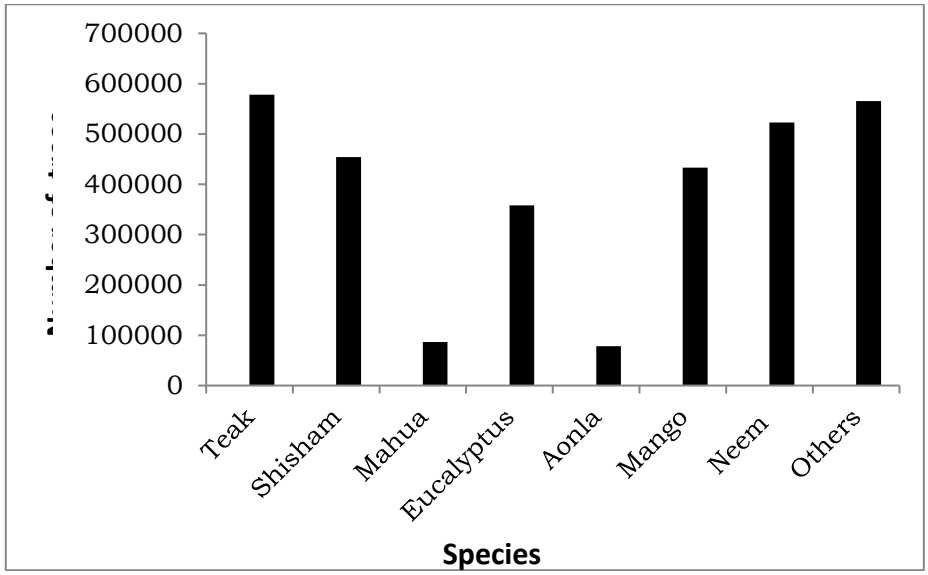

Fig. 2. Species wise total no. of trees in Ballia district

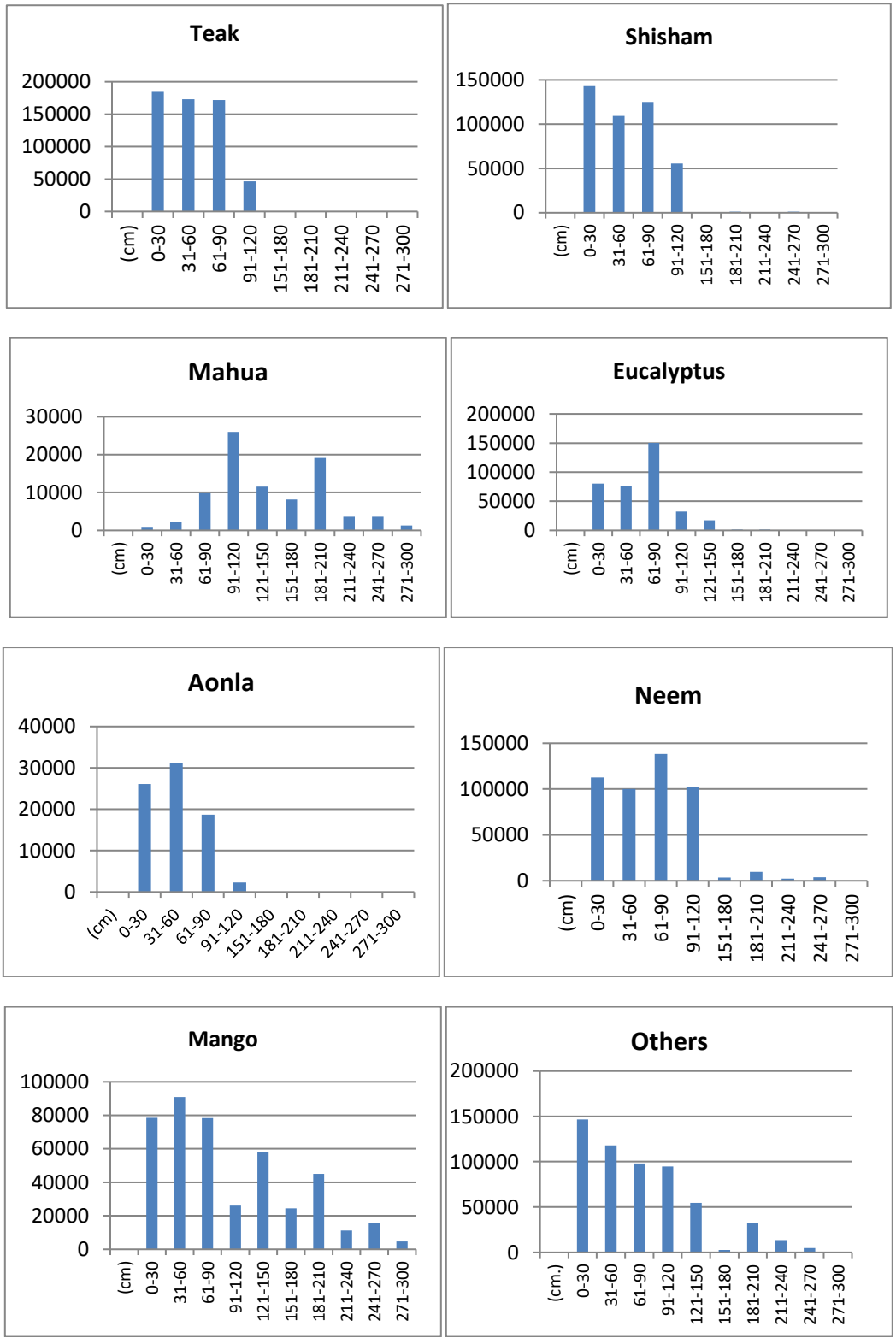

Fig. 3. Girth - class wise availability of different tree species in Ballia district

as agro forestry species. Most of the Teak trees are too young to be harvested. It is clear from tree enumeration studies that young plantations of Mango, Neem, Mahua and Shisham were less.

Some other tree species were Jamun (*Syzygium cumini*), Babool (*Acacia nilotica*), Pani gambhar (*Gmelina arborea*), Kathal (*Artocarpus heterophyllus*), Arjun (*Terminalia arjuna*), Ashok (*Saraca asoka*), and Karanj (*Pongamia pinnata*). These species were not able to fulfill the requirement of wood and firewood. These species were scattered on the village fallow land and roadside. The total no. of trees in this category was 565617 and farmers have not adopted such trees with agricultural crops in agroforestry. It reflected that 25.89%trees in this category were under 0-30 cm, 20.86% in 31-60 cm, 17.33% trees in 61-90 cm. and 16.75% trees in 91-120 cm. girth classes.

As discussed, the living condition of the surveyed area was very poor. People only consume need based requirements of timber as well as fire wood. They prefer to buy readymade timber articles from the market. In case of consumption of own trees, people sell these trees through contractor or middlemen. Firewood requirement is also in good quantity because alternative sources of energy as gas, stove, cow dung cakes, heater *etc*. are limited up to a specific class of people. People prefer to buy firewood, kerosene etc. For firewood mostly availability in the market is for mango, Shisham, Neem and Babool. Thinning of trees and market purchase fulfills day to day needs of farmers for firewood.

Mango, Mahua, Teak and Neem were most demanded species for timber. The existing trees in 0-30 cm girth class were less for most of the species and needs to be planted in agroforestry and other afforestation programmes. The scenario in Ballia district has improved much in last ten years. The matured trees of demanded species were also very less in the district. The tree harvesting and sale methods of timber were not much known to villagers and needed to be extended during future extension and trainings. At present, Teak is most demanded timber species besides Mango and Neem. Actually, *deshi* trees of Mango are very less in villages and for timber it is demanded but for fruits, purposes, kalmi variety is in more demand. The systematic planting of trees on bunds / blocks were less. The availability of quality planting material, maintenance and management of plantations and sale of timber produce with good returns were major hurdles in the way of success in adoption of agroforestry in Ballia district.

It is clear that Farmers have common practice to integrate crops, trees, and livestock to solve the problem of acute shortage of fuel, fodder and other goods (Bhatt 2002). The farmers have little opportunities to select the tree species, and therefore, they accept whatever is available on their land (Bhatt et al. 2010). The various problems and constraints of agroforestry can be overcome through policy and institutional reforms (Smith et al. 1998). Moreover, there is deficiency in the understanding of biophysical concerns correlated with productivity, water-resource sharing, soil productivity, and plant interactions in agroforestry systems, since most of the research is site-specific, observational in nature, and not process-oriented (Puri et al. 2004). The promotion of sustainable agroforestry practices on a large scale in future is only possible through amalgamation of proactive farmer policies of government, involvement of the industries, support services from NGOs and willingness of farmers (Verma et al. 2017) for

improvement in status of TOFs. Extension services are important for smooth dissemination of research results on the different aspect of agroforestry but research results on agroforestry, available in the public and private domain do not regularly reach the farmers due to lack of a proper or dedicated extension system. Farmers with major land holdings will get more benefit by the agroforestry related schemes than the small and marginal farmers. So there is need to introduce special programs on agroforestry models for marginal and small farmers because 2/3rd farmers of Indian farmers are small and marginal farmers (Kumar et al. 2017).

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