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Case Study

Demand-Supply gap analysis of trees outside forests - a case study in Ballia District of Eastern Uttar Pradesh, India

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Abstract

The trees have a significant role in fulfilling daily needs of people. As per latest report of FSI, 2019, only 9.20% (6.15% forest and 3.05% Tree cover outside forests) area is covered with trees in the state of Uttar Pradesh,. Thus, sustainable availability of trees in the region of Eastern UP, especially in Gangetic plain region is a challenging task, as status of agroforestry is still in primitive stage there. The district Ballia is last district of the region bordering the state of Bihar. As per report only 0.74% forest is in the district including tree cover. Thus, with a view to find out deficit species in different developmental blocks of the district, a study has been conducted in the year 2019 to assess demand supply gap of important trees of timber value for recommending in afforestation programmes of the district. It is clear from results that for most of the studied species, highest demand supply gap was found in Pandah, Dubhad and Belhari developmental blocks. The lowest demand supply gap was found in Navanagar block. It is clear that highest overall annual demand supply gap for wood of all selected species exists in Pandah block (545180qt) followed by Belhari (458160qt) whereas lowest gap was found in Navanagar (49599qt) followed by Bairia (55150qt). The demand supply gap for studied species in the district was highest for Mango (1166062qt) followed by Mahua (548406qt), Shisham (451866qt) and Teak (356037qt). Thus, massive plantations of desi variety of Mango, Shisham, Mahua and Teak are urgent need of time. The results indicated that suitable species may be selected in afforestation programmes of respective developmental blocks in the district for sustainable availability of species in future.

Keywords: Demand -supply gap, trees outside forest, afforestation, agroforestry, sustainability.

Introduction

Traditionally, growing trees on farms and around homesteads is very common in India. These have a significant impact on the ecologic, economic and social well being of people. Traditional on farm tree wealth and knowledge has given shape to the modern field of agroforestry, which is basically following the traditions on scientific lines for the social and ecological benefits[1,2]. Trees play a special role in the ethos of the people of India and socio-economic development. A number of tree species are revered as sacred trees and sacred groves and are found all over the country[3]. Over the years, alternative sources of energy have been generated but still the wood energy is a prime energy source in domestic sector. The contribution of biomass is 14% of the world energy and 38% in developing countries[4]. These changes in ecology and economics through on- farm trees are well documented and traditionally been followed but presently there are divergent views on present area under agroforestry, which need to be ascertained for ecosystem services[5] and in future more area is expected to shift from agriculture to trees due to poor productivity, high labour cost, shifting of rural people to urban area due to poor infrastructure, uncertain climatic conditions, etc. For meeting growing demand for fuel, fodder, grazing, timber and non-wood forest products from ever growing human population, livestock and industrial needs, Indian forests are under severe pressure. The main reasons for forest degradation are due to growing demand-supply gap especially in meeting people's basic needs in rural area & non-involvement of stakeholders in protection and management of forests[6].

In the last two decades, wood demand has increased by over 60% and the output from forests has reduced to half in the same period. It is because of the dramatic rise of outputs from plantation and farm forestry, if has been reduced by over 50%. In the private sector, more than 50% of industrial timber is being contributed by agroforestry. The community lands share major part of the annual 250 million tons of fuel-wood consumption[7]. Indian timber market has a great challenge for tropical timber sector. Due to the resurgence of the domestic economy, which is poised to grow at over 6% per annum and the rapid expansion of middle and upper income groups, there is increasing demand for timber in India[8]. The suitable timbers have been identified and classified for different uses on the basis of the requirements of end users and properties of different species[9]. In India, the Eastern region of Uttar Pradesh is still lacking massive tree plantations on farm lands.

The trees play an important role in fulfilling daily needs of people. Agroforestry is only a viable option for growing trees along with agriculture crops on available lands, thus, reducing pressure on forests for forest based needs. In the state of Uttar Pradesh, as per latest report of FSI, 2019[10], only 9.20% (6.15 % forest and 3.05% Tree cover outside forests) area is covered with trees. Thus, sustainable availability of trees in the region of Eastern UP, especially in Gangetic plain region is a challenging task, as status of agroforestry is still in primitive stage there. The district Ballia is last district of the region bordering the state of Bihar. As per FSI report[10], only 0.74% forest is in the district including tree cover. Thus, development of agroforestry is urgent need of time in the area. Thus, with a view to find out deficit species in different developmental blocks of the district, a study has been conducted in the year 2019 to assess demand supply gap of important trees of timber value for recommending in afforestation programmes of the district through farmers, state forest department and other tree growers. The outcome of the study will be further helpful for selection of species in agroforestry in different areas of the district.

Material and methods

Study Area: Ballia district bordering Bihar State is eastern most part of the Uttar Pradesh. It has a tract extending to west from the confluence of the river Ganga and the Ghaghra. It separates from Bihar in the south and in the north and east from Deoria respectively. The boundary is determined by the deep streams of these two rivers between Ballia and Bihar. It is bounded by Mau on the west, by Deoria on the north, by Bihar on the north-east and south-east and by Ghazipur on the south-west. The district is situated between the parallels of 25º33' and 26º11' North latitudes and 83º38' and 84º39' East longitudes. It has 17 blocks with 2372 number of villages[11].

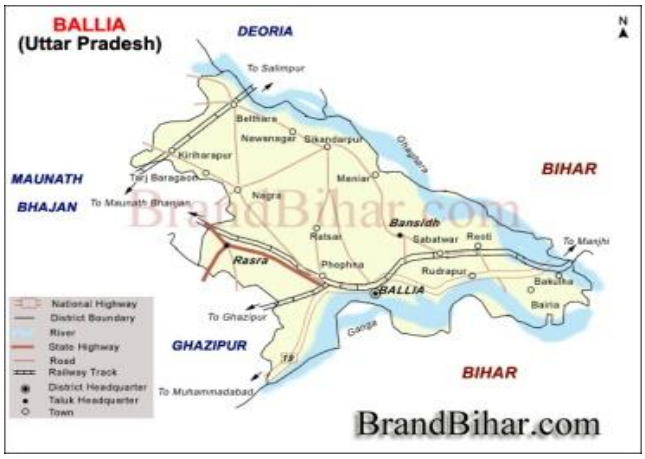

Figure-1: Map of Ballia district.

Socio-economic study: The studies on demand - supply status of important Trees Outside forests (TOFs) was conducted in the year 2019 in Ballia district of Eastern Uttar Pradesh. The timber and fire-wood value tree species were screened which were preferred by farmers, viz. *Dalbergia sissoo* (Shisham), *Tectona grandis* (Sagaun), *Acacia nilotica* (Babool*), Mangifera indica* (Mango), *Azadirachta indica* (Neem), Bamboos, *Madhuca longifolia* (Mahua) and Eucalyptus were selected for the study. A total of 1% villages of district Ballia had been randomly selected through stratified random sampling covering all 17 developmental blocks. The socio-economic parameters were studies with the help of structured questionnaire and participatory rural appraisal techniques. A total of 10% households were involved in the survey including farmers of small, medium, large and marginal category, males and females covering age and caste of all groups in selected villages to study the general information of villages, land use pattern and demand supply position of timber species planed in agroforestry. The random sampling technique was used to select farmers in selected villages. A brief introduction was given to each respondent about the nature and purpose of the study .The interviews were generally held in a common place of villages where people of all categories including women may sit collectively. The observations were grouped in respective developmental blocks of the district covering total villages. For calculation of demand position of timber, item- wise calculation of wood articles was done for all selected species. The supply position of wood was also assessed with the help of farmer's information. Likewise, the status of demand supply gap was also calculated for each species. The demand-supply gap for studied villages had been calculated for per capita and then accordingly for total population of block and district.

Results and discussion

General village profile: The results of respondents covering general information about studied villages for type of houses, education, caste and annual income level and occupation status were analyzed. (Table-1). The results of general information of villages in respective blocks have been depicted in Figgure-2 (a,b,c,d). Most of the villages were favourably located in terms of approachable roads from district head quarters and essential facilities. The connecting roads were metalled and electricity facility was available in the villages. For drinking water, govt. as well as private hand pumps were used by the villagers. The average family size in the villages was from 5-7 members. In district Ballia, about 23.65% of the respondents had kutcha houses (khaprail/ sarpat) where as 76.35% had pucca, RCC houses in the selected villages. The villagers were educated (47%), the rest were in illiterate category (21%) and highly educated category (32%) as well .The categorization of caste has been done into three classes *viz.* SC/ ST, OBC and others. The average data for studied villages were calculated 22.41, 46.88 and 30.71% respectively. The annual income of respondents was classified into four categories. It was found that majority of the population (74.12%) belonged to the range of < 1.0 Lakh whereas the percentage of respondents in other income groups viz. 1-3>3-5 and >5 Lakh were 17.76, 7.47 and below 1% respectively. The occupational status of the villagers was also studied in surveyed area. It was found that 50.94% of the

villagers had agriculture as their primary occupation followed by labour (37.71%), service (7.62%) and business (3.79%). Table 1 also reflects that only 14.29 % of farmers were tree growers. The timber and firewood needs of villagers were fulfilled from own trees (20.71%) and market purchase (79.29 %.).

Demand-supply Gap of timber of tree species: The Table-2 and Figure-3(i-viii) depicts block wise demand, supply and demand-supply gap status of timber for studies species in the selected villages in the district. Figure-3i shows that for Teak, highest demand supply gap was in Pandah block (84427 qt) followed by Dubhad (75218qt) and Belhari (44600qt). For Shisham (Figure-3ii), highest gap was depicted in Belhari block (76400qt) followed by Dubhad (69622qt). Likewise, Figure-3iii showed that for Mango, the gap was again highest in Pandah (189854qt) followed by Belhari (178400qt) and Dubhad (160270qt). For Neem (Figure-3iv), it was recorded that highest gap existed in Belhari (39680qt) followed by Pandah (26809qt) .For Babool (Figure-3v), highest gap was found in Pandah block (45809qt) and in case of Bamboo, Figure-3 vi showed that highest gap of 24082qt was found in Pandah block . Figure-3vii depicts that for Mahua highest demand supply gap was found in Pandah block with 139256qt. For Eucalyptus (Figure-3viii), it was highest in Pandah block (1070qt). It is clear from results that for most of the studied species, highest demand supply gap was found in Pandah, Dubhad and Belhari developmental blocks. In these blocks, it was observed that farmers were not much aware about tree planting and efforts of implementing agency were also not encouraging. The lowest demand supply gap was found in Navanagar block. It is clear from Table-2 and Figure-4 that highest overall annual demand supply gap for wood of all selected species exists in Pandah block (545180qt) followed by Belhari (458160qt) whereas lowest gap was found in Navanagar (49599qt) followed by Bairia (55150qt). Figure-5 gives a very clear picture of demand supply gap for studied species in the district. It was highest for Mango (1166062 qt) followed by Mahua (548406qt), Shisham (451866qt) and Teak (356037qt). The reason behind over demand of Mango is that it is affordable timber for all income classes and availability of very less desi variety of Mango trees because farmers are more focused on kalmi variety of Mango in their orchards. Thus, massive plantation of desi variety of Mango is urgent need of time. Shisham is preferred wood of farmers but due to increased mortality and less planting have increased its demand. Likewise, Mahua is a slow growing species and is demanded by farmers for door and window making works but less plantation of this species has created its great demand. Teak, which is valuable timber is most demanded in the area for its quality and less availability in the region.

The results indicated that suitable species may be selected in afforestation programmes of respective developmental blocks in the district for sustainable availability of species in the future. It was found that respondents were mainly dependent on Mango, Shisham, Mahua and Neem for their wood requirements in case of average income group till Rs. 5.0 lakh per annum. In higher income group of >Rs. 5.0 Lakh, people were also dependent on Teak for their timber requirements. The selection of species for tree plantation programmes provides fuel-wood, timber, fodder etc. in the society and also optimize land use, reduce pressure on protective and productive forests, increase the productivity of land, check soil erosion, improve the environmental condition and maintain ecological balance, promote cottage industries, regulate micro-climate conditions for maximum production of ground vegetation[12]. It has been seen that people when do not get reasonable prices for their produces then they do not prefer to participate. Lack of facilities discourages them to follow agro-forestry systems. There is a need to have biomass bank where cultivators after harvesting and curing biomass can deposit and on need they can utilize the same. Mathur *et al.*[13] reported that forest biomass can be changed into solid, liquid and gaseous fuels and can be converted into usable energy forms, for which the conversion technology is already available. Further, the common species of the area proved to be deficient may be identified out of existing species for tree plantation programmes. The demand for wood continued to increase due to growing demand for timber products[14]. The research may be undertaken to identify such production systems for TOF that are efficient, ecologically sustainable and financially viable[15]. The productivity of the lands involving trees outside forests can be increased many folds with a proper management of inputs[16]. TOFs are less studied than other wood resources and is not addressed explicitly in forest policies and legislation. The current repressive legislation, intending to prevent farmers to exploit the TOF for wood, fuel and fodder, do not encourage farmers to develop TOF at farm and landscape level[17]. It is urgently needed to adapt forest policies and legislation to these facts and to promote techniques, which can accelerate the transformation of residual TOF into constructed parklands.

Conclusion

Mango, Mahua, Teak and Neem were most demanded species for timber and firewood. The plantations 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 tree harvesting and sale methods of timber were not much known to villagers and needed to be extended during future extension and trainings. The systematic planting of trees on bunds / blocks were less in the district. The trees scattered on farms and around homesteads on vacant lands were most common in agroforestry. The management of TOFs and sale of timber produce with good returns were major hurdles in the way of success in adoption of agroforestry in the district. It was assessed that generating awareness amongst farmers for tree planting in agroforestry with introduction of technical packages including each and every component will definitely open a new way to the success.

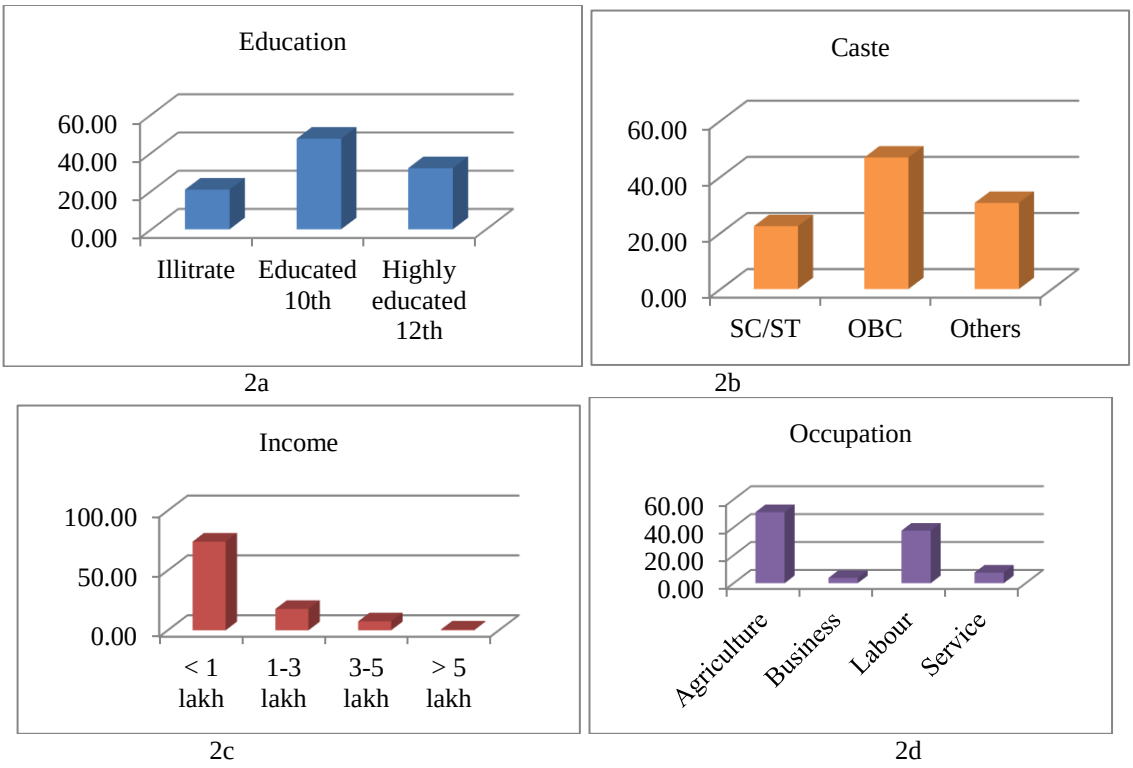

Figure-2: General village profile in the Ballia district.

Table-1: General Information about Villages Covered under blocks of Ballia District.

Particulars	Category	Block wise information in %																	Mean (Ballia district)
		Dubhar	Belhari	Bairia	Murli Chhapra	Beruarbari	Garwar	Chilkahar	Maniar	Navanagar	Pandah	Bansdih	Rewati	Sohanv	Hanumangaj	Siar	Nagra	Rasra	
		Nagwan	Belhari	Govindpur	Sukraoli	Kaithwali	Nadaoli	Pakhanpura	jigni	Mahro	Narayan usar	Chitbisram khurd	Kanchanpur	Chaubey Ichcha kapura	Sagarpali	Babhnaoli	Malipur	Nasirpur	
Type of house	Katcha	55	45	40	40	20	10	5	5	2	30	25	30	25	25	20	20	5	23.65
	Pucca	45	55	60	60	80	90	95	95	98	70	75	70	75	75	80	80	95	76.35
Education	Illiterate	35	30	20	40	30	20	20	30	15	30	20	10	10	10	10	12	10	20.71
	Educated 10th	40	40	60	25	40	50	50	20	60	60	60	50	50	60	50	40	50	47.35
	Highly educated 12th	25	30	20	35	30	30	30	50	25	10	20	40	40	30	40	48	40	31.94
Caste	SC/ST	20	20	25	5	20	2	10	5	10	97	20	40	30	25	2	50	0	22.41
	OBC	10	35	35	90	60	96	89	85	25	2	60	5	60	40	5	45	55	46.88
	Others	70	45	40	5	20	2	1	10	65	1	20	55	10	35	93	5	45	30.71
Income Level in Rs.	< 1 lakh	80	80	80	95	70	80	70	70	75	90	80	90	75	80	50	45	50	74.12
	1-3 lakh	10	14	19	5	20	18	20	20	20	8	15	8	20	15	30	30	30	17.76
	3-5 lakh	5	5	1	0	8	2	8	10	4	2	5	2	5	5	20	25	20	7.47
	> 5 lakh	5	1	0	0	2	0	2	0	1	0	0	0	0	0	0	0	0	0.65
Occupational Status	Agriculture	60	61	50	35	40	60	50	55	60	27	45	73	60	40	60	30	60	50.94
	Business	4	1	1	.5	5	2	5	5	5	1	1	1	3	10	10	5	5	3.79
	Labour	30	35	45	60	35	33	30	35	28	70	50	25	30	40	20	55	20	37.71
	Service	6	4	4	4.5	20	5	15	5	7	2	4	1	7	10	10	10	15	7.62
	Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Tree Growers		10	25	20	8	20	10	15	20	10	10	10	5	10	30	10	15	15	14.29
Source of timber and fire wood	Market	85	70	80	90	75	80	70	65	75	90	78	87	82	88	76	85	72	79.29
	Private trees	15	30	20	10	25	20	30	35	25	10	22	13	18	12	24	15	28	20.71

Table-2: Annual demand-supply gap for timber (qt) of tree species in Ballia district**.**

Tree Species	Developmental Blocks of Ballia district																	
	Dubhar	Belhari	Bairia	Murli Chhapra	Beru arbari	Garwar	Chilkahar	Maniar	Nava nagar	Pandah	Bansdih	Rewati	Sohanv	Hanuman ganj	Siar	Nagra	Rasra	Total in Ballia district
Teak	75218	44600	7900	7456	8808	4708	6720	11504	5482	84427	10324	8847	14395	30962	9950	12182	12554	356037
Shisham	69622	76400	9580	8428	10808	18062	11320	18390	11674	24236	18924	15205	27790	67382	18900	15862	29283	451866
Mango	160270	178400	16720	30898	58080	16992	63200	47788	12312	189854	61612	34910	83160	131268	33975	22230	24393	1166062
Neem	20596	39680	7080	4456	18232	10266	7520	9380	3482	26809	11628	8358	8316	16804	3975	2196	2367	201145
Babool	39192	27720	3080	3510	3808	4248	3680	4690	5166	45809	5916	3930	24948	2376	2750	3303	3973	188099
Bamboo	1662	928	1100	1148	3808	1239	1503	1072	1099	24082	2428	1441	18711	1708	1312	2150	2211	67602
Mahua	39694	89200	8240	5728	9616	7496	29960	16482	9472	139256	38700	12052	46400	53924	19987	10089	12110	548406
Eucalyptus	1494	1232	1450	1789	1860	1754	1440	6566	912	10707	1428	2465	1155	1176	1944	2124	1065	40561
Total	407748	458160	55150	63413	115020	64765	125343	115872	49599	545180	150960	87208	224875	305600	92793	70136	87956	3019778

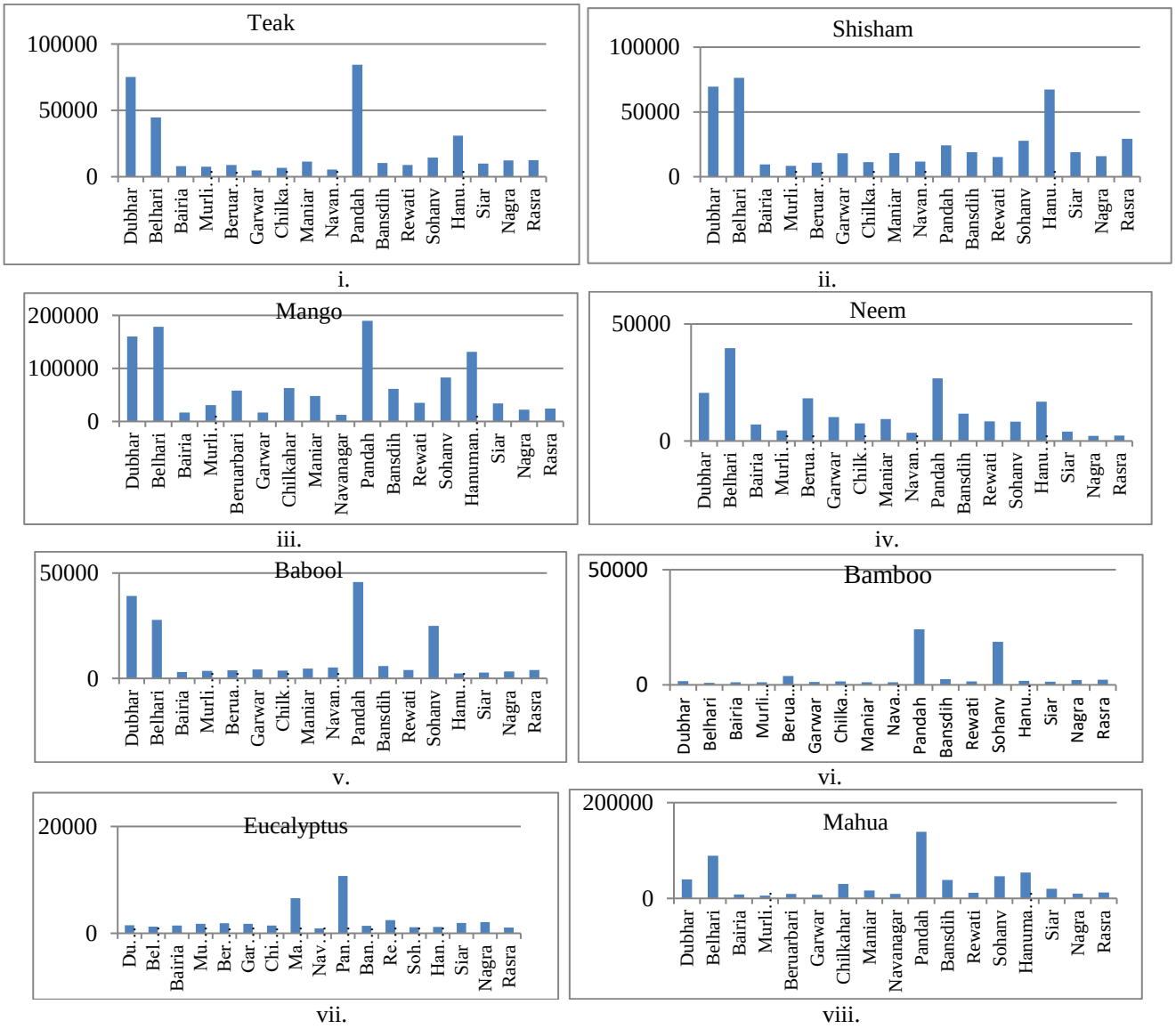

Figure-3:i–viii: Annual demand supply gap (qt) of tree species in developmental blocks of Ballia district.

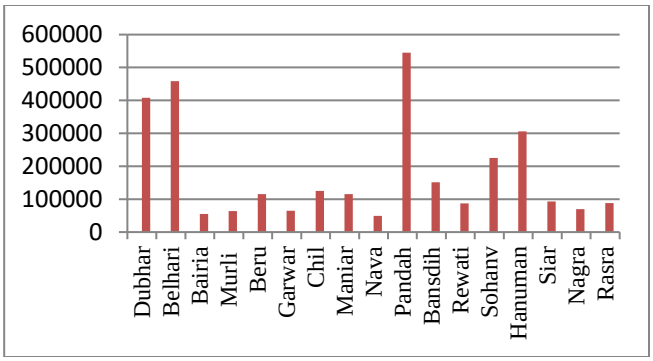

Figure-4: Total Demand supply gap of selected species in blocks of Ballia district.

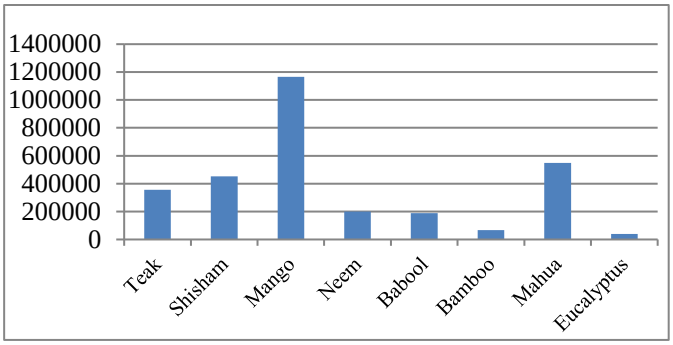

Figure-5: Species wise demand supply gap of Ballia district.

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