

Original Research Article

Assessment of Urban Forestry in Hetauda City, Makwanpur, Nepal

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Abstract: Trees have been an important part of human settlements throughout history. In the Nepalese context, the development of urban forestry is seen only in some cities to some extent. Questionnaire survey, key informant survey, and direct field observation techniques were used to access the information on urban forestry in Hetauda sub-metropolitan city which is in the phase of rapid urbanization with demanding the development of urban green infrastructure. The research aims to identify the present status of urban forestry by people's views regarding urban forestry. It also explores the list out of the preferred tree species, peoples' perception about urban forestry and new plantation site referred by people in Hetauda city. The perception of the local people towards UF was measured by the Likert scale scoring the statements on different issues. Documentation of present status and practices of urban forestry, list out of the most preferred species by the local people was recorded. *Saraca indica* and *Azadirachta indica* are the most liked species by local people for urban plantation and most of the people want greenery along the roadside.

Keywords: Hetauda Sub-Metropolitan, Development, New Plantation Site, Referred Trees, Roadside

INTRODUCTION

An urban forest is defined broadly as the natural and planted trees that are found in urban areas [1] including the associated vegetation and resources in and around dense human settlements, ranging from small communities in rural settings to metropolitan regions [2]. Urban forests are the backbone of the green infrastructure, bridging rural and urban areas and ameliorating a city's environmental footprint [3]. The 20th century has been characterized as the century of urbanization for Europe and North America, and the 21st century will be century of urbanization in Asia [4]. Cities reshape and alter natural landscapes as they expand, creating microclimates in which temperatures, rainfall and winds differ from those of the surrounding countryside [3].

If we talk about development of urban forestry in Nepal context, UF is seen only in some cities to some extent. There has been a practice of UF in the form of Park development and plantation [5]. Some popular parks in the urban areas of the country are- Tribhuvan Park, Godavari Park, UN Park in Kathmandu; Sahid Smarak Park in Hetauda; Basundhara Park in Pokhara; Fulbari Park in Butwal etc. The need of urban forestry has been increased when people become more aware on the importance of trees in city areas. Urban forestry development is required along the many political boundaries, property lines, road sides and different land uses throughout the city.

Hetauda is considered one of the cleanest and greenest cities in Nepal. It is also initial roadside plantation area in Nepal. But it is also being one of the victim of urbanization due to commercial, industrial, population pressure so the overall city environment is being worsened day by day alarming urban dwellers. Plantations are established, managed and maintained in Hetauda Sub Metropolitan City. As urban forestry has not been much flourished as it has to be in this area. This study will help to gain the information about peoples understanding on urban forestry and change the attitude

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of people towards urban forestry. Furthermore, it will help the management committee about the plantation site people prefer the most because of which there will be less chance of conflict between sub metropolitan and people.

MATERIALS AND METHODS

Study Area

The study was carried out in Hetauda Sub-metropolitan city which is located at a distance of 76km from the capital city via the fast track, at a distance of 132km via Daman and 224km via Narayanghat. Lying in the central development region of the nation, it is properly situated at the central of the Makwanpur district. It lies in the 27°25' N latitude and 85°02' E longitude and is situated at a level of 300-390m above the sea level Hetauda Sub-metropolitan city, 2017. It covers an area of 261 sq. km where around 254 sq.km. (97%) is land and the remaining 7 sq.km (3%) consists of water. It has 19 wards and is surrounded by Bakaiya Goupalika in the east, Manahari and Rakshirang Goupalika in the west, Bhimpedi, Makawanpurgadhi and Kailash Goupalika in the north and Bara district in the south. According to census 2011, Hetauda Sub metropolitan consists of 152,875 total populations. The total population of female is 77,911 and that of male is 74,964. Hetauda is one of the most diversified city in the country according to the ethnicity. The ethnic makeup of the city consists of Tamang (31.07%), Brahmins (26.55%), Chhetri (13.79%), Newars (8.80%) and others [6]

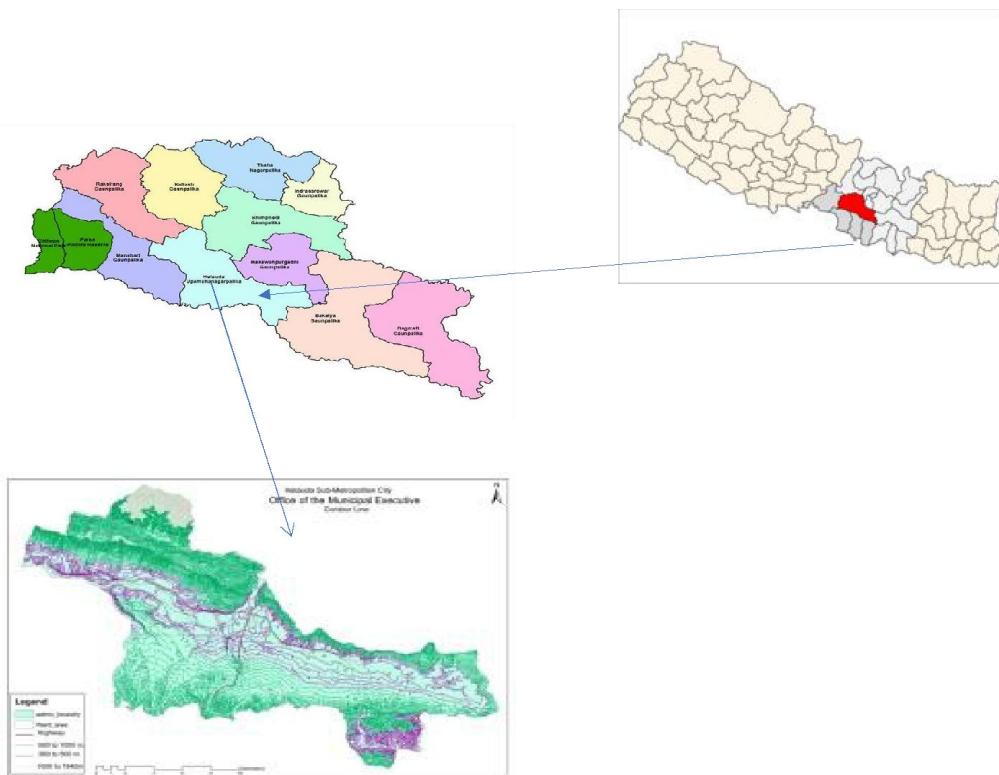


Fig-1: Map of the study area

Data Collection

Direct field observation and Transect walk was carried out [7] along the city to gather information regarding present status, opportunities and problem regarding urban forestry in city also crosscheck the information we got from key informant interview and household survey. By purposive sampling, 100 household were chosen among 34,270 household in study area. Semi-structured questionnaire was prepared to collect data about people's perception regarding existing urban forestry activities. Key informant interview (n=5) was conducted among members of Sub Metropolitan officers, private nurseries and also from NGOs. They were interviewed about existing situation, problem, and opportunities regarding urban forestry.

Data Analysis

The data collected from different sources has been processed, tabulated and analyzed qualitatively as well as quantitatively by using simple statistical tools like percentage, weighted mean, mean and appropriate statistical computer software like MS Excel was used in this regard. Similarly, the data obtained from the questionnaire survey was analyzed by preference ranking.

$$\bar{x} = \frac{w_1x_1 + w_2x_2 + \dots + w_nx_n}{w_1 + w_2 + \dots + w_n}$$

Where

x is the repeating value

w is the number of occurrences of x (weight)

\bar{x} is the weighted mean

RESULTS AND DISCUSSION

List of Urban Tree Species Preferred by People

A total of 62 species of trees belonging to 51 genera was recorded in Makwanpur district. *Shorea forest* was dominant in lower elevation while *Quercus* forest, *Alnus-Rhododendron*, *Quercus-Lyonia* and *Quercus-Symplocos* forests at higher elevation. Similarly, *Castanopsis tribuloides* has the widest distribution range (570 m to 2240 m asl) followed by *Shorea robusta*, *Lagerstroemia parviflora*, *Trichilia connaroides*, *Syzygium jambos*, *Castanopsis indica*, *Schima wallichii* etc [8]. Most of the people prefer the trees which are beneficial for health and which are fruit bearing. Similarly, people choose species which are flowering, and which increases the aesthetic beauty of the area. People even suggested for the medicinal plants that would be beneficial for them as well as can be of multiple.

Table-1: List of preferred tree species

Botanical Name	Family	Local Name
<i>Saraca indica</i>	Legumes	Ashok
<i>Pterocarpus santalinus</i>	Legumes	Raktachandan
<i>Cinnamomum tamala</i>	Lauraceae	Tejpatta
<i>Litchi chinensis</i>	Sapindaceae	Lichi
<i>Santalum album</i>	Santalaceae	Shrikhana
<i>Ficus religiosa</i>	Moraceae	Pipal
<i>Cinnamomum camphora</i>	Lauraceae	Kapoor
<i>Juniperus Indica</i>	Cypress	Dhupi
<i>Rauvolfia serpentine</i>	Apocynaceae	Sarpaganda
<i>Mangifera indica</i>	Anacardiaceae	Aanp
<i>Azadirachta indica</i>	Meliaceae	Neem
<i>Nyctanthes arbor-tristis</i>	Oleaceae	Parijaat
<i>Pinus roxburghii</i>	Coniferae	Salla
<i>Bombax ceiba</i>	Malvaceae	Simal

Peoples' Perception towards urban trees

Table-2: People's perception towards urban forestry

Considered Statements	Percentage of responses					wt. mean	Perception
	1	2	3	4	5		
1. Do you think urban forestry program will expand?	3	2	6	17	72	4.55	SA
2. Do you expect any benefits from urban forest?	2	6	9	23	60	4.33	A
3. Do you think trees in the urban areas increases its beauty?	0	5	13	58	24	4.01	A
4. Do you think trees in the urban areas reduce its air pollution?	0	0	2	10	88	4.86	SA
5. Do you think urban forest maintenance and management is done by government and local people participation?	4	12	36	33	15	3.43	UD
6. Is there urgent necessary to launch efficient urban forestry program?	0	7	24	58	11	3.73	A
7. Do you want to participate in any urban tree activities?	0	5	0	37	58	4.48	A
8. Has the tree along roadside been planted according to your desire?	30	15	12	15	28	2.96	UD
9. Are you satisfied with availability current trees species along roadside?	12	8	5	24	51	3.94	SA
10. Are you satisfied with the current tree species?	7	11	43	25	14	3.28	A
11. Trees along roadside are hazardous to your home and life?	32	34	15	12	7	2.28	UD
12. Do you feel that trees along roadside are yours?	1	4	23	44	28	3.94	A

13. Do you want more trees (without any hazards) along roadside?	0	1	2	58	39	4.35	SA
14. The poor management of roadside trees is due to lack of your participation	3	6	28	49	14	3.65	A
15. Do you think peoples' participation is essential for urban tree management?	2	3	16	56	23	3.95	A

Note: 1 - Strongly disagree (SD); 2 -Disagree (D); 3 -Undecided (UD); 4 -Agree (A); 5 - Strongly Agree (SA).

Level of participation

Table-3: Level of participation

Considered Statements	Percentage of responses				
	1	2	3	4	5
1. Do you think urban forest maintenance and management is done by government and local people participation?	4	12	36	33	15
2. Do you want to participate in any urban tree activities?	0	5	0	37	58
3. Do you feel that trees along roadside are yours?	1	4	23	44	28
4. The poor management of roadside trees is due to lack of your participation	3	6	28	49	14
5. Do you think peoples' participation is essential for urban tree management?	2	3	16	56	23
Mean	2	6	20.6	43.8	27.6

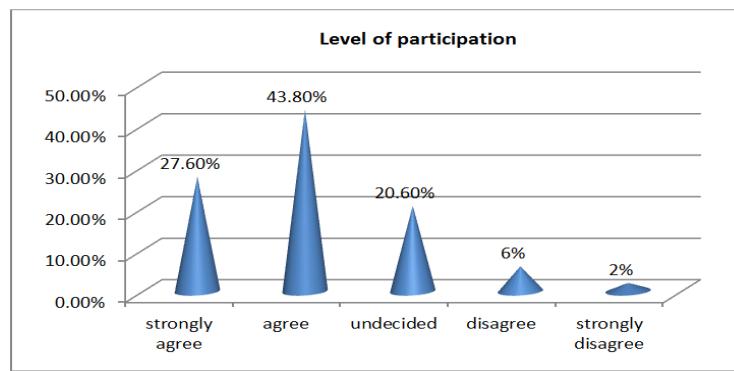


Fig-2: Level of participation

From the figure above it is found that 27.60% of the respondents strongly agree with the activities regarding urban forestry. Similarly, 43.80% agree with this phenomenon. Like wisely 20.60% of respondents are found to be undecided. In the same way 6% respondents disagreed with urban forestry activities. Around 2% respondents are found to be strongly disagreed.

Level of benefits

Table-4: Level of benefits

Considered Statements	Percentage of responses				
	1	2	3	4	5
1. Do you think urban forestry program will expand?	3	2	6	17	72
2. Do you expect any benefits from urban forest?	2	6	9	23	60
3. Do you think trees in the urban areas increases its beauty?	0	5	13	58	24
4. Do you think trees in the urban areas reduce its air pollution?	0	0	2	10	88
Mean	1.25	3.25	7.5	27.4	61

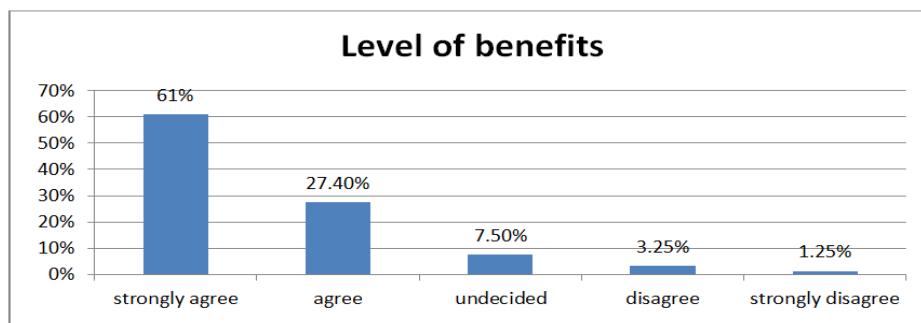


Fig-3: Level of benefits

In accordance with above graphical representation, it is stated that 61% respondents are found to be strongly agreed with the overall benefits of urban forestry where pollution control, aesthetic beauty, fresh air(oxygen) were noted more. In the same pattern 27.4% are found to be agreed on beneficial aspect of urban forestry; however, 7.5% are found to be undecided. Ultimately 3.25% respondents disagree on the aspect regarding urban forestry awareness activities and 1.25% is found to be strongly disagreed.

Level of Satisfaction

Table-5: Level of satisfaction

Considered Statements	Percentage of responses				
	1	2	3	4	5
1. Is there urgent necessary to launch efficient urban forestry program?	0	7	24	58	11
2. Are you satisfied with availability current trees species along roadside?	12	8	5	24	51
3. Are you satisfied with the current tree species?	7	11	43	25	14
4. Do you want more trees (without any hazards) along roadside?	0	1	2	58	39
Mean	4.75	6.75	18.5	41.25	28.75

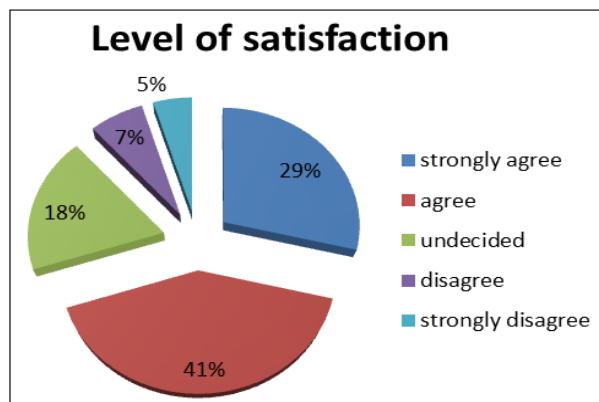


Fig-4: Level of satisfaction

From the above pie-chart it is found that 28.75% of the respondents strongly satisfied with the activities regarding urban forestry. Similarly, 41.25% agree with this phenomenon. Like wisely 18.50% of respondents are found to be undecided. In the same way 6.75% respondents disagree with urban forestry activities. Around 4.75% respondents are found to be strongly disagreed.

New plantation site preferred by people

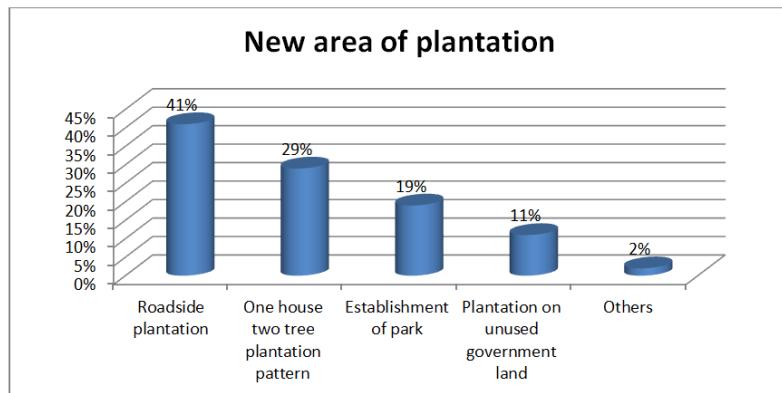


Fig-5: New plantation site preferred by people

From the above data we can say that, people preferred first plantation site is roadside plantation where 41% agree for it. Similarly, 29% people prefer one house two tree plantation pattern which can be useful for the management committee to develop next project for the development of the urban forestry in study area. Accordingly, people third choice is establishment of park (19%) and plantation on unused government land (11%) is fourth. Some of the people are even found that they do not prefer any of the option above and choose others if there is any other better option than these

four. Some people prefer easy availability of fodder for their cattle as like people of Gorkha [9]. Few people who live near by forestry campus want urban forestry as like corridor of habitat, like biological corridors.

CONCLUSION

Based on our study we can conclude that urban forestry practices existing in the study area are urban park, roadside plantation, and urban forest. People preferred tree species like *Saraca indica* (Ashok), *Azadirachta indica* (Neem), *Nyctanthes arbor-tristis* (Parijat), *Juniperus Indica* (Dhupi). One of the major challenges for urban forestry development in the study area was the lack of proper policy and legal framework. Other challenges are finance, proper caring, and timely management of the urban trees. Most people are aware of the benefits of urban forestry so they want proper management of urban forestry especially roadside plants. They want to identify the most preferred site for the new plantation which can reduce the conflicts between the government and the public. People want fast-growing and easily surviving evergreen species for the roadside plantation. Most of them are satisfied with the roadside plantation of *Saraca indica* in Hetauda city.

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Conflict of interest: The author declares no conflict of interest.

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