Urban tree diversity of Honnavar, Uttara Kannada District, Karnataka, India

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ABSTRACT

Urban trees serve many useful functions such as climate change mitigation by carbon sequestration, air quality improvement by air pollution abatement, biodiversity conservation and source of ecosystem goods to urban inhabitants. They also have aesthetic, socio-religious and recreational value in urban contexts. In spite of the importance, they have not received much scientific attention. This paper investigates the diversity and density of tree species growing both within the built environment as well as road-side avenues in the town of Honnavar town, which is the administrative town of a coastal taluk by same name, Uttara Kannada district, Karnataka state. The tree flora of Honnavar town comprises of 112 species in which about 71% are indigenous wild species. The other 29 % involves exotic and introduced species. The top six dominant species by density are *Mangifera indica* (mango, 22.016% of total tree population), *Polyalthia longifolia* (False Ashoka, 11.212%), *Peltophorum pterocarpum* (Yellow flame tree, 9.43%), *Samania saman* (Rain tree, 8.2%) and *Artocarpus heterophyllus* (Jackfruit, 5.25%). *Tectona grandis* (5.14%). The tree diversity represents a good assemblage of different utility categories such as wild and cultivated fruit yielding trees, shade and ornamental trees, sacred and religious trees, etc. Besides the high proportion of older trees of wild Mango and Jackfruit, fruit, presence of other fruit yielding trees like *Averrhoa carambola, A.bilimbi, Spondias pinnata and Spondias dulcis* etc.; large sized sacred trees such as *Ficus religiosa* and *F. benghalensis;* rare medicinal species such as *Garcinia indica*, *Saraca asoca*, *Terminalia bellirica*, *Anthocephalus kadamba* etc. are some of the notable features of the urban tree flora of Honnavar.

INTRODUCTION:

Presently, 50% of total global populations live in cities which occupy only 3% of the land area, and it is expected that the urban population will further rise to 67% in the next 50 years (Grimm *et al*., 2008). In developing countries, about 44 % of the population currently live in urban areas, which is likely to increase considerably in the next 20 to 30 years (Montgomery, 2008). During the last 50 years the population of India has grown two and a half times, but the urban population has grown nearly five times (Taubenböck *et al*., 2009). This kind of rapid urbanization is bringing complex changes to ecology, economy and society at local, regional, and global scales (DeFries and Pandey, 2010).

Deteriorating quality of urban ecosystems has already become a major concern of urban planners and managers. Environmental problems such as air and water pollution are more rampant in urban areas which currently account for 78% of global carbon emissions, 60% of domestic water use, and 76% of wood used for industrial purposes. It is inevitable that essential steps are taken to redesign the urban ecosystems to ameliorate these environmental problems and to ensure availability of clean air, water and other ecosystem services needed for healthy urban living.

Conservation and restoration of urban green spaces comprising of urban trees and forests is one important aspect of improving the environmental quality of urban areas. The term 'urban trees' generally includes trees growing both within the built environment as well as road-side avenues and public places in urban systems. They play a very significant role in the urban environment and serve many important functions, such as climate change mitigation by carbon sequestration, air quality improvement by air pollution abatement, oxygen generation, noise reduction, mitigation of urban heat- island effects, microclimate regulation, stabilization of soil, ground water recharge, prevention of soil erosion, biodiversity conservation and source of ecosystem goods to urban inhabitants. They also have aesthetic, socio-religious and recreational value in urban contexts.

In spite of their eco-sociological importance, urban trees have not received much scientific attention in India. There are only a few detailed studies on the urban trees of cities like Bangalore (Sudha and Ravindranath, 2000, Nagendra and Gopal, 2010), Chandigar (Kohli *et al*., 1994) and Nagpur (Gupta *et al*., 2008). We have initiated a study of the urban trees of Uttara Kannada District of Karnataka and the preliminary data on the species diversity and population density of urban trees of Honnavar town is presented in this paper. Earlier, similar study was conducted in Karwar (Bhat *et al*., 2010).

STUDY AREA AND METHODOLOGY:

Honnavar is a small coastal town on the west coast of India and it is the Taluk place of Uttara Kannada district of Karnataka. The total area of the town is 9.38 km^2 and its population is-19,109 (2011 census). This town is situated on the bank of river Sharavati (Fig. 1).

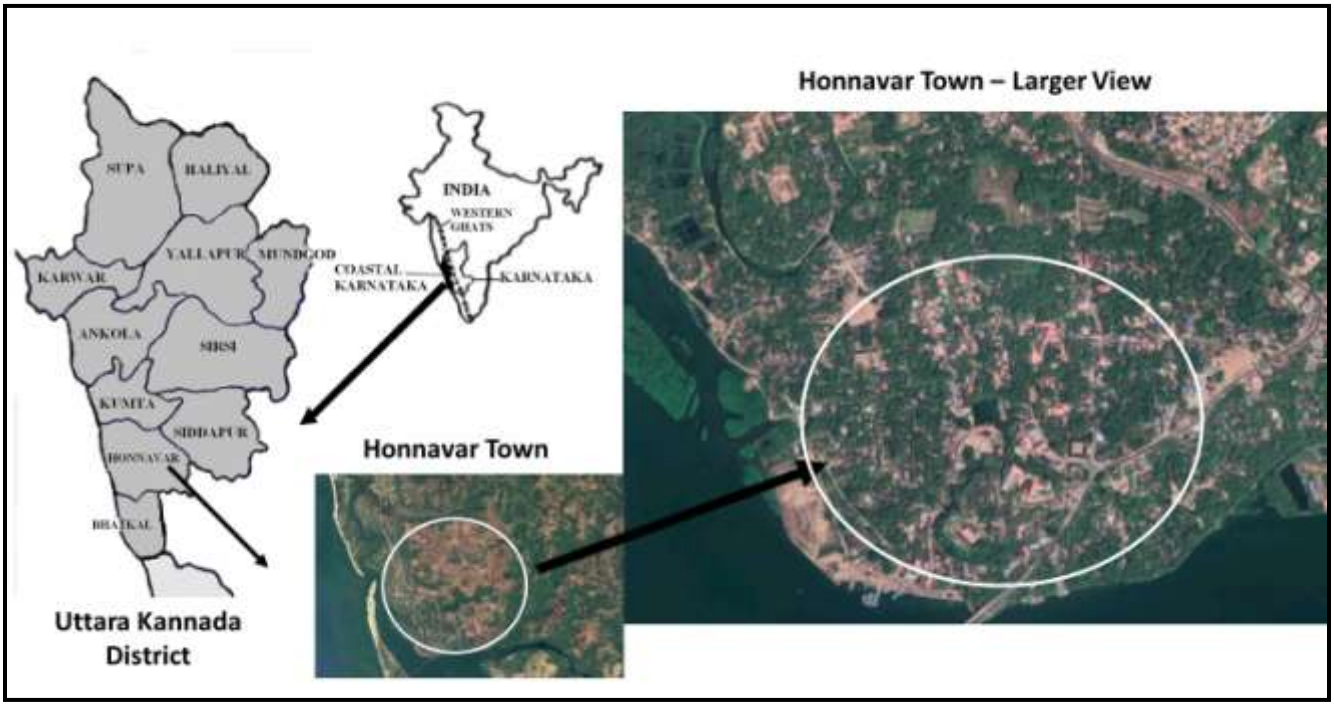

Fig. 1. Map of the study area showing Honnavar Town, Uttara Kannada District, Karnataka

12 of the major roads of Honnavar town, which together cover the different locations of the town, were selected for tree enumeration. All plants having an approximate girth of more than 15 cm. were considered as trees. All such trees visible on either side of the entire length of the selected roads were noted and their numbers counted, while walking from one end of the road to the other. They included trees occurring on road sides, parks and also inside the compounds of both public and private buildings. Trees were identified with the help of local flora and other relevant literature (Cooke, 1967; Bhat, 2003; Swaminathan & Kochhar, 2003,).

RESULTS AND DISCUSSION:

The tree diversity of Honnavar town comprises of 112 species which includes 110 angiosperms and two gymnosperms. These species represent a total of 92 plant genera and 42 families. A list of all these trees with their family, common name, flowering/fruiting season and major use category is provided as table 1. A total of 2982 trees belonging to all the species were enumerated during the present study. The tree species diversity of Honnavar town is high when compared to the smaller area (9.38km^2) of the town. A comprehensive study of urban forests of 360 km^2 area of Bangalore found 374 species in the different land-use categories (Sudha and Ravindranath, 2000). Urban forest in 43 ha of NEERI campus at Nagpur, Maharashtra has only 46 tree species (Gupta *et al*., 2008). The 114 km^2 area of Chandigarh which is considered to be the greenest city of India has about 200 species which includes about 66 multipurpose trees (Kohli *et al*., 1994). 106 species was recorded in urban area of Karwar, the head quarters of Uttara Kannada district (Bhat *et al*., 2010).

Table 1. Tree species recorded from Honnavara town, Uttara Kannada, Karnataka.

Sl No.	Name of the species	Family	Common name	Native (N)/ Exotic(E)	Flowering /Fruiting	Uses
01	*Acacia auriculiformis*	Fabaceae	Acacia	E	Sep-Dec	M
02	*Adenanthera pavonia*	Fabaceae	Gulugunji mara	I	Mar-June	M
03	*Aegle marmelos*	Rutaceae	Bilva	I	Apr-May	S
04	*Annona muricata*	Annonaceae	Bombayi Halasu	I	June- Dec	F
05	*Ailanthus triphysa*	Simoaroubacea e	Guggula dhoopa	I	Jan-Apr	M
06	*Albizia lebbeck*	Fabaceae	Bage	I	Apr-May	M
07	*Alstonia scholaris*	Apocynaceae	Halemara	I	Dec-Mar	M
08	*Anacardium occidentale*	Anacardiaceae	Geru, Godambi	E	Dec-June	F
09	*Annona reticulata*	Annonaceae	Rama phala	I	June-Aug	F
10	*Annona squamosa*	Annonaceae	Seetha phala	I	June-Aug	F
11	*Anthocephalus cadamba*	Rubiaceae	Kadamba/apatya chakke	I	Dec-March	M
12	*Araucaria* sps.	Araucariaceae	Christmas tree	E	-	O
13	*Artocarpus gomezianus*	Moraceae	Vaate huli	I	Mar-Apr	F
14	*Artocarpus heterophyllus*	Moraceae	Halasu	I	Dec-June	F
15	*Artocarus incisus*	Moraceae	Deevi/Neeru halasu	I	Nov-Jan	F
16	*Averrhoa bilimbi*	Oxalidaceae	Bimbuli	I	All months	F
17	*Averrhoa carambola*	Oxalidaceae	Karabalu	I	May-Aug	F

18	*Azadirachta indica*	Meliaceae	Kahi bevu	I	Jan-July	M
19	*Bambusa arundinacea*	Poaceae	Bidiru, Bambu	I	-	M
20	*Bauhinia tomemtosa*	Fabaceae	Mani Mandara	I	Nov-Jan	O
21	*Bauhinia purpurea*	Fabaceae	Mandara	I	Sep-Mar	O
22	*Borassus flabellifer*	Arecaeae	Tale mara	I	Jan-Apr	F
23	*Buchanania lanzan*	Anacardiaceae	Nurukalu	I	Dec-Mar	F
24	*Caesalpenia pulcherrima*	Fabaceae	Rathnagandhi	I	All months	O
25	*Callistemon citrinus*	Myrtaceae	Bottle brush	E	Mar-Nov	O
26	*Calophyllum inophyllum*	Clusiaceae	Sura Honne mara	I	Oct-Apr	M
27	*Caryota urens*	Arecaceae	Baine mara	I	All months	M
28	*Cassia fistula*	Fabaceae	Kakke mara	I	Mar-May	O
29	*Cassia siamea*	Fabaceae	-	I	-	O
30	*Casuarina equisetifolia*	Casuarinaceae	Galimara	E	-	M
31	*Ceiba pentandra*	Bombacaceae	Bili buruga	I	Dec-Jan	O
32	*Citrus grandis*	Rutaceae	Chakota	I	All months	F
33	*Cordia mixa*	Boraginaceae	Challe hannu	I	Mar-Apr	F
34	*Couroupita guianensis*	Lecythidaceae	Nagalinga pushpa	E	All months	O
35	*Croton roxburghii*	Euphorbiaceae	Somaru	I	Nov-Jan	M
36	*Cycas* sps.	Cycadaceae	Cycas	I	-	O
37	*Dalbergia latifolia*	Fabaceae	Sissum	I	Dec-Feb	T
38	*Delonix regia*	Fabaceae	May flower	E	Apr-May	O

39	*Dichrostachys cinerea*	Fabaceae	Banni	I	Sep-Oct	S
40	*Dillenia pentagyna*	Dilleniaceae	Kaltega	I	March-June	T
41	*Erytrina indica*	Fabaceae	Channe	I	Sept-Oct	M
42	*Eucalyptus sp.*	Myrtaceae	Nilgiri	E		M
43	*Ficus benghalensis*	Moraceae	Alada mara	I	Dec-Jan	S
44	*Ficus elastica*	Moraceae	Rubber mara	E	-	O
45	*Ficus callosa*	Moraceae	-	I	All months	M
46	*Ficus hispida*	Moraceae	Gerittalu	I	All months	M
47	*Ficus microcarpa*	Moraceae	Kirugoli	I	Dec-Jan	S
48	*Ficus racemosa*	Moraceae	Atti mara	I	All months	S
49	*Ficus religiosa*	Moraceae	Arali/Ashwatha	I	Mar-July	S
50	*Garcinia indica*	Clusiaceae	Murugalu	I	Nov-Feb	F
51	*Gliricidia sepium*	Fabaceae	Gobbara mara	E	Feb-Apr	M
52	*Grevillea robusta*	Proteaceae	Silver oak	E	-	M
53	*Haldina cordifolia*	Rubiaceae	Heddi mara	I	Sep-Oct	M
54	*Hibiscus mutabilis*	Malvaceae	Dasavala	E	Sep-Dec	O
55	*Hibiscus rosa-sinensis*	Malvaceae	Dasavala	I	All months	O
56	*Holoptelia integrifolia*	Ulmaceae	Tapasi	I	Mar-Apr	T
57	*Ixora brachiata*	Rubiaceae	-	I	-	O
58	*Lagerstroemia speciosa*	Lythraceae	Nandi, Hole dasavala	I	Apr-June	O

59	*Leucaena leucocephala*	Fabaceae	-	I	-	M
60	*Macaranga peltata*	Euphorbiaceae	Chandakalu	I	Feb-Mar	M
61	*Madhuca longifolia*	Sapotaceae	Hippe	I	Jan-Apr	M
62	*Mangifera indica*	Anacardiaceae	Mavu	I	Dec-Mar	F
63	*Manihot esculenta*	Euphorbiaceae	Maragenasu	E	-	T
64	*Manilkara zapota*	Sapotaceae	Sapota	E	All months	F
65	*Melia azedarach*	Meliaceae	Hucchu bevu	I	Mar-May	M
66	*Michelia champaca*	Magnoliaceae	Sampige	I	All months	O
67	*Millingtonia hortensis*	Bignoniaceae	Mugila mallige	I	All months	O
68	*Mimusops elengi*	Sapotaceae	Bakula	I	Mar-apr	S
69	*Moringa oleifera*	Moringaceae	Nugge mara	I	Jan-Apr	F
70	*Muntingia calabura*	Elaeocarpaceae	Singapore cherry	E	All months	F
71	*Murraya koenigii*	Rutaceae	Kari Bevu	I	Dec-Mar	M
72	*Myristica fragrans*	Myristicaceae	Jayikayi	I	All months	F
73	*Nerium indicum*	Apocynaceae	Kanagile	E	-	O
74	*Nyctanthus arbor-tristis*	Oleaceae	Parijata	I	All months	O
75	*Peltophorum pterocarpum*	Fabaceae	Gulmohur	E	Jan-May	O
76	*Persea americana*	Lauraceae	Benne hannu	E	Mar-April	F
77	*Phyllanthus acidus*	Euphorbiaceae	Rajavale	I	Dec-May	F
78	*Phyllanthus emblica*	Euphorbiaceae	Nellikayi	I	Aug-Dec	F

79	*Plumeria obtusa*	Apocynaceae	Sampige	E	All months	O
80	*Plumeria rubra*	Apocynaceae	Gosampige	E	All months	O
81	*Polyalthia longifolia*	Annonaceae	Ashoka	I	Apr-June	O
82	*Pongamia pinnata*	Fabaceae	Honge	I	Apr-June	M
83	*Premna obtusifolia*	Verbenaceae	-	I	All months	M
84	*Psidium guajava*	Myrtaceae	Perale	E	All months	F
85	*Ravenala madagascariensis*	Musaceae	Travellers Palm	E	-	O
86	*Rhus odina*	Anacardiaceae		I	-	F
87	*Roystenia regia*	Arecaceae	Bottle palm	E	-	O
88	*Samanea saman*	Fabaceae	Rain tree	E	Mar-May	O
89	*Santalum album*	Santalaceae	Gandha	I	Mar-Aug	M
90	*Sapindus laurifolius*	Sapindaceae	Antuvala kayi	I	Oct-Dec	F
91	*Saraca indica*	Fabaceae	Ashoka	I	All months	S
92	*Spathodia campanulata*	Bignoniaceae	Flame tree	E	Sep-Dec	O
93	*Spondias dulcis*	Anacardiaceae	Sihi amate	I	Feb-Mar	F
9*4	*Spondias pinnata*	Anacardiaceae	Amate kayi	I	Feb-Mar	F
95	*Streblus asper*	Moraceae	Mitli mara	I	Jan-Mar	M
96	*Strychnos nux-vomica*	Loganiaceae	Kasaraka	I	Jan-Feb	M
97	*Syzygium aromaticum*	Myrtaceae	Lavanga	I	Jan-Apr	S
98	*Syzygium cumini*	Myrtaceae	Nerale	I	Mar-Apr	F
99	*Syzygium malaccensis*	Myrtaceae	Jambunerale	E	Apr-May	F

100	*Tabebia rosea.*	Bignoniaceae	-	E	Feb-Mar	O
101	*Tabebia* sp.*(Yellow flower)*	Bignoniaceae	-	E	Feb-Mar	O
102	*Tamarindus indicus*	Fabaceae	Hunase mara	I	Apr-June	F
103	*Tectona grandis*	Verbenaceae	Saguvani	I	June-Aug	T
104	*Terminalia arjuna*	Combretaceae	Arjuna	I	Jan-Mar	M
105	*Terminalia bellirica*	Combretaceae	Shanti mara	I	Jan-Mar	M
106	*Terminalia catapa*	Combretaceae	Kadu Badami	E	Jan-Mar	O
107	*Thespesia populnea*	Malvaceae	Huvarasi	I	All months	O
108	*Thevetia peruviana*	Apocynaceae	Karaveera	E	All months	O
109	*Trema orientalis*	Ulmaceae	Kiruhale	I	Dec-Mar	O
110	Unidentified 1 (*Ficus* sp.)	Moraceae	-	I	-	M
111	*Zanthoxylum rhetsa*	Rutaceae	Jummanakayi	I	June-July	F
112	*Ziziphus mauritiana*	Rhamnaceae	Bugari mara	I	Mar-May	F

F = Fruit yielding, O = Ornamental, S = Sacred, m = Medicinal and other uses.

About 71% of the recorded tree species of Honnavar are indigenous while only 29% species are introduced or of exotic nature. Majority of the introduced tree species are observed in the roadside, parks and in front of government buildings as avenue and ornamentals whereas the trees grown and maintained within the compounds of residential buildings and private lands are predominantly the indigenous types with various beneficial properties. A few gigantic sized trees of *Samanea saman* and *Peltophorum pterocarpum* dominate the main roads of the centre of the town which represent the surviving older trees. Similarly, several large sized sacred and religious trees such as *Ficus religiosa, F. benghalensis, F. racemosa, Aegle marmelos,Dichrostachys cinerea Mimusops elengi*, etc. are found at the vicinity of temples and other worship places.

When population density was considered, the top ten most common tree species are *Mangifera indica* (Mango, 22.016% of total tree population), *Polyalthia longifolia* (False Ashoka, 11.212%), *Peltophorum pterocarpum* (Yellow flame tree, 9.430%), *Samania saman* (Rain tree, 8.2%), *Artocarpus heterophyllus* (Jackfruit, 5.25%), *Tectona grandis* (Teak, 5.14%),.

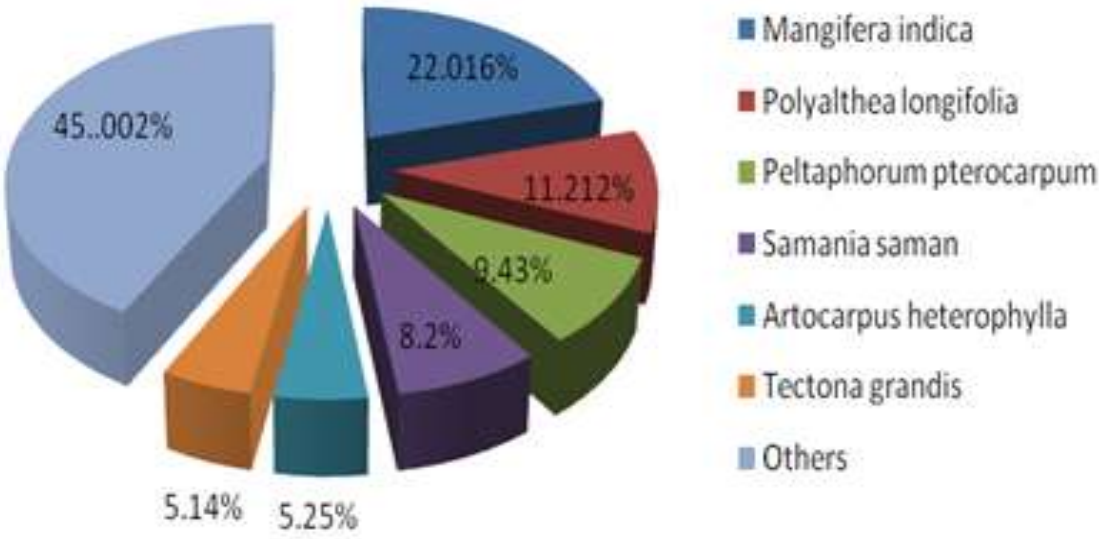

Fig. 2. Population density of notable tree species of Honnavar town, Uttara Kannada.

These 05 species together account for about 55.998% of the total trees of Honnavar (Fig. 2). The other 107 species together account for only 44.002% of trees. Among them, about 49 species are represented by only ten or less number of trees each. Notable among such rare species with less number of trees are (06 tree), *Adenanthera pavonia* (02 trees), *Couropita guianensis* (03 trees), *Ceiba pentandra* (05 trees), *Dichrostachys cinerea* (03 trees), *Dalbergia latifolia* (02 trees), *Erytrina indica (07), Haldina cordifolia* (03 trees), *Mimusops elengi* (04 trees), *Santalum album* (03 trees), *Streblus asper* (05 trees),*Anthocephalus cadamba* (02trees) *Persea americana* (02trees) and *Zanthoxylum rhetsa* (06 trees).

In general, the tree diversity of Honnavar represents a good assemblage of different utility categories such as wild and cultivated fruit yielding trees, shade and ornamental trees, sacred and religious trees, medicinally useful trees, etc. Besides the high proportion of older trees of wild mango and jackfruit, presence of other fruit yielding trees like *Artocarpus incisus* and *Spondias pinnata*, *Averrhoa carambola*, *Averrhoa bilimbi*, *Persea Americana*. Large sized sacred trees such as *Ficus religiosa* and F. *benghalensis*, gigantic exotic avenue trees such as *Samanea saman* and *Peltophorum pterocarpum*, rare medicinal species such as *Anthocephalus cadamba*, *Garcinia indica*, *Saraca asoca*, *Terminalia bellirica*, etc., are some of the notable features of the urban tree flora of Honnavar.

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