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RESEARCH ARTICLE

BOTANICAL GARDENS - WAY TO SUSTAINABILITY AND EX-SITU CONSERVATION

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ABSTRACT

Ex situ conservation, the protection of organism outside of their native habitats is an important strategy towards reaching the goal of biodiversity conservation. Amongst the various approaches of ex situ conservation botanical gardens hold an important position. With an inherent objectivity of conservation they are important ingredient of research and education. Since the mid-1970s public gardens world- wide has been active in the development of plant conservation programs often involving the cultivation and long-term maintenance of plants or populations of threatened species. Botanical gardens collectively exhibit an extremely diverse world flora. This article attempts to illustrate the importance of botanical gardens in the conservation of plant diversity along with the associated educational and research benefits, taking into account the flora of Botanical garden, situated at University of Delhi, Delhi, India.

INTRODUCTION

Sustainable plant conservation has been appropriately recognized as one of the main activities of botanical gardens. The increasing pressure on the natural resources and their by-products has led to dwindling of forest resources and loss of species diversity. With every passing day, enhanced anthropogenic activities have led to an increase in the list of rare and endangered species. Amongst the plants facing danger of extinctions in wild, most endangered floras ones are those in the tropics, where plant diversity is highest and habitat destruction is alarmingly fast. Several studies have been made indicating that the amount of threats to the indigenous plant resources have increased manifolds during the past several years. Botanical gardens address the key issue of species loss by acting as a refuge for the threatened species. Botanical gardens are mostly open to the public to spread awareness towards the natural resources and their benefits. It represents a place where several plant related aspects can be displayed, and where information can be conveyed in influential way so as to change people's attitude towards the environment and natural resources. The Botanical Garden can be divided into some broad areas, regions covering ornamental gardens comprising of orchids, ferns, herbs and other plants with aesthetic values. Arboretum comprises of trees collected across the world, providing climatic conditions favourable for their growth and development. In addition to the recreational, conservational and aesthetic importance, botanical gardens of colleges and universities comprises of areas specially devoted for buildings which harbour herbarium and museums in addition to the live laboratories, green houses and other modern laboratory facilities have made botanical gardens a live laboratory for experimentation and research especially in the field of studying ecological interactions in play (Primack *et al*., 2009) These botanical gardens are a source of diversity not only for flora but also for the associated fauna particularly insects, birds, bats etc. and also for the micro flora. Botanical gardens present information on various associations being set up to promote the involvement of community for achieving sustainable development through local level awareness. Thus considering the importance of the diversity of the plant species and its relevance in our day to day life, the authors have documented the plant species growing in the Delhi University Botanical Garden and their associated importance in this article. The paper highlights: (i) avenues of aligning botanical gardens at local level and its advantages, and (ii) also focuses on case studies that depict the multidimensional services provided by the floral species. Keeping in view the importance of Botanical gardens a survey was conducted at Botanical garden situated at University of Delhi to divulge the flora associated in a specially designed area. The importance of the plant species present was thus unearthed to know its educational, medicinal and aesthetic importance.

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MATERIAL AND METHODS

A survey was conducted in the Botanical garden of University of Delhi located at an altitude of 702 feet from the sea level.

The identification and nomenclature was accomplished by the Flora of Delhi, further confirmation and minor rectifications at species level were done taking the assistance of herbarium specimens documented in the Delhi University Herbarium and other on-line sites. Relevant literatures, descriptions and types were also consulted to authenticate the identity of the plants (Stearn, 1977; Bose *et al*. 1991; Maheswari, 1963; Pradip, 2006; Menon, 2000; Randhawa 1965; Sahani 1998; Sampling: The site of observation and data collection was the botanical garden of the University of Delhi, Botany Department, and adjoining areas, since it comprises the maximum diversity of the plants which represents the Delhi flora both indigenous as well as the exotic ones. The plants and their distribution were surveyed in order to assess their impact on the local community. Enlisting of all the plants along with their taxonomic status, economic utility, and importance in biodiversity conservation was done.

RESULTS

Table (Table 1) catalogues the botanical names of the plant cultivated at the Delhi University botanical garden and the adjoining areas (Fig. 1), alongwith their common names, family and economic utility has been provided. There are a total of 58 families (Pteridophyta, 2; Gymnosperms, 6, Dicotyledons, 71; and Monocotyledons, 10). The total number of species are 98 (Pteridophyta, 2; Gymnosperms, 6; Dicotyledons, 72; and Monocotyledons, 18). The plants growing in the Botanical garden have considerable economic utilities which includes medicinal value (for example, *Ephedra gerardiana, Rauvolfia serpentina*), edible starch and sago (*Cycas revoluta*), spice and culinary value (*Foeniculum vulgare, Cinnamomum camphora),*edible oil (*Helianthus annuus*), ornamental value (*Saraca asoca, Livistona chinensis*), fibre plant (*Cannabis sativa, Gossypium herbaceum*), fruit trees (*Carica papaya, Syzygium cumini, Psidium guajava,Manilkara zapota*), biodiesel prospect (*Jatropha curcas),* lubricant source

Table 1.

S.NO.	TANICAL NAME	COMMON NAME	FAMILY	IMPORTANCE (Medicinal/Aesthetic/Economic etc.)
		PTERIDOPHYTES		
1.	*Marsilea quadrifolia* L.	Sushni saag	Marsileaceae	Culinary and medicinal
2.	*Azolla sp.*Lam	Mosquito fern, water fern	Salviniaceae	Used as biofertilizer
		GYMNOSPERMS		
3.	*Araucaria araucana* (Molina) K.Koch	Monkey tail tree	Araucariaceae	Edible seeds
4.	*Agathis robusta (C.Moore ex F.Muell.) Bailey*	Kauri Pine	Araucariaceae	Timber yielding
5.	*Ephedra distachya* L.	Somlatha	Ephedraceae	Used to relieve acute muscular and rheumatic pains
6.	*Juniperus communis* L.	Cedar /Ginepro Gin	Cupressaceae	Used in herbal medicine, treatment of digestive disorders plus kidney and bladder problems
7.	*Platycladusorientalis* L. Franco	biota or oriental thuja	Cupressaceae	Ornamental/aesthetic values
8.	*Cycas revoluta* Thunb.	king sago, sago cycad, Japanese sago palm	Cyacadaceae	Pith contains edible starch, and is used for making sago
		ANGIOSPERM (Dicotyledonae)		
9.	*Justicia adhatoda* L. *syn: Adhatoda vesica* Nees	Adusa or Aruha	Acanthaceae	Pharmacological and medicinal importance
10.	*Thunbergia grandiflora* (Roxb. ex Rottl.) Roxb.	Skyflower/ Bengal clock vine	Acanthaceae	Medicinal plant and a green manure plant
11.	*Mangifera indica* L.	Aam	Anacardiaceae	Fruit plant,pickles, fruit parts possesses medicinal value
12.	*Foeniculum vulgare* Mill.	Saunf	Apiaceae	Spice and for culinary and medicinal purposes
13.	*Alstonia scholaris* (L.) R. Br.	Blackboard tree, Indian devil tree	Apocynaceae	Astringent herb for treating skin disorders, malarial fever, urticaria, chronic dysentery, diarrhoea etc.
14.	*Plumeria alba*	frangipani trees	Apocynaceae	Aesthetic value
15.	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Sarpagandha	Apocynaceae	Contains bioactive compounds like reserpine, ajmaline, rescinnamine, serpentinine having medicinal importance
16.	*Helianthus annuus* L.	Sunflower	Asteraceae	Seed yield edible oil
17.	*Ceiba pentandra* (L.) Gaertn.	Kapok	Bombacaceae	Used for ethno-medicinal purposes and also in oil extraction.
18.	*Cereus hildmannianus* K. Schum.	Cactus	Cactaceae	Ornamental plant
19.	*Bauhinia variegata* L.	Kachnar, Purple Orchid Tree	Caesalpiniaceae	Flowers contain flavonoids, kaempferol-3-galactoside and kaempferol-3-rhamnoglucoside. The bark glycoside have pharmacological properties
20.	*Cassia fistula* L.	Golden shower	Caesalpiniaceae	Used medicinally in Ayurveda
21.	*Saraca asoca* (Roxb.) Willd.	Ashoka tree	Caesalpiniaceae	Used as ornamental plant
22.	*Cannabis sativa* L.	Hemp, *Bhang*	Cannabinaceae	Yields fibre. Plant yields hallucinogenic compound, hydrocannabinol
23.	*Carica papaya* L.	Papaw or Pawpaw	Caricaceae	As food, a cooking aid and in traditional medicine. Papain tenderizes meat,stem and bark may be used in rope production
24.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Beheda	Combretaceae	antifungal, antibacterial, anti-cancer properties
25.	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Axlewood, dhaora	Combretaceae	Source of ghatti gum, *Antheraea paphia* moth fed on its leaves which produces the tassar silk (Tussah), a form of wild silk of commercial importance

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26.	*Cuscuta reflexa* Roxb.	dodder	Cuscutaceae	Parasitic plant, have medicinal value
27.	*Kalanchoe pinnata* (Lam.) Pers.	Pathar chattam	Crassulaceae	alkaloids, steroids, lipids, and other phytochemical compounds present in extracts of the plant have high medicinal value
28.	*Hevea brasiliensis* (Willd. ex A. Juss.) Mull. Arg.	Rubber tree	Euphorbiaceae	Latex is of industrial importance in manufacture of rubber. Also used for producing mattresses, boots, mats, common household items, clinical gloves etc.
29.	*Jatropha curcas* L.	Jatropha	Euphorbiaceae	Used for the production of biodiesel
30.	*Ricinus communis* L.	Castor oil plant	Euphorbiaceae	Used for medicinal purposes and as lubricant
31.	*Phyllanthus emblica* L.	Amla	Euphorbiaceae	Cultural and religious significance, Medicinal use, Culinary use, in cosmetics
32.	*Cicer arietinum* L.	Chick pea	Fabaceae	Edible fruit, cooked in stews, ground into flour called gram flour
33.	*Crotalaria retusa* L.	Rattlepods	Fabaceae	Used as a green manure, alkaloids present are used to induce pulmonary hypertension. Also used as fish poison.
34.	*Crotalaria spectabilis* Roth	Rattlepods	Fabaceae	Used as a green manure, alkaloids present are used to induce pulmonary hypertension. Also used as ornamental
35.	*Flemingia semialata* Roxb.	Winged-stalk	Fabaceae	Used as a fodder, Host for lac insect
36.	*Flemingia macrophylla* Willd.) Merr.	Hahapaan	Fabaceae	Used in mulching and weed control. Lac insect host
37.	*Glycine max* (L.) Merr.	Soyabean, Greater bean	Fabaceae	High protein food source
38.	*Indigofera tinctoria* L.	True Indigo	Fabaceae	Indigo dye is obtained from it, used in alleviating pain,used as an anti-inflammatory for insect stings, snakebites and swellings
39.	*Ocimum basilicum* L.	Tulsi	Lamiaceae	Used for culinary and therapeutic purposes
40.	*Salvia splendens* Sellow ex Schult.	Scarlet Sage	Lamiaceae	Ornamental plant, leaves show antioxidant activity
41.	*Cinnamomum camphora* (L.) J. Presl	Tejpatta	Lauraceae	Used as aromatic source and a spice
42.	*Centella asiatica* (L.) Urb.	Satawari ,Brahmi booti	Apiaceae	Used as food in making refreshing drinks and also as a spice
43.	*Magnolia grandiflora* L.	Great Laurel Magnolia	Magnoliaceae	primitive genus, aromatic bark contains magnolol, honokiol, 4-O-methylhonokiol and obovatol, , used in traditional medicine, act as host to a variety of moth species, used in wrapping etc., cultivated as an ornamental plant
44.	*Gossypium herbaceum* L.	Cotton Levant cotton	Malvaceae	Yields cotton, the seed surface fibre is used in manufacturing clothes
45.	*Albizia lebbeck*	Lebbeck	Mimosaceae	Lebbeck is an astringent, and used to treat boils, cough, and to treat the eye diseases, flu, gingivitis, lung problems
46.	*Ficus religiosa* L.	Sacred Fig	Moraceae	Used in traditional medicine for asthma, diabetes, diarrhoea, epilepsy, gastric problems, inflammatory disorders, infectious and sexual disorders
47.	*Ficus benjamina* L.	Gullar	Moraceae	Fruits are edible
48.	*Morus alba* L.	White mulberry	Moraceae	Fruits are edible. Feedstock for silkworms, shows antibacterial activity
49.	*Eucalyptus camaldulensis* Dehnh.	River red gum, Red gum, Murray red gum	Myrtaceae	Timber yielding, essential oil, eucalyptus oil are used in perfumery, and has medicinal value
50.	*Syzygium cumini* (L.) Skeels	Jamun or portugese plum	Myrtaceae	Edible fruits
51.	*Psidium guajava* L.	Apple guava or Common guava	Myrtaceae	Edible fruits
52.	*Mirabilis jalapa* L.	The four o'clock flower	Nyctaginaceae	Used in food colouring. The leaves may be eaten cooked as well,as an ornamental plant
53.	*Bougainvillea spectabilis* Willd.	Bougainvillea	Nyctaginaceae	Cultivated as an ornamental plant
54.	*Nymphaea* species	Water-lilies	Nymphaeaceae	Cultivated as an aquatic ornamental plant
55.	*Oxalis debilis var. corymbosa* (DC.) Lourteig	Pink Wood Sorrel	Oxalidaceae	Cultivated as an ornamental plant
56.	*Oxalis acetosella* L.	wood-sorrel	Oxalidaceae	Uses as toxic agent, also cultivated as an ornamental
57.	*Oxalis corniculata* L.	wood sorrels	Oxalidaceae	Used to make a lemony-tasting tea when dried
58.	*Papaver rhoeas* L.	Opium	Papaveraceae	Used as food and oil extraction
59.	*Grevillea robusta*	Southern Silky oak or Silky oak	Proteaceae	Wood is used for making furniture
60.	*Putranjiva roxburghii* Wall.	Child's amulet tree, Child-life tree, Lucky bean tree	Putranjivaceae	Wood is used for making furniture
61.	*Ranunculus sceleratus* L.	Little leaf buttercup, buttercup	Ranunculaceae	Used for abscesses and sore throat and as a sedative
62.	*Ziziphus jujuba* Mill.	Ber or Indian plum	Rhamnaceae	Fruits are edible, also used in making pickles and beverage
63.	*Pyrus pashia*	Pear	Rosaceae	Used as fruit and juices
64.	*Ixora pavetta*	West Indian jasmine	Rubiaceae	Aesthetic importance, it is also used in Indian folk medicine
65.	*Citrus sinensis* (L.) Osbeck	Citrus, Sweet orange	Rutaceae	Used as a fruit and for extracting fruit juice.
66.	*Manilkara zapota* (L.) P. Royen	Sapota	Sapotaceae	Fruits edible, leaves showed anti-diabetic, antioxidant and hypo-cholesterolemic (cholesterol-lowering) effects.
67.	*Antirrhinum majus*	Dog flower	Scrophulariaceae	Ornamental flowering plant
68.	*Withania somnifera* (L.) Dunal	Ashwagandha or poison gooseberry	Solanaceae	Roots have rejuvenating property, known as Indian Ginseng
69.	*Tamarix dioica* Roxb. ex Roth	Salt cedar	Tamaricaceae	For carpentry and as firewood plant
70.	*Lantana camara*L.	Lantana	Verbenaceae	Invasive weed.

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71.	*Mimusops elengi*L.	Indian Medlar Tree	Sapotaceae	Its timber is valuable, fruit is edible and is used in traditional medicine
72.	*Delonix regia*(Boj. ex Hook.) Raf	Peacock Flower	Caesalpiniaceae	grown as an ornamental tree, has soil improving properties
73.	*Callistemon viminalis* R. Br.	Weeping bottle brush	Myrtaceae	Ornamental, insect repelling qualities, antibacterial properties
74.	*Dalbergia sissoo* Roxb.	Indian Rosewood	Papilionaceae	Timber tree, the young branches and foliage eaten by livestock
75.	*Syzygium nervosum* DC	Rai Jamun	Myrtaceae	Fruits are edible
76.	*Pterospermum acerifolium* (L.) Willd	Kanak Champa	Sterculiaceae	For planking and wooden boxes, used in religious purposes also
77.	*Casuarina equisetifolia* L.	Beef wood tree	Casuarinaceae	Cultivated for fuel, erosion control and as a windbreak
78.	*Tabernaemontana divaricata* R.Br. ex Roem. & Schult.	Crape Jasmine	Apocynaceae	Ornamental and ethnic values
79.	*Jatropha curcas* L.	Purging Nut	Euphorbiaceae	Jatropha oil is processed to produce high-quality biofuel
80.	*Carissa congesta* L.	Karonda, Bengal Current	Apocynaceae	fruit is a rich source of iron, valuable for stabilizing eroding slopes
		Monocotyledoneae		
81.	*Monstera deliciosa* Leibm.	Swiss cheese plant (or just cheese plant), Fruit salad plant, Monster fruit	Araceae	Ornamental climber. Fruits edible
82.	*Elaeis guineensis*	Oil palm	Arecaceae	Oil from palm seeds edible
83.	*Caryota rumphiana* Mart.	Fish tail palm/albert palm	Arecaceae	An Ornamental plant
84.	*Livistona chinensis* (Jacq.) R. Br. Ex Mart.	Chinese fan palm	Arecaceae	Cultivated as an ornamental tree
85.	*Canna indica*L.	Canna, Keli	Cannaceae	Cultivated as an ornamental plant
86.	*Rhoeo discolor* (L'Her.) Hance	Oyster plant, Purple-leaved Spiderwort	Commelinaceae	Cultivated as an ornamental plant
87.	*Cyperus species*	Papyrus sedges,Flatsedges,	Cyperaceae	Cultivated as an ornamental plant
88.	*Sansevieriazeylanica* (L.) Willd.	Mother-in-law's tongue, Devil's tongue, Jinn's tongue, Bow string hemp, Snake plant	Asparagaceae	Cultivated as an ornamental plant
89.	*Sansevieria cylindrical* Bojer ex Hook.	Common Spear Plant	Asparagaceae	Cultivated as an ornamental plant
90.	*Oryza sativa* L.	Rice	Poaceae	Rice is an important cereal crop
91.	*Hordeum vulgare* L.	Barley	Poaceae	Seeds are important millet, an animal feed, used in beverage industry, source of amino acids, variegated varieties used as an ornamental crop
92.	*Phyllostachys aurea* Riviere & C. Riviere	Golden or fishpole Bamboo	Poaceae	Used in making Bamboo Pipes
93.	*Saccharum officinarum* L.	Sugarcane	Poaceae	Sugar yielding plant
94.	*Triticum aestivum* L.	Wheat	Poaceae	Important cereal crop, also used as fodder for cattle
95.	*Eicchornia crassipes* (Mart.) Solms	Terror of Bengal	Pontederiaceae	An invasive aquatic weed
96.	*Ravenala madagascariensis* Sonn.	Travellers palm	Strelitziaceae	Ornamental tree. Used in therapeutic purposes
97.	*Aloe vera* (L) Burm. f.	Indian aloe	Xanthorrhoeaceae	Used as a cosmetic and has therapeutic value
98.	*Bambusa vulgaris var. Vittata* Schrad.*ex*J.C.Wendl	Tiger bamboo	Poaceae	Used as fuel and the leaves used as fodder

for machines (*Ricinus communis)*, grain legume (*Cicer arietinum,Glycine max*), green manure crop (*Crotalaria retusa, Crotalaria spectabilis)*,natural dye resource (*Indigofera tinctoria)*,timber value (*Eucalyptus camaldulensis, Grevillea robusta)* and cereal crop *(Triticum aestivum, Oryza sativa)* etc.

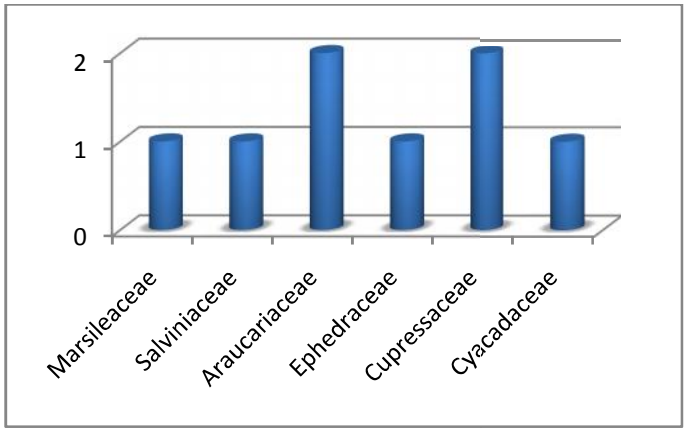

Figure 1. Diversity of Pteridophytes and Gymnosperms

DISCUSSION

Botanical gardens play a key role in collection and maintenance of rich repository of plant resources. The collections sometimes are centuries old and the plant species have been conserved by ex situ conservation technique. Botanical gardens also enables research in threatened plants and may perhaps lead to the understanding problems associated with species that has led to its decline in its natural habitat. India has twenty one botanical gardens well distributed from the Northernmost part of Kashmir to the Southernmost part of Tamil Nadu e.g., Ootacamund botanical gardens. From just a site seeing place, the role of botanical gardens has widened to include more serious measures in view of assessment and inventorisation of endemic, rare and threatened plant species; evolving conservation strategies; studies on fragile ecosystems and protected areas like Sanctuaries, National Parks and Biosphere Reserves; monitoring of changes in floristic components; ex-situ conservation, multiplication and maintenance of germplasm of plant genetic resources, endemic and threatened species, wild ornamentals, etc.; ethnobotanical and geobotanical studies and the development of National

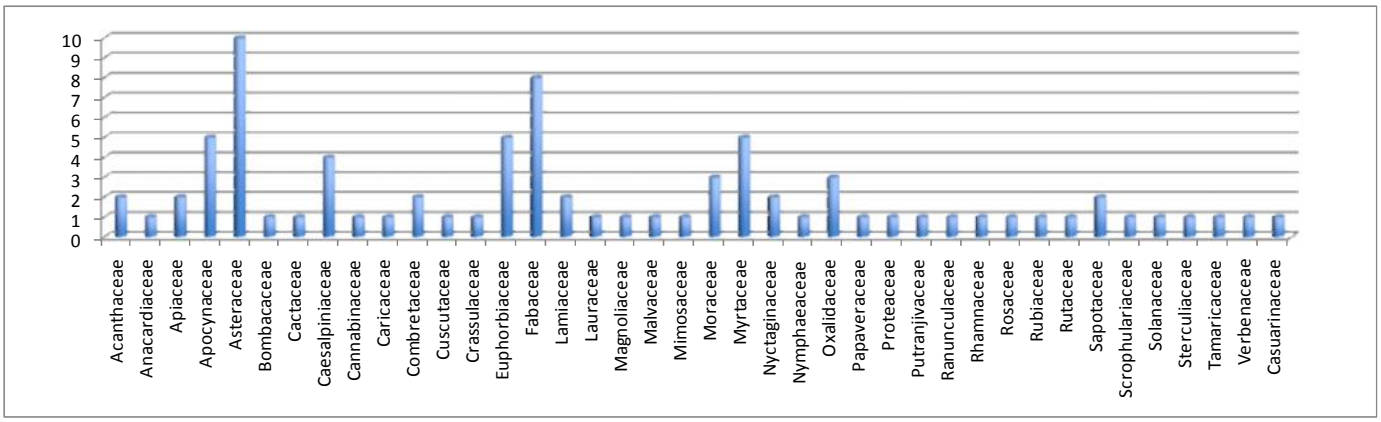

Figure 2. Diversity of Angiosperms (Dicots)

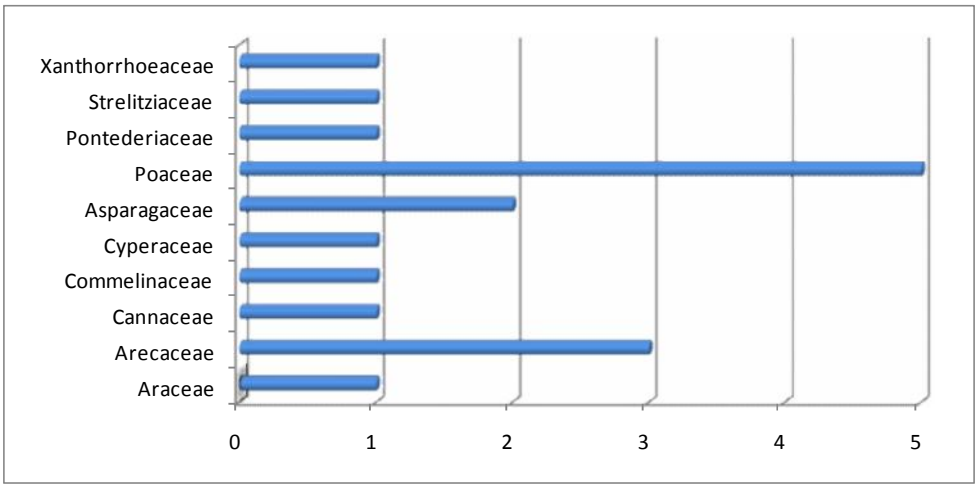

Figure 3. Diversity of Angiosperms (Monocots)

Database on Herbarium, live collections, plant genetic resources, plant distribution and nomenclature. The Botanical Garden at Delhi University has considerable diversity and is a home for a total of 56 families which includes Pteridophytes, Gymnosperms, Dicotyledons and Monocotyledons), 83 genera and 98 species. Figures 1-3 represents the diversity in the families with respect to the genus and species. Maximum species diversity is represented in the families Fabaceae and Asteraceae. Maximum usage of leaves and fruits in making traditional as well as modern medicines has been indicated. Botanical garden also enables the people to understand the plants and to know its economic utilities. Therefore, the botanical gardens create awareness by educating a mass of people regarding the relevance of flora for their meaningful usage. The botanical garden with rich diversity of flora acts as a place of learning for the students, academicians, researchers, planners, conservationists, etc. It is a natural laboratory and in an urban city like Delhi, the Delhi University Botanical Garden plays important role in education especially pertaining to the plants. Knowledge can also be gained in the field of plant horticulture, ethno-botany, biodiversity resources and restoration ecology. Botanical gardens can also generate seeds for seed banks and explants source for carrying out tissue culture for propagating the threatened species.

Education should be considered the strength of botanical gardens as it allows them to create awareness for conservation of plants, reaching out scores of people and to communicate how this can be achieved. The botanical garden and its adjoining area with a variety of trees species also serve the purpose of recreation amongst the masses. The botanical gardens act as micro green lungs for a small landscape, providing a continuous recharge of purified air. It is the responsibility of the citizens, State to maintain such botanical gardens in localities thus preserving various species and educating people about the importance of local flora. Development and funding essentially helps to maintain botanical gardens and to reap their potential for biodiversity conservation.

Conclusion

The current survey of the Delhi University Botanical garden and it adjoining area revealed immense diversity in its flora. The Botanical garden thus plays a key role in ex situ conservation along with educating people about the importance of species existing in these gardens. The botanical garden also helps in conducting research studies on the threatened species and may also lead to an understanding of the reasons behind the population decline in natural habitats. The multiplication of

the threatened plants and its planting in natural habitats could be one of the ways by which the plant populations could be prevented from extinction in the natural habitats in a sustainable manner.

REFERENCES

Blatter, E. and Millard W.S.. 1937. Some beautiful Indian tree (revised edition by W.T. Stearn 1977), Bombay Natural Society, Mumbai.

Bose, T.K. and Chowdhury, B. 1991. Tropical Garden Plants in colour, Calcutta Horticulture and allied Publishers.

Hawkins, R.E. 1986. Encyclopedia of Natural History, Bombay Natural history Society, Oxford University Press.

Krishen P. 2006. Trees of Delhi- A field guide, D.K Delhi.

Maheswari, J.K. 1963. The Flora of Delhi. Council of Scientific and Industrial Research, New Delhi

Menon S. and Pallava B. 2000. Tree of India Timeless Books, South Extension- I, New Delhi.

Primack R. B. and Miller-Rushing A. J. 2009. The role of botanical gardens in climate change research. 182(2), 303–313.

Randhawa M.S. 1965. Flowering Trees, National Book Trust, New Delhi.

Sahani, K.C. 1998. The book of Indian Trees, Bombay Natural History Society. Oxford University Press.

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