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DESIGNED PLANT BIODIVERSITY IN A COLLEGE CAMPUS IN CHANDIGARH

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ABSTRACT: The importance of biodiversity planning in urban area is a small step to mitigate the biodiversity loss because of urbanization and deforestation. The sustainable urban communities can be created by designing the landscapes with diverse group of plants ranging from trees, medicinal plants and ornamental plants which not just provide healthy, pollution free environment but also provide with various ecosystem services like medicinal value, food and fruit supply, aesthetic value and educational services. This study aims at understanding the contribution of plants in providing ecosystem services to the people so that the readers have a sense of appreciation towards the healthy environment created by diverse group of plants growing in the college campus.

Keywords: Urban forestry, Plant diversity, Ecosystem service, Landscape, Pollution.

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1.INTRODUCTION

Green spaces in small urban sectors not only have positive effect on the aesthetic value and the health of masses but also contribute to overall urban biodiversity and the ecology of the area [1-3]. Urban areas have high level of air pollution and the green cover of plants act as green purifiers of air and filters for suspended particulate matter [4-8]. They also help in providing cleaner air. Moreover, they provide health benefits like medicinal value as well as influence the general well-being of people [9-10]. Apart from these health benefits, the plants in urban areas help in promoting ecological knowledge as well as reduce aggressiveness and provide forum for outdoor classrooms. The Union Territory of Chandigarh is located in the foothills of the Shivalik hill ranges and tree

plantation and landscaping is a unique feature of Chandigarh [11-14]. There has been planting of different types of flowering as well as evergreen trees along the roads, shopping complexes, residential areas and in parks. All the roads running north-south are planted with canopy - forming tree so as to minimise low sun rays whereas roads running east-west have 'vista' forming trees like Kachnar and the Kusum. Also, the road dividers have flowering bougainvillea and roundabouts have evergreen shrubs and sculptures. This all planned green cover in Chandigarh gives a beautiful look to Chandigarh as well as has number of health benefits. The importance of educational institutes is not just to provide education to the people but at the same time they should be well equipped to accommodate the need of good quality of life including the need of recreational pursuit, healthy environment and stress free atmosphere. All these needs can be partially fulfilled by the designed biodiversity of plants in the campus [15-17]. This observational study was done to observe the structural diversity of plants ranging from ornamental plants, trees, vegetable plants and medicinal plants found in the college campus and elucidate the various ecosystem services provided by these plants. DAV College, Sector 10, Chandigarh is not just a temple of knowledge but have a good collection of different type of plants.

2. MATERIALS AND METHODS

The campus of DAV College, Sector 10, Chandigarh was selected to study the designed biodiversity of plants. The college was established in the year 1958 when the city of Chandigarh was in its infancy. The college is located in Sector 10 of Chandigarh and is spread over an area of 683463 square meters and is bounded in north by Residential area, south by skating ring, west by Government polytechnic for women, and east by Lawn tennis courts of Chandigarh Lawn Tennis Association. It comprises of sciences and humanities blocks, Library, canteen, administrative block, palm garden, medicinal plants garden, plant nursery, Playground, Parking areas and hostels. All these areas were taken into account to study plants diversity. The entire plantation of the campus was observed and photographed. The literature review was done to study the importance of the plantation observed.

3. RESULTS AND DISCUSSION

The study found that different type of plants ranging from ornamental plants, medicinal plants, vegetable plants and various types of trees were present in the campus that are providing many ecosystem services to the people [18-22] (**Tables 1-3**). The various plant types found in the campus provided with many ecosystem services ranging from aesthetic value which is a visual treat for eyes and provide peace to the mind of students and teachers (**Fig 1-3**). The campus has many trees which provide fruits like Mango, Amla, Figs, Laukat and Lemon. Some plants were also providing seasonal vegetables to the residents.

Table 1: The list of trees found in the campus and the services provided by them

Sr. No	Botanical Names(Family)	Ecosystem services
1.	<i>Polyalthia longifolia</i> (Annonaceae)	Asthetic value
2.	<i>Grevillea robusta</i> (Proteaceae.)	Shading effect and aesthetic value
3.	<i>Mangifera indica</i> (Anacardiaceae)	Fruit , medicinal value, Plywood making and shading effect
4	<i>Alstonia scholaris</i> (Apocynaceae)	Pencil making, utensils and coffin making and medicinal value
5	<i>Ficus infectoria</i> (Moraceae)	Give shadow and used medicinally
6	<i>Araucaria sp.</i> (Araucariaceae)	Ornamental tree
7	<i>Syzigium cumini</i> (Myrtaceae)	Fruit and medicinal value
8	<i>Ficus religiosa</i> (Moraceae)	Shade giving and food
9	<i>Azadirachta indica</i> (Meliaceae)	Medicinal value and insecticidal properties
10.	<i>Phyllanthus emblica</i> (Phyllanthaceae)	Fruit, medicinal value, shampoo and soaps, oil .
11.	<i>Nerium indicum</i> (Apocynaceae)	Medicinal value, religious value and ornamental.
12	<i>Roystonea regia</i> (Arecaceae)	Ornamental,oil and medicinal value
13	<i>Eucalyptus sp.</i> (Myrtaceae)	Wood and insecticidal properties
14	<i>Callistemon</i> (Myrtaceae)	Ornamental tree
15	<i>Cycas revoluta.</i> (Cycadaceae)	Ornamental and seeds edible
16	<i>Tabemaemontana sp.</i> (Apocynaceae)	Ornamental tree
17	<i>Eriobotrya japonica</i> (Rosaceae)	Fruit and medicinal plant
18	<i>Citrus lemon</i> (Rutaceae)	Fruit and medicinal plant
19	<i>Artocarpus heterophyllus</i> (Moraceae)	Food and medicinal value
20	<i>Juniperus sp.</i> (Cupressaceae)	Ornamental tree and Christmas tree
21	<i>Schleichera oleosa</i> (Sapindaceae)	Shade giving and aesthetic value
22	<i>Cascabela thevetia</i> (Apocynaceae)	Aesthetic value
23	<i>Morus sp.</i> (Moraceae)	Fruit, silkworm cultivation.
24	<i>Albizzia lebbeck</i> (Fabaceae)	Aesthetic value and nitrogen fixation in soil
25	<i>Chukrasia tabularis</i> (Meliaceae)	Shade giving,piano-cases,furniture and dye making

26	<i>Dypsis lutescens</i> (Arecaceae)	Ornamental palm
27	<i>Ptychosperma macarthuri</i> (Arecaceae)	Ornamental palm
28	<i>Ravenala madagascariensis</i> (Strelitziaceae)	Ornamental value
29	<i>Chamaedorea costaricana</i> (Arecaceae)	Ornamental palm
30	<i>Butia capitata</i> (Arecaceae)	Ornamental palm
31	<i>Caryota sp.</i> (Arecaceae)	Ornamental palm
32	<i>Beaucarnea recurvata</i> (Asparagaceae)	Ornamental value
33	<i>Ravenea</i> (Arecaceae)	Ornamental palm
34	<i>Phoenix dactylifera</i> (Arecaceae)	Fruit and Ornamental palm
35	<i>Mimusops elengi</i> (Sapotaceae)	Aesthetic and medicinal value

Table 2. The list of medicinal plants in the campus (Herbal garden)

S.No	Botanical name(Family)	Medicinal value
1	<i>Rauwolfia serpentine</i> (Apocyanaceae)	Sedative, dysentery, tonic etc.
2	<i>Stevia sp.</i> (cruciferae)	Artificial sweetner of low calories.
3	<i>Terminalia arjuna</i> (Combretaceae)	Heart diseases
4	<i>Vitex negundo</i> (Lamiaceae)	Cough remedy, skin diseases, liver and spleen disorder etc
5	<i>Acorus calamus</i> (Acoraceae)	Sedative, laxative and carminative
6	<i>Elettaria cardamomum</i> (Zingiberaceae)	Indigestion and pulmonary diseases
7	<i>Gymnema sylvestre</i> (Asclepiadaceae)	Reduce blood sugar level and obesity.
8	<i>Asparagus racemosus</i> (Asparagaceae)	Soothing effect on digestive system etc.
9	<i>Terminalia chebula</i> (Combretaceae)	Laxative, purgative and astringent
10	<i>Clitoria ternatea</i> (Fabaceae)	Leucoderma, Piles, blood purifier and laxative
11	<i>Justicia adhatoda</i> (Apocynaceae)	Anti-inflammatory and asthma
12	<i>Ocimum gratissimum</i> (Lamiaceae)	In worships, comman cold,malaria and headache.
13	<i>Bryophyllum pinnatum</i> (Crassulaceae)	Kidney and gall stones, jaundice and in joint pains
14	<i>Tinospora cordifolia</i> (Menispermaceae)	Antipyretic, build immune system, urinary disorder.
15	<i>Carissa carandas</i> (Apocynaceae)	Urine related problems
16	<i>Bacopa monnieri</i> (Scrophulariaceae)	Skin problem and memory enhancer etc

17	<i>Curcuma longa</i> (Zingiberaceae)	Cancer cure, antimicrobial property and arthritis etc.
18	<i>Vinca minor</i> (Apocynaceae)	Cancer drug
19	<i>Plumbago zeylanica</i> (Plumbaginaceae)	Digestive and carminative herb
20	<i>Aloe vera</i> (Aloaceae)	Skin disorder, jaundice, pain killer etc.
21	<i>Hibiscus-rosa-sinensis</i> (Malvaceae)	Skin care, absorb UV light and hair care.
22	<i>Withania somnifera</i> (Solanaceae)	Diuretic, sedative and boost immunity
23	<i>Swertia chirayaita</i> (Gentianaceae)	Tonic for digestion and general well being.
24	<i>Mimusops elengi</i> (Sapotaceae)	Medicinal value and shade giving

Table 3. The list of ornamental plants and vegetable plants in the campus

S.No	Botanical names	Services
1	<i>Dahlia pinnata</i> (Asteraceae)	Ornamental and food crop
2	<i>Tagetes sp.</i> (Asteraceae)	Ornamental and medicinal value
3	<i>Matthiola incana</i> (Brassicaceae)	Heavily scented ornamental plant
4	<i>Phlox paniculata</i> (Polemoniaceae)	Aesthetic value
5	<i>Nemesia sp.</i> (Scrophulariaceae)	Aesthetic value
6	<i>Tropaeolum sp.</i> (Tropaealaceae)	Medicinal value, culinary food, aesthetic value
7	<i>Salvia sp.</i> (Lamiaceae)	Aesthetic value and medicinal value
8	<i>Artemisia sp</i> (Asteraceae)	Aesthetic value
9	<i>Calendula officinalis</i> (Asteraceae)	Aesthetic value
10	<i>Dianthus caryophyllus</i> (Caryophyllaceae)	Aesthetic value
11	<i>Viola sp.</i> (Violaceae)	Medicinal value and ornamental
12	<i>Lilium candidum</i> (Liliaceae)	Ornamental
13	<i>Lobularia maritime</i> (Brassicaceae)	Aesthetic value
14	<i>Petunia sp.</i> (Solanaceae)	Aesthetic value
15	<i>Verbenia sp.</i> (Verbenaceae)	Medicinal value and aesthetic value
16	<i>Gazania linearis</i> (Asteraceae)	Aesthetic value
17	<i>Narcissus sp.</i> (amaryllidaceae)	Medicinal plant and sweet smelling
18	<i>Lupinus albus</i> (Fabaceae)	Stock feed and ornamental plant
19	<i>Delphinium sp.</i> (Ranunculaceae)	Ornamental plants
20	<i>Dracaena sp</i> (Asparagaceae)	Ornamental plant
21	<i>Furcaria sp.</i> (Agavaceae)	Ornamental plant
22	<i>Pedilanthus sp.</i> (Euphorbiaceae)	Ornamental value

23	<i>Zamia sp.</i> (Zamiaceae)	Aesthetic value
24	<i>Rhoeo sp.</i> (Commelinaceae)	Aesthetic value
25	<i>Croton sp.</i> (Euphorbiaceae)	Aesthetic value
26	<i>Lantana camara</i> (Verbenaceae)	Aesthetic value
27	<i>Pothos sp.</i> (Araceae)	Ornamental plant
28	<i>Rosa sp.</i> (Rosaceae)	Ornamental value, medicinal value and perfumes
29	<i>Bougainvillea sp.</i> (Nyctaginaceae)	ornamental value

Figure 1: *Polyalthia longifolia* (Annonaceae)



Fig 2: *Beaucarnea recurvata* (Asparagaceae)



Fig 3: Tree Plantation along the playground

Medicinal plants grown in the area like Rauwolfia, Stevia, Harar, Kaner, Tulsi, Patharchatta, Chirata etc. provided many health services and helped fight various diseases. The simple view of natural elements like trees and flowers at work places lead to less job pressure and fewer ailments and headaches in the workers [23]. Visual landscapes are important for psychological well-being. Shade trees and smaller plants such as shrubs help cool the urban environment [24,25]. The branches and leaves reduce the amount of solar radiations that reaches the area below the canopy of the tree this in turn reduces the heat transmitted to the buildings and the environment [26]. Evaporation and the shading effect of trees can reduce the summer's air temperature [27]. This leads to power saving as one requires less cooling of buildings where students study. Trees which provided these services in the campus were Alstonia, Mangifera, Polyalthia, Tabemaemontana, Eriobotrya and Phyllanthus etc. In addition to energy saving, trees and plants also help in providing good quality air. Leaves help in removing various pollutants from air as dry depositions. Plants take up gaseous pollutant through stomata's while some get adhered to the surface of the leaves where they can be washed by rain. By these ways various air pollutants can be reduced in urban areas [28-29]. Trees also remove the carbon dioxide from the atmosphere by storing or sequestering it [30]. This provides us with cleaner and cooler air to breathe and hence a healthy life. Diversity of plants in campus also provided a good opportunity to the students to learn about the different type of plants and there benefits. The plant

diversity in the college campus seems to be aesthetically, environmentally and structurally a well-planned urban landscape.

4. CONCLUSION

The DAV college campus sets a good example of urban forestry. It not just stands as a source of giving excellent education services to students and staff, but at the same time provided them with natural asset of green cover which helps them to have a healthy and stress free environment.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are base of this research.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The authors confirm that the data supporting the findings of this research are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Benedict M.E and McMahon E.T. 2006. Green Infrastructure: Linking landscapes and communities. Island Press, Washington D. C., USA
2. Müller N, Werner P, Kelcey J.G. 2010 Urban biodiversity and Design. Conservation Science and Practice Series No. 7. Blackwell Publishing Ltd., Oxford, England.
3. Smith R.M, Gaston K.J, Warren P.H, Thompson K. Urban domestic gardens (VIII): environmental correlates of invertebrate abundance. *Biodivers Conserv* 2006 15:2515–2545.
4. Barwise, Y., Kumar, P. Designing vegetation barriers for urban air pollution abatement: a practical review for appropriate plant species selection. *npj Clim Atmos Sci* 2020; 3: 12
5. Baldauf, R. Roadside vegetation design characteristics that can improve local, near-road air quality. *Transp. Res. Part D* 2017; 52: 354–361
6. Al-Dabbous, A. N. & Kumar, P. The influence of roadside vegetation barriers on airborne nanoparticles and pedestrians exposure under varying wind conditions. *Atmos. Environ.* 2014; 90: 113–124
7. Abhijith, K. V. & Kumar, P. Field investigations for evaluating green infrastructure effects on air quality in open-road conditions. *Atmos. Environ.* 2019; 201: 132–147

8. Janhäll, S. Review on urban vegetation and particle air pollution—deposition and dispersion. *Atmos. Environ.* 2015; 105: 130–137
9. Tzoulas K, Korpela K, Venn S, Yli-Pelkonen V, Kaźmierczak A, Niemela J, James P. Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review. *Landscape and urban planning.* 2007 ;81:167-78.
10. Groenewegen PP, Van den Berg AE, De Vries S, Verheij RA. Vitamin G: effects of green space on health, well-being, and social safety. *BMC Public Health.* 2006 ;6:149.
11. Singh C, Watts R, Dhillon HS. *Trees of Chandigarh.* Department of Environment, Chandigarh, India, 1996
12. Dhillon HS, Thakur AK, Singh KJ. Growth and propagation aspects of some medicinally important trees in Chandigarh, India: a review. *Journal of Medicinal Plants Studies* 2014;2:29-35.
13. Chaudhry P. Valuing recreational benefits of urban forestry-A case study of Chandigarh city of India. *International Journal of Environmental Sciences.* 2013;3(5):1785-9.
14. Chaudhry P, Sharma MP, Singh G. Significance of environmental amenities in a planned city: An evidence from Chandigarh, India. *IOSR Journal of Environmental Science, Toxicology And Food Technology.* 2013;4:60-6.
15. Muller N, Werner P, Kelcey JG, editors. *Urban biodiversity and design.* John Wiley & Sons; 2010 Mar 5.
16. Lau SS, Gou Z, Liu Y. Healthy campus by open space design: Approaches and guidelines. *Frontiers of Architectural Research.* 2014 ;3:452-67.
17. Huang JC, Mitsch WJ, Zhang L. Ecological restoration design of a stream on a college campus in central Ohio. *Ecological engineering.* 2009 ;35:329-40.
18. Lim TK. *Edible medicinal and non-medicinal plants.* Dordrecht, The Netherlands: Springer; 2012.
19. Farnsworth NR, Akerele O, Bingel AS, Soejarto DD, Guo Z. Medicinal plants in therapy. *Bulletin of the World Health Organization.* 1985;63(6):965.
20. Farnsworth N.R. and Soejarto D.D. Global importance of medicinal plants. In: Akerele O., Heywood V. and Syngé H. (eds) *The Conservation of Medicinal Plants.* Cambridge University Press, Cambridge, UK, 1991, pp. 25–51.
21. Gurib-Fakim A. Medicinal plants: traditions of yesterday and drugs of tomorrow. *Molecular Aspects of Medicine.* 2006 ;27:1-93.
22. Dahanukar SA, Kulkarni RA, Rege NN. Pharmacology of medicinal plants and natural products. *Indian J Pharmacol.* 2000;32:S81-118.

23. Kaplan S, Talbot J.F, Kaplan R. Coping with Daily Hassles: The Impact of Nearby Nature on the Work Environment (Project Report No 23-85-08). 1988 USDA Forest Service, North Central Forest Experiment Station, Urban Forestry Unit Cooperative Agreement
24. Givoni B. Impact of planted areas on urban environmental quality: a review. *Atmospheric Environment. Part B. Urban Atmosphere.* 1991;25:289-99.
25. Akbari H, Pomerantz M, Taha H. Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. *Solar Energy.* 2001 ;70:295-310.
26. Akbari H, Kurn DM, Bretz SE, Hanford JW. Peak power and cooling energy savings of shade trees. *Energy Buildings* 1997; 25:139-148.
27. U.S. Geological Survey. 2007. The Water Cycle: Evapotranspiration. <http://ga.water.usgs.gov/edu/watercycleevapotranspiration.html>,
28. Kocić K, Spasić T, Urošević MA, Tomašević M. Trees as natural barriers against heavy metal pollution and their role in the protection of cultural heritage. *J Cult Herit.* 2014 ;15:227-33.
29. Jamil S, Abhilash PC, Singh A, Singh N, Behl HM. Fly ash trapping and metal accumulating capacity of plants: Implication for green belt around thermal power plants. *Landscape and Urban Planning.* 2009 ;92:136-47.
30. Wagner J. Urban Forestry: Making a Global Difference. *International Society of Arboriculture Arborist News* 2003; 12: 26-28