International Journal of Experimental Research and Review (IJERR)

ISSN: 2455-4855 (Online) ***Original Article***

Received: 20th June, 2019; **Accepted:** 27th July, 2019; **Published:** 30th August, 2019

DOI: https://doi.org/10.52756/ijerr.2019.v19.003

Creating Urban Green Spaces (UGS) in Educational Institutions: A pilot project in Gurudas College, Kolkata-700054, West Bengal, India

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Abstract

Urban green spaces (UGS) supply ecosystem services such as biodiversity, climate regulation and other benefits. Urban green spaces are essential for the quality of life, health, and well-being of citizens. Urban green spaces provide a habitat for both flora and fauna. Creating herbal garden(s) or gardens with ornamental plants within the campus is a great way of increasing the green space in a campus. Not only does it help in conserving biodiversity it provides an opportunity to the students to know about their local plant genetic resources. This paper is a based on a pilot project in Gurudas College where faculty and students members of the NSS and Vasudha units increased the green space in the college campus. They created a medicinal garden and also helped in maintaining the ornamental garden.

Keywords: Biodiversity, college campus, medicinal garden, urban green spaces (UGS).

Introduction

The urban green space ecosystem is an important component of an ecosystem in any community development. Urban green spaces are one of the most significant elements of any urban ecosystem, both due to its ecosystem dynamics and its essential contribution in well being of human race (Padigala, 2012). The well-being of humans has always been inexorably linked to the health of our local environments, as we depend on the continued functioning of ecosystem services such as carbon sequestration and cycling, the provision of natural resources, and crop pollination. In order for ecosystems to function properly, robust biological diversity is necessary to maintain habitats and fulfill a wide range of natural roles. The World's 6th mass extinction is underway. If allowed to continue, humans will soon be deprived of biodiversity benefits such as crop pollination, water purification, food sources, ecosystem services and cultural benefits (Ceballos, 2015). Conservation efforts must be

implemented not only on the global front but also locally.

Urban Green Space (UGS) Ecosystem

Urban Green Spaces (UGS) refer to all open spaces mainly covered by vegetation which are directly or indirectly available for human usage in an urban environment (Fratini & Marone, 2011). Urban Green Spaces (UGSs) are defined as all green spaces in urban areas, including forests, parks, private gardens, allotment gardens, campuses, cemeteries, fields, arable land, meadows and greenery along railway tracks, regardless of whether they are formally managed by the city, by their private owners or through any other arrangement. Urban green spaces are an integral part of any cities, providing its residents with numerous benefits both tangible and in-tangible (Gaodi et al., 2010). UGSs provide ecosystem services like pollutant sequestration and ambient temperature regulation etc. (Nowak et al, 2006; Jim and Chen, 2008). Urban green spaces also contribute to economic services like increased property prices in urban areas (Luttik, 2000).

UGS are well acknowledged for the numerous social, environmental, and economic benefits they provide for humankind (Van Leeuwen et al., 2010). Urban green spaces are essential for the quality of life, health, and well-being of citizens. Urban green spaces supply ecosystem services such as biodiversity, climate regulation and other benefits. Benefits include improving air quality, ameliorating local climate, and conserving biodiversity, as well as providing venues for leisure and recreation, health benefits, creating job opportunities, and supporting child development. Cultural services of urban green spaces can be perceived and are the main contributors to human well-being for urban inhabitants (Bolund & Hunhammar, 1999; Gilbert, 2016; Hartig & Kahn, 2016). Cities play important roles in the conservation of global biodiversity, particularly through the planning and management of urban green spaces (UGS). However, UGS management is subject to a complex assortment of interacting social, cultural, and economic factors, including governance, economics, social networks, multiple stakeholders, individual preferences, and social constraints.

These UGSs are ecosystems of vital importance in enhancing the quality of life in an urban environment. In 2014, 54 percent of the world's population were living in urban settings and it is projected to reach 70 percent by 2050 (UN, 2014). Urban green spaces provide a habitat for both flora and fauna. Sometimes they are home to rare and threatened species too. These open spaces provide habitat for pollinators (Baldock, 2015). As urban green spaces sustain more wildlife and biodiversity providing a more favorable habitat, they require more protection from human interference (Schwartz, 2002). Green spaces within cities provide rich learning laboratories as sites that support opportunities for young people to explore, play and learn about nature within the city (Derr, 2018).

Urban Green Spaces (UGSs) in educational institutions:

Griffith (1994) is of the opinion that authorities of higher educational institutions should reorient their priorities by adding to their programs, designing attractive and engaging campuses that are favorable to academic activities since "attractively landscaped formal open spaces or habitats left in their natural form, as woods and gorges, help

establish a venerable campus identity, stir alumni sentimentalism, create a strong sense of community, and curb escalating campus densities."

The key role of higher education institutions in the transition to a more sustainable society has been recognized and highlighted for almost three decades (Wright, 2010). Recent research has shown that students' psychological health might benefit from a campus environment is green (McFarland et al., 2008; Lachowycz & Jones, 2013). Studies have shown that students prefer university spaces with actual greenery or nature posters, and that they also expect that a green outdoor university environment can be more restorative (van den Bogerd et al., 2018).

Benefits of creating Urban Green Space in campus

In an educational campus, open spaces are an important natural landscape for healing effects. Theoretically, open spaces can utilize various garden features, especially natural elements such as green plants, flowers and water, to help foster restoration from stress and provide positive influences on human beings. Surveys also show that most university students chose open spaces with natural settings to ameliorate their moods when they were stressed, upset, depressed, angry or confused (Lau & Yang, 2009). In green building assessment tools such as Leadership in Energy and Environmental Design (LEED), open spaces as the sphere for micro-ecology and sustainable environments are believed to lead to a healthy community where plants, natural habitats, pavements, shades and lights jointly create an eco-system and microclimate in addition to supplying comfort and sustenance for users (USGBC, 2009). Creating herbal garden(s) or gardens with ornamental plants within the campus is a great way of increasing the green space in a campus. Not only does it help in conserving biodiversity it provides an opportunity to the students to know about their local plant genetic resources. Scientists several decades ago wrote about the educational value of herbal/medicinal gardens. They felt that students of Botany might develop interest in the subject if they visit the medicinal plant garden (Zufall, 1925). These visits would also train them to observe they concluded. It was hoped that it would inculcate a sense of familiarity with surrounding biodiversity and its conservation, especially with the herbal plants.

Material and Methods

Gurudas College is an undergraduate college located in Phoolbagan in Kolkata, West Bengal, India. It is located in an urban locality in the heart of the city. The college was established in 1956. It is affiliated with the University of Calcutta. The name commemorates the legacy of Sir Gurudas Banerjee, the first Indian vice-chancellor of the University of Calcutta. The college has the National Service Scheme (NSS) units and Vasudha, the Nature Club of Gurudas College, comprising of both faculty and student members. Both NSS and Vasudha are instrumental in creating Urban Green Space (UGS) in Gurudas College, Kolkata-700054.

Gurudas College had three buildings constructed on three plots intersected by public roads. They are named as Main building, Commerce Building and the Golden Jubilee Building. The Golden Jubilee Building has the largest plot of land. The college administration encouraged the participation of students in Vasudha projects by incorporating one class per class per week in the routine for Vasudha

activity. The plants were labelled by members of the National Service Scheme (NSS). Awareness of the medicinal plant bio-diversity also promotes their ex situ conservation. Several medicinal plants were maintained in the herbal garden. Some of the plants were collected by the faculty members of Vasudha from the Forest Department, Government of West Bengal over the years. They were collected especially during the 'Aranya Saptaha' in the month of July when free saplings are distributed by the Forest Department. Most of the fruit tree saplings and ornamental plants were purchased with the financial assistance of the college. Upon the request of the college authorities the Forest Department, Government of West Bengal, has also planted several avenue trees on the public roads around the college campus. The medicinal plants were collected with the kind assistance of Medicinal Plants Research and Extension Centre, Ramkrishna Mission Ashrama Narendrapur which has a huge medicinal garden of their own.

Results

An area was earmarked for the plantation of the medicinal plants. Apart from this plot in several plants both medicinal (Fig. 1 & 2) and ornamental (Fig. 3 & 4) were planted in the campus. Trees were planted alongside the boundary walls of the college (Fig. 5). Students helped in watering the plants as part of their NSS activities. A list of medicinal plants is given in Table 1. Ornamental plants were planted all around the three buildings. Some of the ornamental plants panted were viz. cape jasmine (*Gardenia jasminoides*), chrysanthemum (*Chrysanthemum* sp.) cosmos (*Cosmos bipannatus*), dahlias (*Dahlia* sp.), frangipani (*Plumeria* sp.), jungle geranium (*Ixora coccinea*), marigold (*Tagetes patula*), pin wheel flowers (*Tabernaemontana divaricata*), red cape honeysuckle (*Tecomaria capensis*), roses (*Rosa* sp.), scarlet sage (*Salvia splendens*), spider lily (*Crinum asiaticum*), snapdragon (*Antirrhinum majus*). In the Golden Jubilee campus a plot of land was earmarked for annual winter ornamentals every year.

Some of the plants that were procured from the Forest Department during 'Aranya Saptaha' are viz. *Caesalpinia pulcherrima*, *Cassia fistula*, *Alstonia scholaris*, *Azadirachta indica*, *Embica officanalis*, *Holarrhena pubescens*, *Michelia champaca*, *Mimusops elengi*, *Murraya paniculata*, *Psidium guajava*, *Saraca asoca*, *Spathodea campanulata*, *Tecoma stans*, *Terminalia arjuna*.

Discussion

In addition to the plants listed in Table 1 many other plants, weeds, shrubs and trees are present in the campus of Gurudas College, Kol-700054. As the college is built in three separate plots attempts by Vasudha members to increase the greenery around all the three buildings. (Fig. 6 & 7). Ornamental plants are also planted in the campus which enhances the aesthetic beauty. During the monsoon season weeds are allowed to grow in the Golden Jubilee Campus. It provides habitat to local fauna. During the winter months the area is cleared for Annual Sports. The students help in clearing the plants too (Fig. 8) as part of their NSS activities. The faculty members in charge of Vasudha try to plant new saplings in the spring time. During a few years special assistance from the Forest Department, Government of West Bengal was sought and received in planting new saplings (Fig. 10).

Table 1. List of medicinal plants in Gurudas College Kol-700054 campus.

Sl. No.	Plant's Scientific Name	Local Name	Family
1	*Achyranthes aspera* Linn.	Apang	Amarantaceae
2	*Andrographis paniculata* (Burm. F.) Wall. Ex Nees	Kalmegh	Acanthaceae
3	*Asparagus racemosus* Willd	Shatamuli	Liliaceae
4	*Azadirachta indica* A. Juss.	Neem	Meliaceae
5	*Barleria pronitis* L.	Kantajanti	Acanthaceae
6	*Boerhaavia diffusa* Linn.	Punarnaba	Nyctaginaceae
7	*Cajanus cajan* (L.) Huth	Arhar	Papilionaceae
8	*Cassia fistula* L.	Badarlathi	Fabaceae
9	*Catharanthus roseus* (L.) G. Don.	Nayantara	Apocynaceae
10	*Cissus quadrangularis* L.	Harjora	Vitaceae
11	*Costus speciosus* (Konig) Smith.	Jangli Ada	Costaceae
12	*Cyanodon dactylon* (Linn.) Pers.	Dubghas	Poaceae
13	*Cymbopogon nardus* (L.) Rendle,	Lemon grass	Poaceae
14	*Cyperus rotandus* Linn.	Mutha Ghas	Cyperaceae
15	*Dillenia indica* L.	Chalta	Dilleniaceae
16	*Duranta repens* L.	Kata Mehendi	Verbenaceae
17	*Eclipta alba* Hassak L.	Kesut	Asteraceae
18	*Embica officanalis* Gaertn.	Amloki	Euphorbiaceae
19	*Euphorbia hirta* L.	Baradudhi	Euphorbiaceae
20	*Hibiscus mutabilis* L,	Sthalpadma	Malvaceae
21	*Holarrhena pubescens* Wall. ex G.Don	Kurchi	Apocynaceae
22	*Hygrophila schulli* (Ham.) M.R. & S.M. Almeida,	Kulekhara	Acanthaceae
23	*Jatropha curcas* L.	Bharandah	Euphorbiaceae
24	*Kalanchoe pinnata* (Lam.) Pers.	Patharkuchi	Crassulaceae
25	*Leucas cephalotes* (Roth.) Spreng.	Dandakolos	Lamiaceae
26	*Michelia champaca* L.	Swarnachapa	Magnoliaceae
27	*Mimosa pudica* L.	Lajjabati	Mimosaceae
28	*Moringa oleifera* Lam	Sajina Leaf	Moringaceae
29	*Nerium oleander* L.,	Kolke	Apocynaceae
30	*Ocimum tenuiflorum* L.	Tulsi	Lamiaceae
31	*Phyllanthus fraternus* Webster	Bhui amla	Euphorbiaceae
32	*Piper betle* L.,	Paan	Piperaceae
33	*Polyalthia longifolia* (Sonn.) Thw.,	Debdaru	Annonaceae
34	*Rauvolfia serpentina* Benth.	Sarpagandha	Apocynaceae
35	*Saraca asoca* (Roxb.) Willd.	Ashok	Fabaceae
36	*Solanum xanthocurpum* Schrad & Wendl.	Kantikari	Solanaceae
37	*Terminalia arjuna* (Roxb.ex DC.) Wt. & Arn.	Arjuna	Combretaceae
38	*Vernonia cinerea* Less.	Jhur-Jhuri	Asteraceae
39	*Vitex negundo* L.,	Nishinda	Verbenaceae
40	*Zamia furfuracea* L. f.	Cardboard palm	Zamiaceae

Fig. 1. *Catharanthus roseus* (L.) G. Don, common name Nayantara.

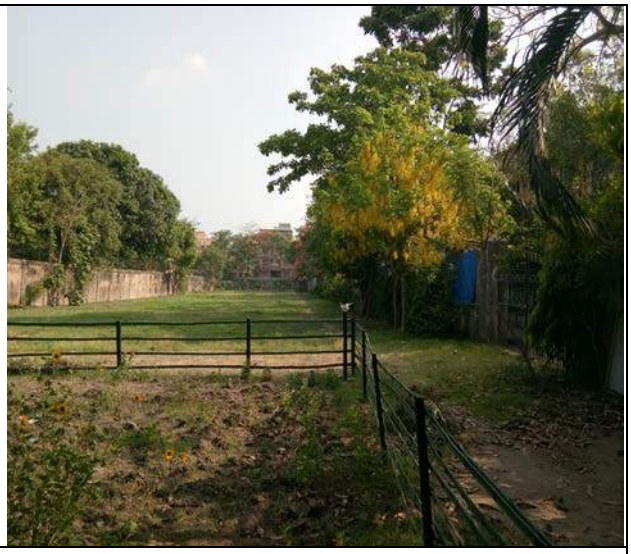

Fig. 2. Golden Jubilee complex with *Cassia fistula* L., common name Badar Lathi, in full bloom during spring time.

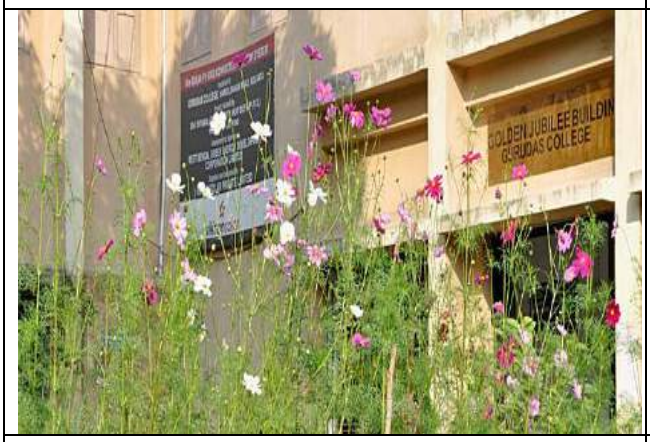

Fig. 3. *Cosmos bipannatus* flowers in ornamental plot in the Golden Jubilee Campus.

Fig. 4. Oranmental plot in Golden Jubilee campus of Gurudas College.

Fig. 5. Avenue tree: Terminalia arjuna (Roxb.) Wight & Arn., Common name Arjun.

Fig. 6. Ornamental plot in Main campus.

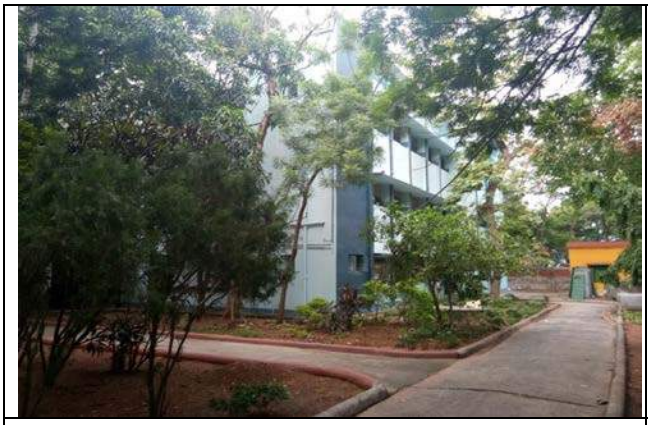

Fig. 7. Green campus in the Commerce Building campus.

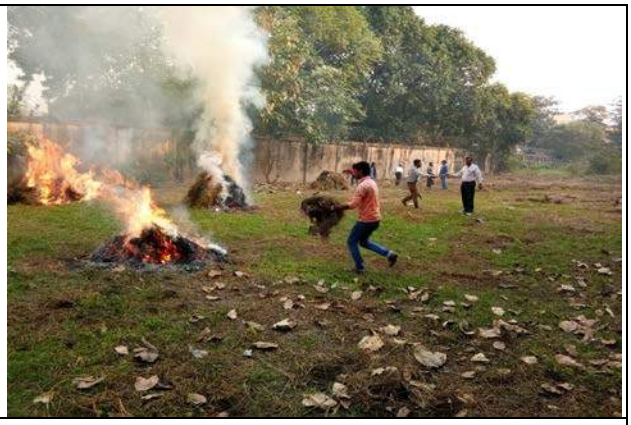

Fig. 8. NSS volunteers clearing the open space in Golden Jubilee complex during the winter months.

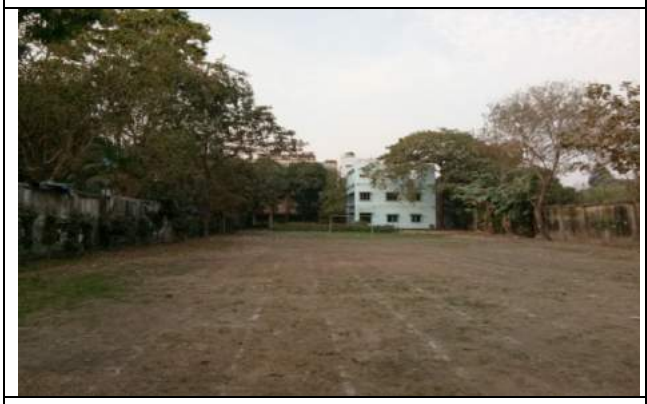

Fig. 9. Golden Jubilee campus after clearing the weeds in winter.

Fig.10. Students of Botany Department during Field study in the Golden Jubilee campus during monsoon months.

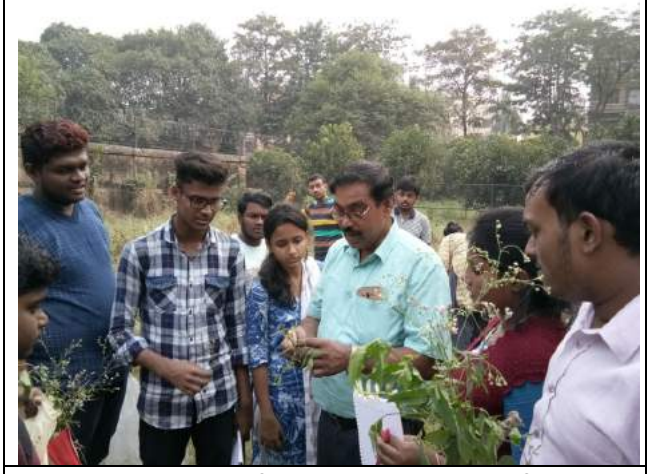

Fig.11. Students of the Department of Botany during field study in the Golden Jubilee complex.

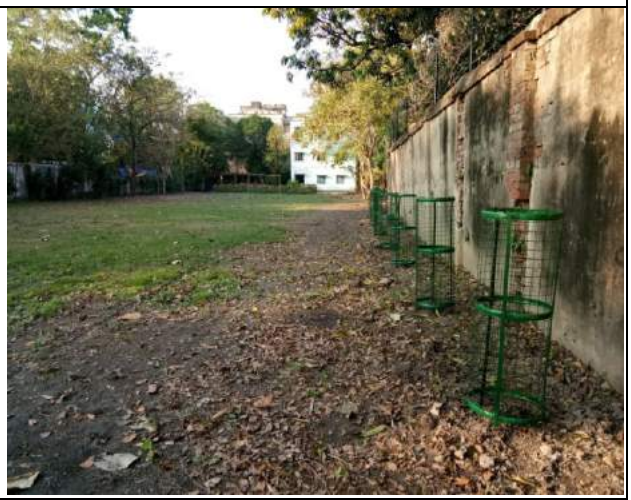

Fig. 12. New saplings in the Golden Jubilee Complex.

Field studies are undertaken on a regular basis for the students of the Department of Botany (Fig 10 and 11) within the college campus. Students get the opportunity to get acquainted with the local flora. Of course it depends on the faculty members to increase the student's interest in biodiversity. They can observe different morphological forms among the different plants. Quadrate studies are also undertaken every year in the college campus (Ali et al., 2016).

Conclusion

It has been observed that creating urban green spaces in educational institutions not only help in biodiversity conservation it also helps the students connect with nature. Many of the students in urban settings live in flats, many of them do not get access to open spaces. When the students are engaged in creating green spaces in their campus they get the opportunity to get acquainted with plants. They learn to identify medicinal plants and know about their common uses. In Gurudas College as the students are actively involved in creating the garden through the NSS and Vasudha activities a sense of ownership and pride are instilled within these students. The overall aesthetic value of the campus is enhanced which has appositive impact on all.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this work.

Acknowledgment

The authors thank the Principal, Gurudas College, Kolkata 700054 for providing the garden infrastructure. Special thanks are due to all members of Vasudha and NSS for their effort in maintaining the urban green space in the college campus.

References

Ali, A., Maity, R., Ali, A., Bose, D. and De, M. (2016). Assessment of the changes in the herbaceous angiosperm species diversity over time by ecological sampling methods in Gurudas College campus: a case study. Proceedings of the UGC sponsored One Day State Level Seminar on 'Modern Aspects of Plant Sciences with Special Emphasis to Biodiversity and Conservation' (ISBN 978-93-81687-56-7) on 23rd May, 2016 organized by the Department of Botany, Acharya Jagadish Chandra Bose College, Kolkata in collaboration with Bangabasi College, Kolkata. Pp. 33-37.

Baldock, K. C. R. (2015). Where is the UK's pollinator biodiversity? The importance of urban areas for flower-visiting insects. *Phil. Trans. R. Soc. B.* 282: 2014-2849.

Bolund, P. & Hunhammar, S. (1999). Ecosystem services in urban areas. *Ecol. Econ.* 29: 293–301.

Ceballos, G. (2015). Accelerated modern human-induced species losses: Entering the sixth mass extinction. *Sci. Adv.* 1: e1400253.

Derr, V. (2018). Urban green spaces as participatory learning laboratories. *Proceedings of the Institution of Civil Engineers - Urban Design and Planning.* 171 (1): 25-33.

Fratini, R. & Maroni, E. (2011). Green-space in urban area: Evaluation of the efficiency of public spending for management of green urban areas. *IJED*. 1(1): 9-14.

Gaodi, X., Wenhua, L., Xiao, Y., Zhang, B., Chunxia, L., Kai, A., Wang, J., Kang, X. and Wang, J. (2010). Forest ecosystem services and their values in Beijing. *Chinese Geographical Science*. Pp. 2051-2058.

Gilbert, N. (2016). Green space: A natural high. *Nature*. 531: S56–S57.

Griffith, J. C. (1994). Open space preservation: An imperative for quality campus environments. *The Journal of Higher Education*. 65(6): 645-669.

Hartig, T. & Kahn, P. H. (2016). Living in cities, naturally. *Science.* 352: 938–940.

Jim, C. Y. and Chen, W.Y. (2008). Assessing the ecosystem service of air pollutant removal by urban trees in Guangzhou. *Journal of Environmental Management*. 88: 665-676.

Lachowycz, K. and Jones, A. P. (2013). Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework. *Landscape and Urban Planning*. 118: 62–69.

Lau, S. S.Y. and Yang, F. (2009). Introducing healing gardens into a compact university campus: design natural space to create healthy and sustainable campuses. *Landsc. Res*. 34 (1): 55-81.

Luttik, J. (2000). The value of trees, water and open space as reflected by house prices in the Netherlands. *Landscape and Urban Planning*. 48: 161-167.

McFarland, A., Waliczek, T. and Zajicek, J. (2008). The relationship between student use of campus green spaces and perceptions of quality of life. *Hort. Technology*. 18(2): 232–238.

Nowak, D. J., Crane, D. E. and Stevens, J. C. (2006). Air pollution removal by urban trees and shrubs in the United States. *Urban Forestry & Urban Greening*. 4 : 115-123.

Padigala, B. (2012). Urbanization and changing green spaces in Indian cities (Case study - city of Pune). *International Journal of Geology, Earth and Environmental Sciences*. 2: 148 – 156.

Schwartz, M. W. (2002). Conservation's Disenfranchised Urban Poor. *Bio Science*. 52: 601-606.

United Nations (Department of Economic and Social Affairs - Population Division). (2014). World Urbanization Prospects: The 2014 Revision Highlights.

USGBC. (2009). LEED 2009 for New Construction and Major Renovations. U.S. Green Building Council.

van den Bogerd, N., Dijkstra, S. C., Seidell, J. C. & Maas, J. (2018). Greenery in the university environment: Students' preferences and perceived restoration likelihood. *PloS one*. 13(2): e0192429. doi:10.1371/journal.pone.0192429.

Van Leeuwen, E., Nijkamp, P. & de Noronha, V. T. (2010). The multifunctional use of urban Green space. *International journal of agricultural sustainability*. 8(1-2): 20-25.

Wright, T. (2010). University presidents' conceptualizations of sustainability in higher education. *Int. J. Sustain. High. Educ.* 11: 61–73.

Zufall, C. J. (1925). The educational value of a medicinal plant garden. *Journal of Pharmaceutical Sciences*. 14 (1): 26-28.