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Application of Green Walls in Sustainable Urban is the Remedy to the Global Problems

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Abstract:

Green roofs and façades are passive techniques and add more benefits not only for reducing the energy demand of buildings, but also for providing environmental benefits, In recent year's global problems such as pollution and climate change are very dangers to the life, due to over consumption of resources and deforestation, in the developing countries like India, this has been change the climatic conditions, The impact of urban development on the natural environment generates unique challenges to us, and seeking passive design strategies in hot and humid climates it can change by applying the green and sustainable buildings as a trend of current development concept, this may help to prevent from extensive building heat gain, reduce the energy, including visual relief, and improving air quality. Hence, practising green wall technology is still new despite its great benefits. This paper attempts to reduce energy consumption in buildings by adopting passive cooling strategies in the sustainable urban to achieve the aim of the study and create awareness in the public.

Keywords **— Green walls, Global problems, Urbanization, pollution**

1.Introduction:

Green walls are growing vegetation on walls and are one tool that can help mitigate the negative effects of pollution. Increase urban biodiversity by providing habitat for wildlife, provide a more aesthetically pleasing environment to work and live and improve return on investment compared to traditional methods (Czerniel 2010, Dunnett and Kingsbury 2004, Getter and Rowe 2006, Mentens et al., 2006, Oberndorfer et al., 2007, Rowe and Getter, 2010). During the three decades after the introduction of the well known definition of"Sustainable Development" in the Report of the World Commission on Environment and Development (WCED 1987), extensive literature has covered the principles and possible frameworks for sustainable construction, (Kibert 1994, Hill and Bowen 1997), The magnitude of temperature decreases due to this transformation depends on the climatic characteristics, the amount of vegetation and urban geometry.

The discussion on green walls influence the air pollution, carbon dioxide emissions, carbon sequestration, water quality of storm water runoff, and noise pollution. Green walls are complementary technologies, socioeconomic and changing recreational demands.

2.History of Green Walls

Green walls are an ancient one in the Babylonians with the famous Hanging Gardens of Babylon, architecture by king of Babylon Nebuchadnezzar, it is one of the seven ancient wonders of the world. Highlights of the history of green walls are provided below: 3rd C. BCE to 17th C. AD: Throughout the Mediterranean, Romans train grape vines (Vitis species) on garden trellises and on villa walls. Manors and castles with climbing roses are symbols of secret gardens.

1920s: The British and North American garden city movement promote the integration of house and garden through features such as pergolas, trellis structures and self-clinging climbing plants. 1988: Introduction of a stainless steel cable system for green facades.

Early 1990s: Cable and wire-rope net systems and modular trellis panel systems enter the North American marketplace.

1993: First major application of a trellis panel system at Universal CityWalk in California.

1994: Indoor living wall with bio-filtration system installed in Canada Life Building in Toronto, Canada.

2002: The MFO Park, a multi-tiered 300’ long and 50’ high park structure opened in Zurich, Switzerland. The project featured over 1,300 climbing plants.

2005: The Japanese federal government sponsored a massive Bio Lung exhibit, the centerpiece of Expo 2005 in Aichi, Japan. The wall is comprised of 30 different modular green wall systems available in Japan.

2007: Seattle implements the Green Factor, which includes green walls.

2007: GRHC launches full day Green Wall Design 101 course; the first on the subject in North America.

2008: GRHC launches Green Wall Award of Excellence and Green Wall Research Fund

3.Impact of Pollution

Polluted air is affected human health (Mayer, 1999). Roughly one in ten people live where there are unhealthful levels every year (ALA, 2010). In developed countries like Canada, the Ontario Medical Association attributes 9500 premature deaths per year (OMA, 2010) and increased costs of health care and lost productivity as a result of air pollution (OMA, 2005). The most common health related symptoms of air pollution are increased respiratory illnesses such as asthma and cardiovascular disease. Human activity related to the combustion of fossil fuels has increased carbon dioxide (CO_2) concentrations in the atmosphere 32% since 1750.

Vegetation removes pollutants in several ways. Plants take up gaseous pollutants through their stomates, intercept particulate matter with their leaves, and are capable of breaking down certain organic compounds such as poly-aromatic hydrocarbons in their plant tissues or in the soil (Baker and Brooks, 1989).

4. Global temperature

The maximum temperatures were recorded present days in India (Table 1, 2 & figure 1) due to deforestation releasing of green house gases in to the atmosphere and leads to El Niño in the environment, not only in India but also in world, practically the smoke released from the industries and change the ambient air quality.

The maximum temperatures were recorded in India in 2017, Bilasur (Chhattisgarh), 49.3 ^{O} C, Tiruvuru (Andhra Pradesh), 47.6 ^{O} C, Rentachintala (Andhra Pradesh), 47.5 ^{O} C, Bapatla, (Andhra Pradesh), 46.8 ^{O} C (Table 2)

Table 1: the maximum temperature records of past several decades in India

Place	State	All time highest Maximum	Highest Maximum in 10 years	Highest Maximum in April 2016
Kozhikode	Kerala	37.2 (Apr 14, 1967)	37.0 (Apr 4, 2015)	37.9 (Apr 30)
Bangalore	Karnataka	38.3 (Apr 30, 1931)	37.6 (Apr 12, 2010)	39.2 (Apr 24)
Anantapur	Andhra Pradesh	43.2 (Apr 30, 1985)	42.9 (Apr 19, 2009)	44.5 (Apr 25)
Mumbai	Maharashtra	42.2 (Apr 14, 1952)	40.6 (Apr 2, 2009)	38.0 (Apr 27)
Delhi	Delhi	45.6 (Apr 29, 1941)	43.7 (Apr 18, 2010)	42.0 (Apr 16)
Lucknow	Uttar Pradesh	41.7 (Apr 30, 2014)	44.0 (Apr 18, 2009)	43.1 (Apr 16)
Bhubaneswar	Odisha	45.0 (Apr 23, 1985)	43.6 (Apr 9, 2010)	45.8 (Apr 11)
Patna	Bihar	44.6 (Apr 29, 1980)	43.5 (Apr 20, 2010)	44.5 (Apr 30)
Nizamabad	Telangana	46.8 (Apr 29, 1988)	44.4 (Apr 20, 2010)	45.1 (Apr 21)
Chennai	Tamil Nadu	42.8 (Apr 27, 1908)	43.0 (Apr 16, 2007)	41.8 (Apr 22)
Khajuraho	Madhya Pradesh	46.9 (Apr 29, 1993)	46.7 (Apr 26, 2008)	45.6 (Apr 16)
Ranchi	Jharkhand	42.6 (Apr 30, 1999)	42.4 (Apr 18, 2010)	42.0 (Apr 27)
Bankura	West Bengal	45.8 (Apr 15, 1973)	45.2 (Apr 21, 2009)	46.7 (Apr 23)

Table 2: Maximum temperature recorded in India -2017

Place	State	maximum in o C
Datia	Madhya Pradesh	44.7
Agra	Uttar Pradesh	44.9
Gwalior	Madhya Pradesh	44.9
Nowgong	Madhya Pradesh	44.9
Khajuraho	Madhya Pradesh	45.1
Wardha	Maharashtra	45.2
Bramhapuri	Maharashtra	45.2
Nagpur	Maharashtra	45.3
Ganganagar	Rajasthan	45.8
Chandrapur	Maharashtra	46.2
Bapatla	Andhra Pradesh	46.8
Machilipatnam	Andhra Pradesh	47.3
Rentachintala	Andhra Pradesh	47.5
Tiruvuru	Andhra Pradesh	47.6
Bilasur	Chhattisgarh	49.3

Figure 1: maximum temperature recorded in 2017 of India

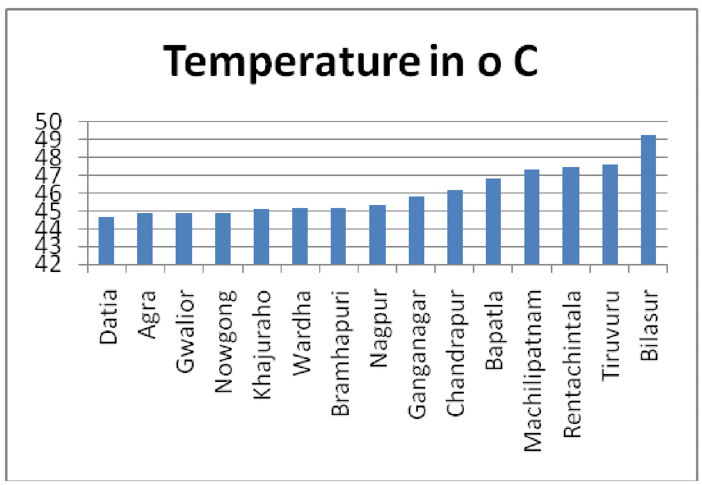


Figure 2: comparison of El Nino phenomenon in 1997-1998 Vs 2016-2017

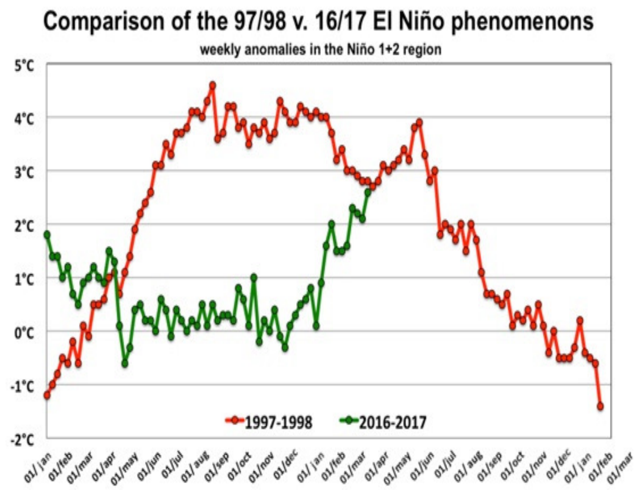
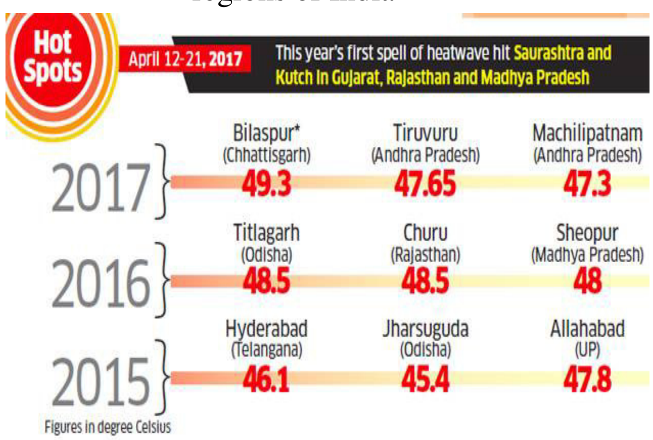


Table3: maximum heat waves in different regions of India



5.Principles and techniques

Traditionally, the constructions in urban mainly focuses on the use of techniques for reducing pollution. (Mora 2005) stated that the sustainable construction can refer to the building process resulting in a sustainable Energy saving, mitigation of environmental impacts and the use of available technologies for the successful preparation of green specifications are summarized under the heading of green technology and techniques. (Anderson and Shiers, 2002), the Guideline Specifications by Green Building (2007, WBDG (2007).

In urban areas, trees have been shown to provide a significant contribution to the reduction of air pollutants (Akbari et al., 2001 & 2005, Nowak, 2006. estimated that trees remove 711,000 metric tons per year. in many urban sites there is little space to plant trees or cultivate an urban forest.

Regarding specific pollutants, Clark et al. (2009) estimate that if 20% of all industrial and commercial roof surfaces in Detroit, MI, were traditional extensive sedum green roofs, over 800,000 kg (889 tons) per year of NO2 (or 0.5% of that areas emissions) would be removed. In Singapore, sulphur dioxide and nitrous acid were reduced 37% and 21%, respectively, directly above a green roof (Tan and Sia, 2005).

5.1 Method for development of greenery

These plants have stress-tolerant characteristics (*sensu* Grime 2001), including low, mat-forming or compact growth; evergreen foliage or tough, twiggy growth; and other drought-tolerance or avoidance strategies, such as succulent leaves, water storage capacity,

5.2 Green Facades

Green facades are a type of green wall system in which climbing plants or cascading groundcovers are trained to cover specially designed supporting structures. Rooted at the base of these structures, in the ground, in intermediate planters or even on rooftops, the plants typically take 3-5 years before achieving full coverage. Green facades can be anchored to existing walls or built as freestanding structures, such as fences or columns.

Self-clinging plants such as English Ivy have commonly been used to create green walls. Their sucker root structure enables them to attach directly to a wall, covering entire surfaces. These aggressive plants can damage unsuitable walls and/or pose difficulties when the time comes for building maintenance and plant removal. Two green facade systems that are frequently used are Modular Trellis Panel and Cable and Wire-Rope Net systems. It is composed of two layers of synthetic fabric with pockets that physically support plants and growing media. The fabric walls are supported by a frame and backed by a waterproof membrane against the building wall because of its high moisture content. Nutrients are primarily distributed through an irrigation system that cycles water from the top of the system down.

6. Impacts of green walls in the Environment

Plants grow without soil- by making plants grow in a unique soil –less medium , we ensure that the per square feet weight the wall is less than 8 kgs/sqr ft. containers are especially designed to allow healthy growth of Plants- after many long months of back breathing experiments, the unique design of the container has evolved. It is not only allows the root system of the plants to grow but also enhances the overall dense look of the green wall. Closed loop irrigation system – the water in the reservoir (at the bottom of the living green wall) is recycled continuously, thus, very little water is required to keep the green wall fresh and green, Containers are light weight and leak-proof- there is no damage to the back wall. Green walls can play a small part in reducing CO_2 in the atmosphere through Photosynthesis.

Living or green, walls have been shown to increase sound insulation (Dunnett and Nolan 2004), fire resistance and (Köhler 2003), and provide additional insulation and to the building. They can reduce the energy required for the maintenance of interior climates (Del Barrio 1998), because vegetation and growing plant media intercept and dissipate solar radiation. Green walls can also mitigate storm-water runoff from building surfaces. Thereby reducing its reliance on mechanical systems in both the summer and winter months. A green wall can be an integral part of a building’s cooling strategy

7. Conclusion

There is an important potential of lowering urban temperatures when the building envelope is covered with vegetation. Air temperature decreases and can reach up to 26.01 ^{O}C maximum and 12.81 ^{O}C day-time average (Riyadh), while inside the canyon decreases reach up to 11.31 ^{O}C maximum and 9.11 ^{O}C daytime averages, again for hot and arid Riyadh. It can be concluded that the

The combination of both green roofs and green walls leads to the highest mitigation of temperatures inside the canyon. If applied to only one unit block, green roofs and green walls can create a small area of mitigated temperatures to the urban heat island effect.

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