Journal of Energy Research and Environmental Technology (JERET)
Print ISSN: 2394-1561; Online ISSN: 2394-157X; Volume 2, Number 2; January-March, 2015; pp. 94-97

http://www.krishisanskriti.org/jeret.html

Mitigation of Heat Island Effect

Anupriya Banerjee[1] and Priya Upadhay[2]

[,21]4th Year, B.Planning
E-mail: [1]anupriya_anu18@yahoo.com, [2]mepriya.angel@gmail.com

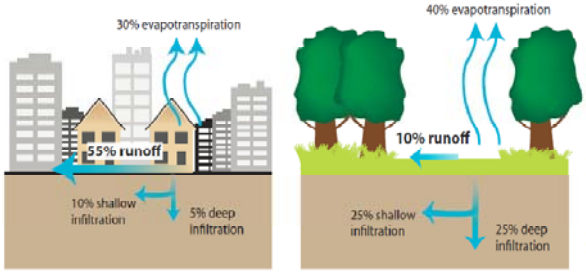
Abstract—*Heat island effect is a typical urban term. This shows temperature rise (heat) in a particular area (island), the difference between temperature of an urban core and its surrounding sub-urban and rural areas is called urban heat island. This rise is temperature not only makes life uncomfortable in that particular urban core it also contributes to the global climate change. The main factors for urban heat island formation is Modern lifestyle and technological advancement. More advancements in development, more is our encroachment and dominance on nature. The main aspects to recognize an urban space is its population and infrastructure. Both of them are contributors of heat but both are important for an urban area. For maintaining a balance in temperature and its mitigation, development of urban area should be planned but the materials used should be organic. Urbanization is presently an unstoppable event, so factors leading to heating must be substituted and eliminated by creative innovations and intensive planning. Planners, architects and local people together will play the major role in mitigation of heat island effect. All levels of government can play a role in introducing community based development process. Where people should be involved at all levels of development programs, through public participation, focus group discussion, initiate awareness programs and incorporate their feedbacks. Pre-formulation of sustainable strategies for urban development leading to harmonious and balanced development between nature and urbanization.*

Keywords: *Urbanization, Temperature, Community, Global*

1. INTRODUCTION

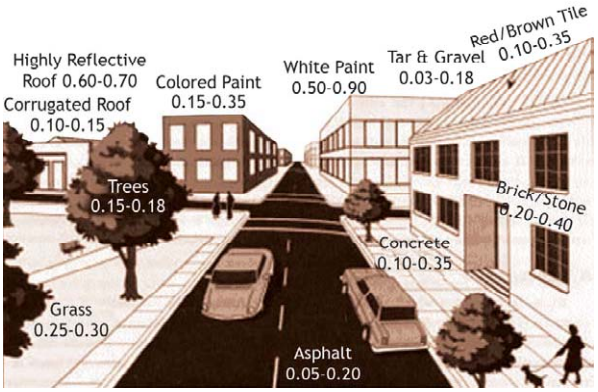
Due to rapid population growth and urbanization, rate of migration is increasing on a tremendous scale. This is not only giving rise to over flowing population in the urban spaces but also results in congestion on roads and increased infrastructural development. It is estimated by UN that almost 70 percent of the world's population will be living in urban areas by 2050 and presently more than 50 percent of the world's population is living in urban areas. This rapid change in urban population resulted in change in land use and land cover of the urban areas.

Infrastructure made up of high temperature materials like concrete, metal,glass, ceramics, alloys,polymers, asphalt which absorbs and reflects high amount of heat. The city surface has a very complex character, which absorbs and reflects the solar radiation. Each surface material has a different albedo that is a measure of the amount of solar radiation reflected back into space or absorbed by the surface.



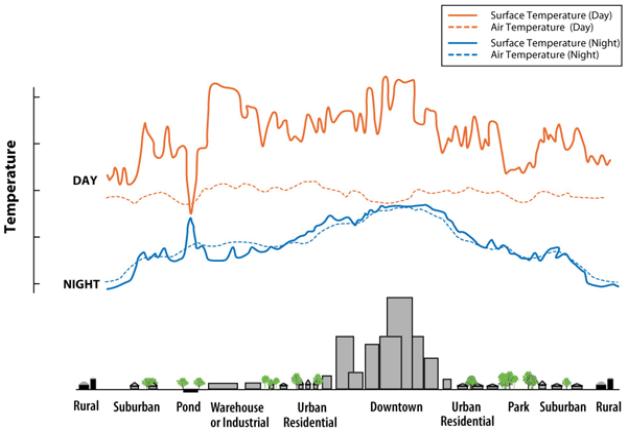
Source: Environment Protection Agency, 2008

Fig. 1: Effect of Changed Land Use and Land cover



Source: U.SEnvironmental Protection Agency

Fig. 2: Various Urban Environment Albedos



Source: U.S Environment Protection Agency

Fig. 3: Urban Heat Island

This not only affects the temperature within the city but also affects micro climate, environment, and health of people and also contributes to global warming.

2. IMPACTS AND ISSUES

Urban heat island are found to be one of the major reasons behind climate change and global warming. According to program on health effects of global environmental change at Johns Hopkins University heat is most likely to increase the risk of mortality in cities at mid latitude and high latitude with significant annual temperature variations [1]. Urban heat Island does not have adverse effects only on environment rather it also has significant impact on human lives and livelihood especially on vulnerable groups like elderly,children and women who are mostly affected by sudden variations in the climate.

These effects need to be minimized and optimized by different innovative and traditional methods so that development and environment can work symbiotically with each other. Although every nation, state and district are trying to minimize the effects of Urban heat Island by different methods and concepts like green roofs, cool pavements etc.

Source: Study OF Chula Vista on Cool Pavement (EPA)

Fig. 4: Vegetal Green Cool pavements

Indian states like Haryana and Rajasthan are also trying to conserve environment by restricting their policies towards afforestation and avoiding deforestation which is also one of the major policy defined in Regional Plan of NCR. Whereas cities developed on the concept like sustainability and Smart City are also considered as major step by developing countries like India to conserve environment and to balance the effect of Global warming. But there is still a way further to proceed. Due to lack in implementation and monitoring of policies and community participation in the formulation of policies.

3. MITIGATION AND INNOVATION

Mitigation of Urban heat Island is an important as well as crucial task to make and implement due to rapid increase in population and need of Urbanization. But impact of Urban Heat Island can be controlled and minimized by working together, incorporating strong implementation policies, using traditional cooling methods and systems as well as using modern and innovative techniques to minimize the effect of urban heat Island in Urban areas.

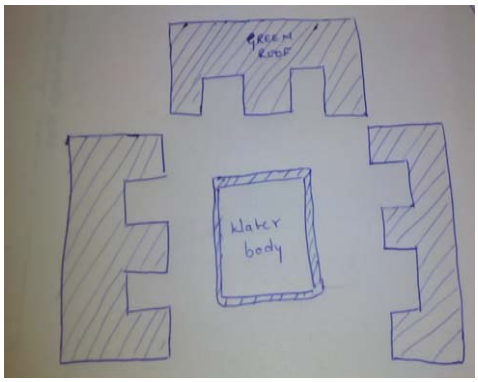
Involving communities and local people in the formation of policies and plans will create a lot of choices for mitigation and will increase the knowledge about local materials that can be used for minimizing the effects of urban heat Island.

Initiating awareness programs to aware the local people about the adverse impacts of urban heat Island on their lives and surroundings will encourage them to plant trees and tackle the situation on their level.

Involvement of local people and communities will not only aware them but also make implementation process much easier and make the policies more effective and efficient for the people.

Encouraging people to plant trees in their homes and surroundings will help in decreasing the local air temperature in every localities and societies of the urban area and on the whole in the whole city, district and state like each drop contributes in filling the pond.

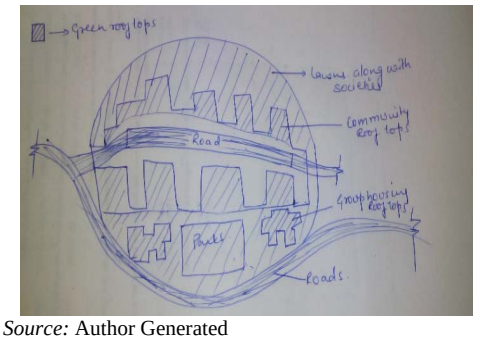
Instead of implementing green roof technique in one building and other far from it, it will be better to implement community green roof tops and urban farming.



Source: Author Generated

Fig. 5: Top View of Group Housing

This will increase the green area cover and eventually decrease the heat with the increase in evaporation as large the area more will be the evaporation and condensation.

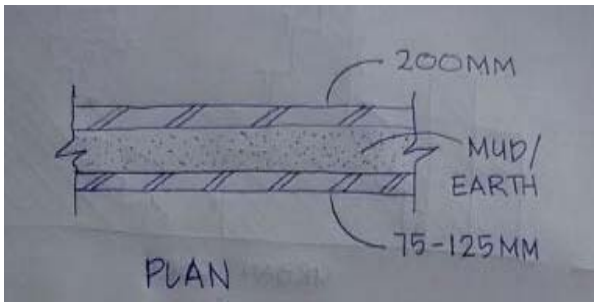


Source: Author Generated

Fig. 6: Suggested Top view Of Urban area

Implementation of community green roofs and urban farming will not only keep the building comparatively cooler but will also reduce the electricity consumption and CFC emission.

Filling Mud inthe Wall Cavity

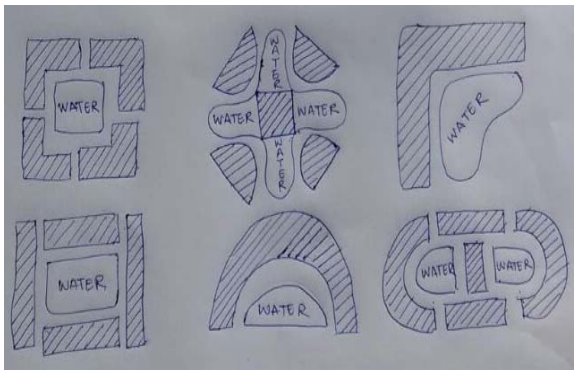


Source: Author Generated

Fig. 7: Suggested Section of Wall

Section of the wall that can keep buildings cool during the day and warm during the night. This will reduce the use of AC's during summer and heater during winters. Hence reducing the CFC's in the atmosphere and prevent urban heat Island effects and Global Warming. This will be more effective than cavity walls.

Urban Development Forms

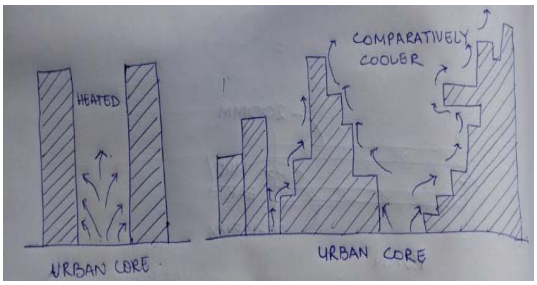


Source: Author Generated

Fig. 8: Suggested Urban Development Forms

Water gets heated slowly and cools slowly, hence it can be used in design to reduce the effect of urban heat island. These different forms will not only allow water cycles to keep the surroundings cool it will also enhance free flow of air. Air circulation keeps the heat stagnation at a particular place low.

Proper architectural designs can keep the air flow in the urban core appropriate and reduce urban heat Island effect. Trees and other natural vegetation should be included into the architectural designs and should be cut or removed. Different forms of courtyards and atriums can be designed inside buildings to protect the existing green cover.

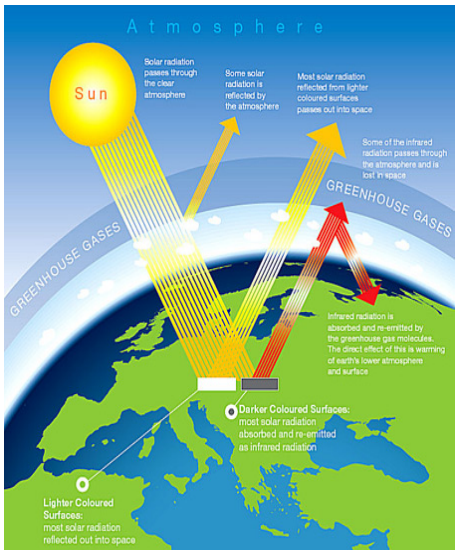


Source: Author Generated

Fig. 9: Suggested Architectural Designs

Traffic is a major source of atmospheric carbon-dioxide. This also contribute to urban heat island. Urban roads do have plantation along the road but the trees are tall and placed at distance. So along with trees, small and dense shrubs should be planted so as to hold the ground, restrict glare and dust flow. This is not only beneficial for air pollution, it is also useful in controlling light pollution. The pollution by vehicles originates at the ground level, so plantation of shrubs along the road is viable option.

Albedos of road materials also plays an important role in heat generation. Dark color absorbs heat and later radiates it into the atmosphere, whereas light color reflects solar radiation outside the atmosphere reducing global warming.



Source: Albedo: A Measure of Pavement Surface Reflectance", American Concrete Pavement Association

Albedos: Reflectance of Pavement Surfaces	
Asphalt	0.05–0.10 (new)
	0.10–0.15 (weathered)

Gray Portland Cement Concrete	0.35–0.40 (new)
	0.20–0.30 (weathered)
White Portland Cement Concrete*	0.70–0.80 (new)
	0.40–0.60 (weathered)

Source: Albedo: A Measure of Pavement Surface Reflectance", American Concrete Pavement Association

Therefore, use of light color material with high albedo is the best option for road construction as this will reduce heat generation and global warming.

4. CONCLUSION

Urban heat Island is a phenomenon triggered by human activities in wish of better and luxurious lifestyle and negligence towards nature and environment, which turned into a global problem with the growth and development of urban core. Deforestation, conversion of land use, exploitation of nature and natural resources are some of the major reasons contributing to Urban Heat Island effect, whose impact is seen worldwide in the form of abnormal changes in microclimate, climatic variations, increased mortality rate, and global warming. Thus mitigating urban heat Island effect become the prime concern worldwide. Involving people and working together at grass root level for mitigating urban heat Island effect will be very effective step in order to fight with the problems. Whereas innovative and creative ideas by youth, aspiring architects,engineers, planners along with the guidance of traditional methods and experienced field workers will be very useful and unique way for mitigating issues generated from urban heat Island effects.

References

[1] C. Michael Hogan., Cutter J. Cleveland., "Heat Island",Environment Protection Agency , 29, June,2010,6.42 A.M.

[2] http://www.dec.ny.gov/lands/30344.html

[3] http://www.urbanheatislands.com/home

[4] http://www.epa.gov/heatislands/index.htm

[5] Taru leading edge, "Urban Heat Island Effect and Its Mitigation Strategies",http://www.thermalcomfort.co.in/sites/thermalcomfort.co.in/files/A%20Report%20on%20Urban%20Heat%20Island%20Effect.pdf,17 , January, 2015

[6] Divya Sharma, Alka Bharat , "Urban Heat Island Effect – Causes , Impacts , Methods of Measurement and Mitigation Options " ,Institute of Town Planners, India Journal 6 - 2, 69-77, April - June 2009

[7] Nichols Consulting Engineers, Chtd.Engineering & Environmental Services,"Cool Pavement Study ", City of Chula Vista Engineering Department,16,January, 2015

[8] Cambridge Systematics, Inc., "Cool Pavement Report",Heat Island Reduction Initiative, U.S. Environmental Protection Agency, June 2005