



URBAN HEAT ISLAND - GS III MAINS

Q. The urban heat islands issue is not only an urban design and development issue, but also an issue of sustainable living of mankind. Elucidate (15 marks, 250 words)

News: *Urbanisation led to 60% more night-time warming in Indian cities than non-urban areas: Study*

What's in the news?

- Urbanisation has led to nearly 60 per cent more night-time warming in over 140 prominent Indian cities compared to non-urban areas surrounding them, a new research from the Indian Institute of Technology Bhubaneswar has found.

Key takeaways:

- According to the research, Ahmedabad, Jaipur and Rajkot had the highest urban effect, while Delhi-NCR and Pune were found to be at the fourth and fifth position, respectively.

Urban Heat Islands:

- It occurs when urban areas witness higher temperatures than their rural surroundings.

Occurrence:

- Urban heat islands result from complex interactions between built environments, natural factors, and human activities.
- This is mostly due to human activities, buildings and infrastructure in cities that absorb and retain heat more effectively than natural landscapes.

Causes of Urban Heat Island:

1. Low Albedo Materials:

- According to Bouyer, Albedo is the ratio of the reflected solar energy to the incident solar energy. If the albedo of the urban surface is low, it will store more solar energy, causing an increase of urban temperature.

2. Paved and Impermeable Surfaces:

- Paved over surfaces, such as roads and parking lots, can absorb solar radiation as heat.

3. Thermal Mass:

- Buildings and infrastructures contain a lot of thermal mass, which results in absorbing a lot of heat during the day and are slow to emit it at night.

4. Dark Surfaces:

- Dark roofs absorb more energy into the building as heat, so they get hotter than lighter-coloured surfaces.

5. Lack of Vegetation:

- Plants and trees provide shade and keep the temperature cool through evapotranspiration. But areas with paved surfaces do not have this luxury.

6. Climate Change:



- Extreme heat waves in urban areas lead to urban heat island formation.

7. Urban Canopy:

- The heat reflected by a building is trapped by the buildings, which is known as the urban canopy. UHI is also formed due to the factor of urban canopy as well.

Effects of Urban Heat Islands:

1. Energy Costs:

- Urban Heat Island effect increases energy costs (e.g., for air conditioning), air pollution levels, and heat-related illness and mortality.
- Increased consumption of air-conditioning for cooling can also contribute to global warming, which further contributes to climate change.

2. Poor Air Quality:

- UHIs often have lower air quality because there are more pollutants (waste products from vehicles, industry, and people) being pumped into the air.
- These pollutants are blocked from scattering and becoming less toxic by the urban landscapes - buildings, roads, sidewalks, and parking lots.

3. Poor Water Quality:

- Water quality also suffers. When warm water from the UHI ends up flowing into local streams, it stresses the native species that have adapted to life in a cooler aquatic environment.

4. Colonization by Heat-loving Species:

- Due to higher temperatures in urban areas, the UHI increases the colonization of species that like warm temperatures, such as lizards and geckos.
- Insects such as ants are more abundant here than in rural areas; these are referred to as ectotherms.

5. Heatwaves:

- Cities tend to experience heat waves that affect human and animal health, leading to heat cramps, sleep deprivation, and increased mortality rates.

6. Health Hazards:

- This is a serious cause for concern as the heat stress continues to build, increasing the risk of heat-related illnesses and even death.
- It poses a grave risk to lives, especially among vulnerable groups like the elderly, babies, pregnant women, those who live in slums and work outdoors.

Challenges Faced by India:

1. Lacking Behind in Tech Adoption:

- India's tech adoption in weather and heat risk monitoring is improving but may not be at par with other developed countries that have sophisticated systems due to more resources allowing them to deploy more extensive networks and achieve higher-resolution data.
- Example: While leading Indian cities have seven to eight India Meteorological Development weather stations on an average, a comparable city like San Francisco would have more than 100 weather monitoring stations.



2. Less Available Data:

- India's focus on weather has been more on water risk and security and hence have more granular data on precipitation, while heat is not a consistent part of the monitoring process.
- In developed economies, weather tracking is done by a variety of actors, from academic and research institutions to government bodies to the private sector. All of this rich data provides a much more nuanced understanding of scenarios.

3. Negligence in Enforcement:

- While more than 20 states have worked with the NDMA to create Heat Action Plans (HAP), most remain on paper. They are hampered by a lack of funding, granularity and a sustainable vision for transformation.

Mitigation Strategies:

1. Trees and Vegetation:

- Increasing tree and vegetation cover lowers surface and air temperatures by providing shade and cooling through evapotranspiration.

2. Green Roofs:

- Growing a vegetative layer (plants, shrubs, grasses, and/or trees) on a rooftop reduces temperatures of the roof surface and the surrounding air and improves stormwater management.
- Also called "rooftop gardens" or "eco-roofs," green roofs achieve these benefits by providing shade and removing heat from the air through evapotranspiration.

3. Cool Roofs:

- Installing a cool roof – one made of materials or coatings that significantly reflect sunlight and heat away from a building – reduces roof temperatures, increases the comfort of occupants, and lowers energy demand.

4. Cool Pavements:

- Using paving materials on sidewalks, parking lots, and streets that remain cooler than conventional pavements (by reflecting more solar energy and enhancing water evaporation) cools the pavement surface and surrounding air.

5. Smart Growth:

These practices cover a range of development and conservation strategies that help protect the natural environment. Some of these practices are:

- Mix land uses, such as residential, commercial, and recreational uses.
- Take advantage of compact building design.
- Create walkable neighbourhoods.
- Provide a variety of transportation choices.
- Encourage community and stakeholder collaboration in development decisions.

The urban heat islands issue is an urban design and development issue, which needs to be looked at from a bigger lens of economic policy, city management and sustainable living in cities.