Urban Form of a City to Deal with Heatwaves

For Prelims: Urban Form of a City to Deal with Heatwaves, Heatwaves, Climate Change, Centre for Science and Environment (CSE).

For Mains: Adopting Urban Form of a City to Deal with Heatwaves.

Source: DTE

Why in News?

Rising instances of **Heatwaves** have emerged as a critical issue in India, making it imperative to adopt **Urban Form** of a City.

- While Larger cities are struggling to deal with **Climate Change** to improve Livability, the smaller ones are on the brink of explosive growth and require **"heat-proof" development.**

What is the Urban Form of a City?

- **About:**
  - Every city has a **unique combination of natural and human-made infrastructure** and the activities resulting from them.
  - Closely packed buildings, for instance, will generate shorter trips and hence, less vehicular emissions **that pollute the air and trap heat.**
  - More greenery and water bodies will sequester carbon emissions and cool the ambient environment.
  - This combination of green spaces, water bodies and buildings is called the **Urban Form of a city**, which plays a crucial role in its **heat resilience and liveability.**
- **The Role of Urban Form in Heat Resilience:**
  - Parameters such as urban morphology, aspect ratio, sky view factor (SVF), blue/green infrastructure (B/GI), floor area ratio (FAR)/floor space index (FSI), and street orientation **collectively define a city's urban form and influence its susceptibility to heat.**
    - A study by the **Centre for Science and Environment (CSE)** in 2022 investigated the response of diverse urban forms to heat across 10 Indian cities, including Pune, Delhi, Kolkata, Bengaluru, and Jaipur.
    - Key findings from the study highlighted potential steps for combating heat in urban India.

What are the Findings of the CSE Related to Urban Infrastructure?

- **Urban Morphology and Heat Resilience:**
  - Urban areas characterized by **open highrise, open midrise**, and compact midrise morphologies with moderate vegetation exhibited **lower land surface temperatures (LST) in heat pockets.**

        - Neighborhoods featuring lowrise buildings **suffered 2-4°C higher LST** due to sparse vegetation. Large low rise industrial zones are particularly **problematic due to heat-trapping roofing materials** like asbestos, galvanised iron sheets and plastic sheets.
            - Such neighbourhoods can benefit by using better roof materials, **reflective paints and green roofs.**
- **Aspect Ratio:**
    - Aspect ratio is the ratio of building height and street width. It affects how much heat is trapped by urban surfaces.
    - The study shows that the **higher the aspect ratio, the lower the LST.** This means the narrower the street, the lesser the heat gain. Buildings shade each other and decrease direct exposure of surfaces to the sun.
- **Sky View Factor and Heat Trapping:**
    - The SVF determines **heat trapping and dissipation within streets** and open spaces. The **value of sky view factor lies between 0 and 1.** Value 1 means there is none to negligible enclosure. Higher SVF values were associated with a considerable increase in LST.
    - Locations with higher SVF, including highways, road intersections, and open parking lots, **experienced heightened temperatures.**
- **Street Orientation and Sun Exposure:**
    - Street orientation impacts heat gain due to sun exposure and wind speed. North-south-oriented streets had higher LST due to greater sun exposure.
    - Streets aligned along the **east-west axis were coole**r as they received less direct sun exposure.
- **Blue / Green Infrastructure:**
    - Greens play a crucial role in **enhancing microclimate of an urban area**. They regulate temperature and relative humidity, absorb and decompose pollutants, improve the overall air quality.
        - However, the benefits vary widely depending on the kind of greens — grass, shrubs or trees with thick foliage.
        - Singapore provides a methodology to calculate effective vegetation cover **(EVC) to reduce urban heat island effect and conserve natural resources.**
    - The CSE study found that **a 30% rise in EVC reduces LST by 2-4°C. EVC is better in trees with canopy.** LST under trees with thick foliage is about 10°C cooler than LST under palm trees in the same locality.

What are the Steps to Adopt Urban Form of a City?

- Urban form-based codes **can offer context-specific cooling solutions.** These codes can tailor zoning regulations to the unique characteristics of a city or neighbourhood. Old markets could feature shaded walkways, temple precincts, cool roofs, and business districts with high EVC (30%).
- Cities must revise their **building by-laws and master plans to incorporate** the insights from this study and improve heat resilience.
    - For instance, Pune's focus on SVF, aspect ratio, effective vegetation cover, and urban morphology could be the model for similar cities.
- Even a modest 1°C temperature decrease could translate into a 2% reduction in a city's power consumption, showcasing the p**otential impact of effective planning.**

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

What are the possible limitations of India in mitigating global warming at present and in the immediate future? (2010)

1. Appropriate alternate technologies are not sufficiently available.
2. India cannot invest huge funds in research and development.
3. Many developed countries have already set up their polluting industries in India.

Which of the statements given above is/are correct?

(a) 1 and 2 only

(b) 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (a)

Mains

Q. Bring out the causes for the formation of heat islands in the urban habitat of the world. **(2013)**