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HEAT-BAKED CHENNAI CAN SET AN EXAMPLE FOR INDIA-PG 6

[Causative factors of Heat-waves
Measures

Heat-baked Chennai can set an example for India

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The year 2023 was by far the hottest ever according to a recent World Meteorological Organization (WMO) report. Global average temperatures reached 1.45° C higher than pre-industrial levels, almost touching the 1.5° C limit set in the Paris Agreement. Scientists predict that 2024 could be similar. With global emissions still growing, climate impacts are worsening. Heatwaves are sweeping through the Indian sub-continent. And, more hotter and longer-lasting heat waves are being predicted in the years to come.

The reality of the urban heat island

In cities, this problem is exacerbated by a phenomenon termed the Urban Heat Island (UHI) effect. Temperatures in large, crowded urban settings can be several degrees higher than in surrounding rural areas, and even hotter at night. Concrete structures and tarmac roads retain heat which stays trapped inside this "urban bubble" along with air pollutants. A lack of green spaces and waste heat from air conditioners and other machinery add to the UHI.

Chennai, a coastal city, is affected by yet another feature which is cause for worry. Humidity reduces the cooling effect of perspiration, leading to a person experiencing an elevated body temperature, debilitating heat stress, exhaustion, and even a potentially fatal heat stroke.

Heat Index

As shown by available heat maps, the UHI in Chennai adds between 2° to 4° C to temperatures in nearby rural areas. So, when the maximum temperature is 40° C elsewhere, parts of Chennai could register between 42° to 44° C. Under high humidity conditions, wet-bulb temperature (indicating the extent to which evaporation can take place and facilitate cooling) of around 38.5° C is considered by the World Health Organization to be "near the limits of human survivability".

In India, a heatwave is officially declared in coastal areas when the maximum temperatures are over 37° C and 4.5° C above normal. Clearly, with an UHI, heatwave conditions are quite easily breached in Chennai. The effects could be much worse, even dangerous, when compared to inland, rural areas.

India has national, State and even some district-level Heat Action Plans (HAP) to reduce morbidity and mortality, especially among the vulnerable poor, infants and the elderly. The National Disaster Management Authority (NDMA) Guidelines, which are being upgraded, and those of several States, outline measures to deal with heatwaves including early warning bulletins, and staggered work hours at outdoor construction sites, with shaded areas and temporary shelters, and strategic provisioning of drinking water and oral rehydration salts. Besides such post facto responses to heatwaves, longer term measures are needed to deal with UHI and reduce urban heat. The Chennai Metropolitan Development Authority (CMDA) has recently commissioned the preparation of presumably more detailed heat maps than what are available now. While awaiting more localised planning and actions, several broad brush measures may be readily thought of and implemented. The Chennai Climate Action Plan (CCAP) offers several meaningful suggestions including those discussed here, albeit scattered under different sections. In our view, they underestimate causative factors and, therefore, remedial measures and targets.

The city is one of the few to have adopted a Climate Action Plan but there is scope for much improvement towards better liveability

A study and findings

Our study on Chennai and climate change (see Proposed Action Plan under www.inhaf.org/climact) looks at UHI as one among several inter-linked multi-dimensional issues. Our major findings and recommendations are discussed here.

1. Increasing green cover, obviously, tops the list. Green areas such as urban forests, large greens and parks, avenue and other trees, even lawns, release moisture which evaporates and cools the environs. Well-distributed green areas also influence local micro-climate, reduce air pollution, and promote health and well being. Tree-lined and shaded walkways and tracks provide pedestrians, cyclists and itinerant workers shelter from the blazing sun, and also encourage non-motorised transportation. With such multiple benefits, green areas are considered essential for sustainable urban development by UN Habitat, which recommends that green spaces be available for all citizens within 400 metres from their residence.

Regrettably, Chennai has among the lowest percentage of green cover of all the metros in India. The area under the Corporation is greener, with promising initiatives such as "*miyawaki* forests", although questions remain about the species planted. However, the expansion of the city has heavily depleted green areas and waterbodies.

Varied figures are cited for green cover in the larger Chennai Metropolitan Area (CMA) depending on the assessment methodology. But an estimated 12% appears reasonable (subject to correction), compared to an estimated over 20% in Bengaluru, Kolkata, Mumbai and Delhi. The densely populated city-state of Singapore has an astounding 47% under green cover. Many European cities have green cover that is well over the EU norm of 30%.

Congested, poorly ventilated localities and informal settlements of the urban poor suffer the most from UHI and would benefit from green areas, parks and waterbodies that are nearby. The Master Plan III should provide for inviolable green areas and local parks with equitable access.

Rough estimates indicate that increasing green cover in the CMA to a well-distributed 25% could significantly reduce UHI by about 1.5° C or more. This could also absorb around 10% of its carbon dioxide emissions and assist moving towards a "net zero" future.

On the use of air-conditioners, energy saving

2. A less understood factor behind UHI is waste heat from air-conditioning. In Chennai, as in other Indian metros, roughly 50% of electricity consumption during summer is for air-conditioning alone, which vent heat out. The more the UHI, the greater the use of air-conditioning, generating even more heat in a nasty feedback loop. It is estimated that moving towards more energy-efficient (EE) air-conditioning, through a combination of mandates for the purchase of five-star or split EE air-conditioners and incentives for the exchange of older air-conditioners for new EE units (as offered by the electricity distributor in Delhi, to reduce peak load, a win-win for distributor and consumer), could reduce UHI by as much as 1.5° C.

Cities such as Shanghai and Seoul have reported a significant reduction in UHI through such strategies. Several east Asian cities have in addition mandated other energy-saving measures for air-conditioning such as having a thermostat setting of 25° C in offices and commercial buildings. Energy savings can also accrue from switching off air-conditioners (and other appliances) from the mains rather than by remote control (this leaves appliances on low power-consuming stand-by mode). Greater consciousness about climate change would undoubtedly help but savings of roughly 25% on electricity charges, would also act as a powerful driver of change.

3. Further, if buildings are better insulated and ventilated, and constructed using appropriate designs and materials according to "green" building codes, they would require less air-conditioning and generate less waste heat.

Total energy savings could then rise to roughly 40%-50% and reduce UHI by, say, around 3° C. There would also be a significant co-benefit – of emissions reduction from thermal power plants in Chennai.

4. Having permeable pavings and walkways using alternative materials, increased shrubbery along sidewalks, berms and dividers, and reflective paint on roofs, walls and streets, are other measures to reduce UHI.

5. A sharp reduction in personal vehicles (most four-wheelers have powerful engines and airconditioners), through a rapid scaling-up of effective public transport with electric buses, would be another major contribution.

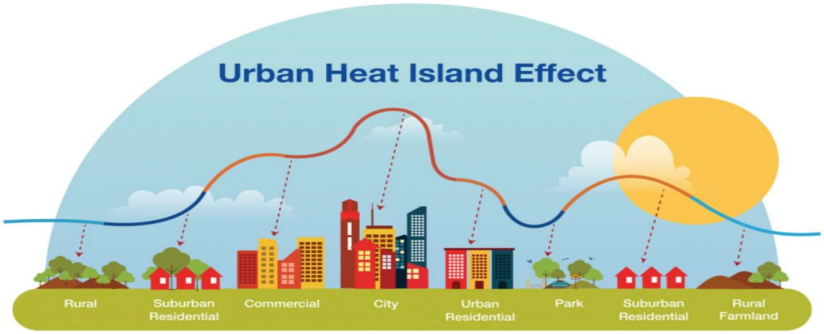
Chennai is one of a very few cities in India to have adopted a Climate Action Plan, but there is considerable scope for improvement. The city and its residents should utilise this opportunity to ensure long-term policies and measures to cool the city, improve liveability, and set an example for the rest of India.

Points To note

→ Urban Heat Island Effect
→ Causes
→ Heat Index, Heat Action Plan.
→ Wet Bulb Temperature
→ Solutions (with example of Chennai climate Action Plan)

Urban heat island

(Relevant for Geography Section of General Studies Paper Prelims/Mains)



- The urban heat island effect is a phenomenon in which urban areas experience higher air temperatures compared to the surrounding rural areas. This disparity is particularly evident during night time. Several factors contribute to this phenomenon, including the utilization of dark materials that absorb heat in construction, the absence of vegetation, and the heat generated by human activities.
- **Causes:**
  - **Reduced albedo materials:** Albedo refers to the ratio of reflected solar energy to incident solar energy. Materials with low albedo absorb a greater amount of solar energy, leading to higher heat retention and elevated urban temperatures.
  - **Impervious and surfaced areas:** Surfaces like roads and parking lots, which are often paved and impermeable, can absorb solar radiation and convert it into heat. Additionally, their impermeability prevents water absorption by plants and natural bodies, hindering cooling mechanisms.
  - **Scarcity of greenery:** The presence of vegetation aids in air cooling by absorbing carbon dioxide and emitting oxygen. Locations with limited vegetation are more susceptible to the urban heat island effect.
  - **Human-driven activities:** Human actions encompassing power generation, transportation, industrial processes, and air conditioning contribute to the release of heat and greenhouse gases, further intensifying the urban heat island effect.

Consequences:

- **The urban heat island effect can lead to various adverse outcomes, which encompass:**
  - Heightened energy usage and associated expenses for cooling structures and transportation.
  - Elevated air pollution and heightened emissions of greenhouse gases stemming from the burning of fossil fuels.
  - Augmented health hazards like heat-related ailments such as heat stroke, heat exhaustion, and cardiovascular conditions.
  - Diminished water quality due to escalated runoff and evaporation patterns. Reduced diversity in species and curtailed ecosystem benefits as a result of habitat reduction and fragmentation.
- **Mitigation Measures:**
  - Enhancing urban design and planning: Effective urban design and planning strategies can mitigate the urban heat island effect by improving natural airflow, minimizing sun-exposed surface area, elevating albedo, and integrating water elements. For instance, opting for porous materials in pavements, establishing open spaces and corridors for air circulation, positioning buildings to optimize shade and air movement, and constructing artificial lakes or ponds can contribute.
  - Expanding greenery: The incorporation of vegetation can effectively counteract high air temperatures through shading and cooling generated by evapotranspiration. Expanding parklands, planting trees along streets, and implementing green roofs and walls that support plant growth are avenues that cities can explore. Research indicates that the presence of vegetation can lead to a temperature reduction of approximately 4°F in nearby areas.
  - Utilizing cool roofs and pavements: Cool roofs and pavements integrate reflective coatings or materials that bounce back more sunlight and absorb less heat. These installations can diminish roof and pavement surface temperatures by up to 50°F and lower the overall ambient air temperature by several degrees.
  - Curbing greenhouse gas emissions: Encouraging eco-friendly transportation practices and bolstering energy efficiency in residences and businesses are effective strategies for reducing greenhouse gas emissions. These actions can contribute significantly to mitigating the urban heat island effect.
- The urban heat island effect is a serious problem that can have a number of negative consequences. However, there are a number of measures that can be taken to mitigate the urban heat island effect. By taking these measures, we can help to make our cities more livable and sustainable.

Prelims Question:

Q.1 Which of the following is/are correct in context of an urban heat island?

1. It is significantly warmer than the adjoining rural areas.
2. The rate of evaporation is faster.
3. Concrete structures are an important reason for formation of urban heat island

(a) 1 and 2 only
(b) 1 and 3 only
(c) 1, 2 and 3 only
(d) 2 and 3 only

Solution: The correct option is C i, ii and iii only

Urban Heat Island (UHI):

- Causes- Unplanned urbanization of cities Reduction in vegetation due to accelerated deforestration,
- Deterioration of water bodies and crop fields Changes in land use pattern like encroachment of water bodies and wetlands
- Rapid development of concrete structures which have low albedo value.
- Consequences- Excessive changes to heat and rainfall patterns, increased threats of global warming and has harmful impacts on plant, animal and human life.

Mains Question:

Q.2 What do you understand by Urban Heat Island Effect? Highlight the factors that give rise to the phenomenon of Urban Heat Island.Suggest measures to deal with it with example.

(250 words/10 Marks)

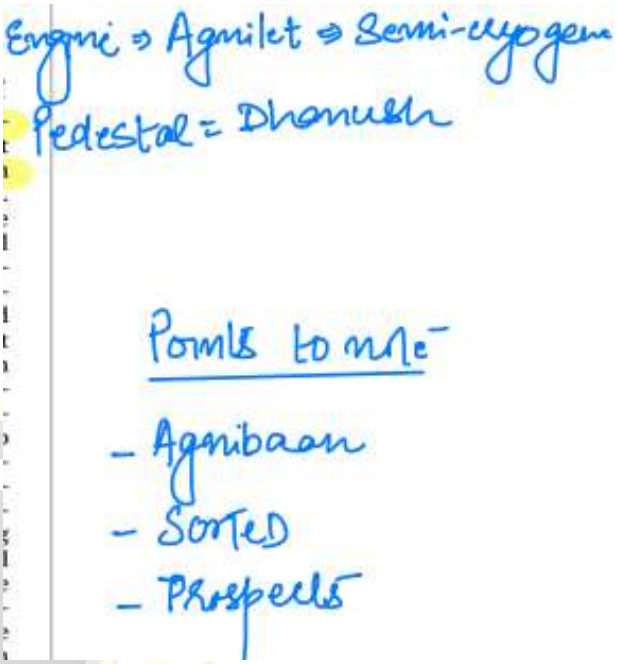
SPLASH BACK (AGNIBAAN)

Splash back

Private rocket flights herald prospects more valuable than commercial fortune

On May 30, a start-up named Agnikul Cosmos successfully conducted the first test flight of its rocket 'Agnibaan' in a mission called 'Suborbital Tech Demonstrator' (SOrTeD). The flight was Agnikul's fifth attempt after the first four were called off owing to suboptimal launch conditions. 'Agnibaan' is a two-stage, 14-tonne launch vehicle designed to lift small satellites to low-earth orbits. Both stages are powered by bespoke semi-cryogenic engines. The test flight flew a 'minimal' version of the rocket with one engine (or stage). Notably, many of the vehicle's components, including the engines, are 3D-printed, and Agnikul has said it will be able to build one rocket a month. With the test flight, Agnikul took 'Agnibaan' on its first steps towards being a full-fledged launch vehicle, which will expand India's commercial launch services offering in keeping with the expanding market for small satellites and the services they can provide. The roster is currently dominated by the Polar Satellite Launch Vehicle (PSLV) and will soon be joined by the Small Satellite Launch Vehicle, both of the Indian Space Research Organisation (ISRO). One blip Agnikul will have to address is the subpar communication of the parameters of the test flight. This is one area in which ISRO has not distinguished itself and it is important for new space startups to steer clear of the same mould.

This said, the flights of 'Agnibaan' – and Skyroot's 'Vikram' in 2022 – herald two prospects more valuable than commercial fortune. ISRO and/or scientists trained there have shared technical know-how and provided physical systems for many private missions, which these startups are now testing, cutting short the time and expenses required. Likewise, these startups are poised now to light the way for ISRO and others, potentially accelerating innovation in the sector. For example, ISRO has been testing a semi-cryogenic engine of its own that could draw from lessons learnt at Agnikul. The government must ensure that the corresponding bureaucratic and legal frameworks encourage the free flow of knowledge. Second, in April, ISRO said it had developed engine nozzles made of a carbon-carbon composite to replace the Columbium alloy nozzles on the PSLV's fourth stage. The switch increased PSLV's payload capacity by 15 kg – a significant amount for an already technologically mature launch vehicle, made possible by education and research opportunities that allowed know-how accrued in some sectors to disperse in others. This privilege is currently most pronounced in India's spacefaring enterprise. As more innovation enters the fray, it is hoped that the resulting solutions and insights will benefit everything, from aerospace to zoology.

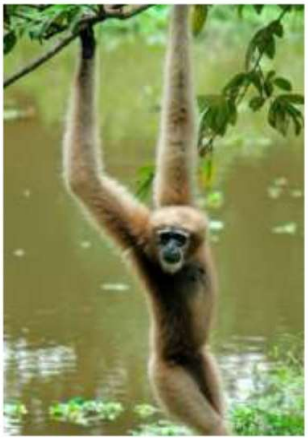


❖ The rocket is also designed for launch from more than 10 different launch ports. To ensure its compatibility with multiple launch ports, AgniKul has built a launch pedestal named 'Dhanush' that will support the rocket's mobility across all its configurations. The Agnilet engine, which powers the entire operation, is the world's sole singlepiece 3D-printed engine.

RAILWAYS TO CONSTRUCT CANOPY BRIDGES ACROSS TRACK IN ASSAM GIBBON HABITAT

Railways to construct canopy bridges across track in Assam gibbon habitat

The Hindu Bureau
GUWAHATI



The canopy bridge designed by the Wildlife Institute of India for installation in a gibbon sanctuary in Assam, and, right, a Hoolock gibbon. SPECIAL ARRANGEMENT

The Northeast Frontier Railway (NFR) has earmarked funds to construct canopy bridges for India's only ape to move across a railway track bifurcating its prime habitat in eastern Assam.

A 1.65-km-long track – set to be doubled and electrified – divides the 2,098.62-hectare Hollongapar Gibbon Sanctuary in Jorhat district. The sanctuary has the largest concentration of the Hoolock gibbon, one of 20 species of apes on earth.

The gibbon, known for its vocalisation, spends much of its time on the upper canopy of tall trees, mostly the hollong (*Dipterocarpus macrocarpus*). The fragmentation of the forest along the track has disturbed the arboreal nature of the ape, putting it at risk while crossing the track.

"We decided to install canopy bridges inside the sanctuary to facilitate the movement of the gibbons across the track. The decision was made in consultation with the Assam State Forest Department, Wildlife Institute of India (WII) and other stakeholders," NFR spokesperson Sabyasachi De said.

These canopy bridges, designed by the WII in consultation with the NFR, will be constructed at identified points to facilitate easy movement of the arboreal species between the two halves of the sanctuary partitioned by the Mariani-Dibrugarh railway track.

"The ends of the canopy bridges, as well as the knots, will be secured and clamped or tightened using appropriate and high-grade fastening materials and techniques. As a fail-safe mechanism, safety nets will be installed below the main twin-rope bridge to save the species accidentally falling off the bridges," Mr. De said.

The canopy rope bridges will be installed in such a way that lianas and creepers can be guided along them to make the bridges look as natural as possible, railway officials said.

The NFR had undertaken efforts in the past to build an artificial canopy bridge while the State Forest Department and Assam-based biodiversity conservation organisation Aaranyak had erected a natural canopy bridge in a part of the sanctuary frequented by the gibbons. The gibbons did not use the artificial bridge but used the natural canopy.

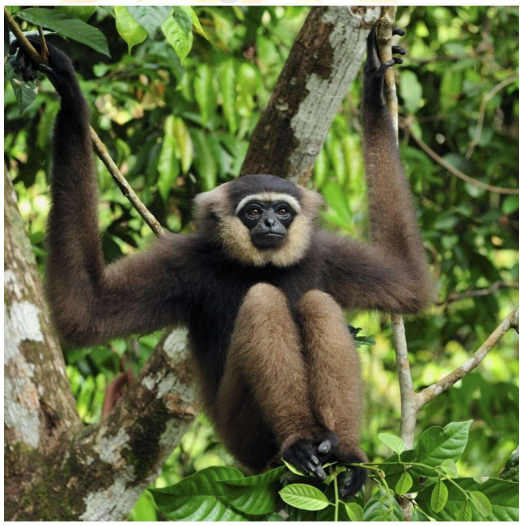
Points To Note:

Canopy Bridges | Eco-Bridges

Gibbons

- **Eco-ducts or Eco-bridges:** These are areas of wildlife habitat that aim to enhance wildlife connectivity that can be disrupted because of highways or logging. Usually these bridges are overlaid with planting from the area to give it a contiguous look with the landscape.

- **Types of Eco-bridges:** It includes canopy bridges (usually for monkeys, squirrels and other arboreal species); concrete underpasses or overpass tunnels or viaducts (usually for larger animals); and amphibian tunnels or culverts.
- **Significance:** Eco-bridges play a very important role in maintaining connections between animal and plant populations that would otherwise be isolated and therefore at greatersk of local extinction.



India's sole ape species, ⇒ Hoolock Gibbon

About:

- Gibbons, known as the smallest and fastest of all apes, inhabit tropical and subtropical forests in Southeast Asia.
  - They have high intelligence, distinct personalities, and strong family bonds similar to other apes.
- They represent one of the 20 gibbon species found worldwide.

Population and Habitat:

- The current population of hoolock gibbons is estimated to be around 12,000 individuals.
- They are found in forested areas of Northeast India, Bangladesh, Myanmar and Southern China.

Gibbon Species in India:

- Two distinct hoolock gibbon species are found in India's northeastern region: the eastern hoolock gibbon (Hoolock leuconedys) and the western hoolock gibbon (Hoolock hoolock).
- A recent study by the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad analyzed the genetics of these gibbons.
- The study revealed that there is actually only one species of gibbon in India, debunking the previous belief of separate eastern and western species based on coat color.
- The genetic analysis showed that the populations previously thought to be eastern and western hoolock gibbons diverged approximately 1.48 million years ago.
- The study also estimated that gibbons diverged from a common ancestor around 8.38 million years ago.

Threats:

- All 20 gibbon species, including hoolock gibbons, are at a high risk of extinction due to conservation challenges.
- Gibbon populations and their habitats have significantly declined over the past century, leaving small populations restricted to tropical rainforests.
- In India, the primary threat to hoolock gibbons is the loss of their natural habitat caused by deforestation for infrastructure projects.

Conservation Status:

- International Union for Conservation of Nature's Red List:
  - Western Hoolock Gibbon: Endangered
  - Eastern Hoolock Gibbon: Vulnerable.
- Also, both the species are listed on Schedule 1 of the Indian (Wildlife) Protection Act 1972.

Question:

Q.3 With reference to Hoolock Gibbon, consider the following statements:

1. It is the only ape species found in India.
2. It has two sub-species and both are listed as endangered in IUCN red list.
3. This species is an example of arboreal adaptation.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Solution:

- The correct option is C 1 and 3 only

Q.4 Consider the following statements:

1. Hoolock Gibbon is the only ape found in India.
2. Hollongapar Gibbon Sanctuary is a protected area in Arunachal Pradesh.
3. The Bhogdoi River flows through the Hollongapar Gibbon Sanctuary.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Answer: C

Notes:

Explanation –

- Statements 1 and 3 are correct. Hoolock Gibbon is the only ape found in India. The Bhogdoi River flows through the Hollongapar Gibbon Sanctuary. Statement 2 is incorrect. Hollongapar Gibbon Sanctuary is a protected area in Assam.