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"WHY INDIAN CITIES FACING URBAN FLOOD CONTINUOUSLY"

THIS ARTICLE COVERS "DAILY CURRENT AFFAIRS" AND THE TOPIC DETAILS OF "WHY INDIAN CITIES FACING URBAN FLOOD CONTINUOUSLY". THIS TOPIC IS RELEVANT IN THE "ENVIRONMENT AND ECOLOGY" SECTION OF THE UPSC- CSE EXAM.

WHY IN THE NEWS?

The heavy rainfall of 111.1 mm that Bengaluru received on Sunday was the highest recorded on a single day in June. The India Meteorological Department, Bengaluru, said, "Bengaluru rain breaks the 133-year-old record with the highest rainfall in a single day in June. Bengaluru city has seen an unprecedented 111.1 mm of rainfall in a single day.

SUSCEPTIBILITY OF CITY TO FLOODING:

- **Urbanisation and Land Use**: Bangalore's rapid urbanisation has led to increase demand for land, resulting in the encroachment of lakes, tanks, and drains. This has disrupted the natural drainage systems, making the city more prone to flooding[1][2][3][4].
- **Loss of Green Cover**: The city has lost the most portion of its green cover, with a 2017 study indicating that 88% of its vegetation and 79% of its water bodies have been lost in 45 years. This loss of natural habitats and water bodies has reduced the city's ability to absorb and manage rainwater effectively.
- **Poor Drainage Planning**: The city's drainage systems are inadequate and poorly planned, leading to the stagnation of floodwaters. The concretisation of drains has further reduced their capacity to handle rainwater, exacerbating the flooding issue.
- **Climate Change**: Climate change has led to an increase in frequent and intense rainfall events, which can affect the city's drainage systems and cause flooding. The recent floods in Bangalore were attributed to climate change and poor urban planning.
- **Flood-Prone Areas:** The city has identified 134 flood-prone points, which are concentrated in areas like the Vrishabhavathi, Koramangala-Challaghatta, and Hebbal valleys. These areas are prone to flooding due to their undulating terrain and the lack of adequate drainage infrastructure.

- **Lack of Regulation**: The lack of regulation of floodplains and the failure to conserve and manage water bodies have contributed to the city's vulnerability to flooding. The encroachment of lakes and wetlands has further reduced the city's natural flood storage capacity.
- **Impact on Daily Life**: Urban flooding in Bangalore has significant impacts on daily life, including the disruption of IT parks, residential areas, and other critical infrastructure. The city's residents and businesses are affected by the flooding, which can have long-term economic and environmental consequences.

THE MAIN CAUSES OF URBAN FLOODING IN BENGALURU ARE:

- **Rapid urbanisation and loss of green cover**: Bengaluru's rapid urbanisation has led to the encroachment of lakes, tanks, and drains, disrupting the natural drainage systems. The city has lost 88% of its vegetation and 79% of its water bodies in 45 years, reducing its ability to absorb and manage rainwater effectively.
- **Inadequate drainage planning**: The city's drainage systems are poorly planned and inadequate, leading to the stagnation of floodwaters. The concretisation of drains has further reduced their capacity to handle rainwater.
- **Heavy rainfall and thunderstorms**: Bengaluru experiences heavy rainfall, often accompanied by thunderstorms, in a short period of time. During an inundation episode in Bellandur in 2022, the city received 80 mm of rainfall in just one hour, which can overwhelm the drainage systems and cause flooding.
- **Encroachment of wetlands and floodplains**: The intense urbanisation process has led to the encroachment of wetlands and floodplains, obstructing the floodway and reducing natural flood storage capacity.
- **Lack of regulation and enforcement**: Failure to conserve and manage water bodies have contributed to the city's vulnerability to flooding. The encroachment of lakes and wetlands has further reduced the city's natural flood storage capacity.
- **Climate change**: Climate change has led to frequent and intense rainfall events, which can damage the city's drainage systems and cause flooding.

THE ROLE OF ENCROACHMENT IN URBAN FLOODING:

- **Loss of Interconnectivity**: The encroachment of wetlands and stormwater drains has disrupted the natural interconnectivity of water bodies, leading to a reduction in the city's ability to manage rainwater effectively. This loss of interconnectivity is a major reason behind the recent urban flooding in Bengaluru.
- **Blocking of Rajakaluves:** The blocking of stormwater drains (rajakaluves) with solid waste or due to encroachment further reduces the city's drainage capacity, exacerbating flooding issues.
- **Encroachment of Lakes and Wetlands:** The encroachment of lakes and wetlands has reduced their natural flood storage capacity, making the city more vulnerable to flooding. This encroachment has also led to the loss of green cover and natural habitats, further contributing to the flooding problem.
- **Conversion of Wetlands**: The conversion of wetlands for mixed land use, such as residential and office complexes, has altered the natural hydrological functions of these areas. This has led to the filling of low-lying areas with excavated earth debris, breaching both drains and lakes and further reducing the city's ability to manage rainwater.

- **Impact on Groundwater Recharge:** The concretisation of drains and the reduction in the width of natural drains have reduced the city's groundwater recharge capacity. This has led to a decrease in the city's ability to absorb and manage rainwater effectively, contributing to flooding.

SEVERAL MEASURES CAN BE IMPLEMENTED TO EFFECTIVELY MITIGATE URBAN FLOODING :

- **Check Dams**: Constructing check dams can help to control the flow of water and prevent flooding. Bengaluru has seen an increase in the number of check dams constructed, with 622 dams built between 2022 and 2023.
- **Ponds/Tanks**: The city has a large number of ponds and tanks that can be used to manage rainwater and reduce flooding. Between 2022 and 2023, 43,093 ponds and tanks were constructed.
- **Trenches**: Building trenches can help to divert floodwaters and reduce the risk of flooding. In 2022 and 2023, 2,963 trenches were constructed.
- **Roof Top Water Harvesting Structures**: Implementing rooftop water harvesting structures can help to collect and store rainwater, reducing the load on drainage systems. Between 2022 and 2023, 103 such structures were built.
- **Watershed Management**: Implementing watershed management practices to reduce the risk of flooding and manage the flow of water through natural channels. This includes measures such as reforestation and soil conservation.
- **Conservation of Water Bodies**: Preserving and restoring urban water bodies like lakes, tanks, and ponds can reduce stormwater runoff and mitigate flooding. These water bodies can be used to capture and store rainwater, thereby reducing the risk of flooding.
- **Rainwater Harvesting**: Rainwater harvesting systems can help collect and store rainwater for non-potable uses, reduce the load on drainage systems, and mitigate flooding. Many municipal corporations in India have made rainwater harvesting compulsory.
- **Green Roofs**: Building green roofsabsorb rainwater and reduce the risk of flooding. Green roofs can also provide insulation, reduce energy consumption, and improve air quality.
- **Flood Plains and Overflow Areas**: Creating flood plains and overflow areas for rivers can help to manage floodwaters and reduce the risk of flooding. These areas can be used to store excess water during heavy rainfall events.
- **Smart Rainwater Management**: Implementing smart rainwater management systems can help to collect and store rainwater for various uses, reducing the risk of flooding. This can include measures such as rainwater harvesting and greywater reuse.
- **Citizens' Prudent Attitudes**: Encouraging citizens to adopt prudent attitudes towards water management can help to reduce the risk of flooding. This includes practices such as avoiding the use of plastic, recycling rainwater, and not tipping oil or corrosive substances down the drain.
- **Sponge Cities**: Implementing sponge city concepts can help to manage rainwater in a natural way, reducing the risk of flooding. This can include measures such as permeable pavements, green roofs, and rainwater harvesting.

PRELIMS BASED QUESTION:

Q. Consider the following statement:

1. Cloud bursts may cause Urban floods.
2. Climate change directly leads to excessive rain in the cities.

Which of the above statements is/are correct?

1. 1 Only
2. 2 Only
3. Both 1 and 2
4. Neither 1 nor 2

Answer: A

MAINS BASED QUESTION :

1. **Why have Indian cities been witnessing Urban flooding? Discuss the strategies to curb urban floods in India.**

Vishal Yadav

VIRUS-LIKE PARTICLES

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "VIRUS-LIKE PARTICLES". THIS TOPIC IS RELEVANT IN THE "SCIENCE & TECHNOLOGY" SECTION OF THE UPSC CSE EXAM.

Why in the News?

Scientists recently at the Institute of Advanced Virology (IAV) in Thiruvananthapuram have innovated a new method to produce non-infectious particles resembling the Nipah virus, known as VLPs, in a lab setting. This discovery enables the creation of more effective and safer antibodies for neutralising NiV, even in environments with less stringent biosafety requirements.

WHAT IS VIRUS-LIKE PARTICLES?

- Virus-like particles (VLPs) are small structures of virus proteins that don't contain virus DNA, making them safe. Because they have a space inside them for carrying these materials, they transport medicines, vaccines, and substances for imaging.
- The efficient vaccine development for HPV, hepatitis B, and malaria involves using VLPs (Virus-Like Particles) to trigger immune responses without causing symptoms of these viruses.
- The VLPs are extremely tiny, ranging from about 20 to 200 nm in radius. Their small size allows them to smoothly access the lymph nodes, a crucial site for immune system activation during infections.
- A Virus-Like Particle (VLP) can include multiple structural proteins, possibly arranged in layers, and may have an outer lipid envelope. This outermost layer protects the genetic material within the particle.
- VLP vaccines from bacterial, yeast, insect, or mammalian cells trigger a strong immune response by presenting numerous epitopes and proteins to the immune system.

- VLPs offer several advantages, including improved immunogenicity, reduced risk of adverse reactions, and the potential for more targeted and effective vaccines.

ABOUT THE NIPAH VIRUS:

- The Nipah virus (NiV) is a virus that can transfer from animals to humans (zoonotic), capable of transmission via tainted food or through direct interpersonal contact.
- It causes severe illness in humans, including encephalitis (brain infection) and death, with a high mortality rate of 40-75%.
- The virus initially emerged in 1999, causing an outbreak across Malaysia and Singapore. This incident resulted in more than 100 fatalities and led to the slaughtering of over a million pigs. Since then, most outbreaks have been concentrated in Bangladesh and India, with Bangladesh experiencing almost yearly occurrences.
- Fruit bats of the Pteropus genus carry the Nipah virus asymptomatically, which humans can contract through direct contact with these bats, consuming contaminated raw date palm sap, or interacting with infected pigs.
- Up to 75% of cases in the recent outbreaks in India and Bangladesh were due to human-to-human transmission. This fact underscores the Nipah virus as a major concern for public health.
- Currently, no authorised vaccines or particular therapies for the Nipah virus infection; supportive care is the only option available.
- To prevent outbreaks of the Nipah virus, it's crucial to avoid contact with ill animals, particularly bats and pigs, in impacted areas and enforce correct infection prevention protocols.

CONCLUSION:

VLPs are a flexible medical science tool capable of mimicking viruses while remaining non-infectious. This characteristic fosters robust immune reactions, making them indispensable in creating vaccines and other biomedical applications. Stability issues, manufacturing complexities, elevated production expenses, and temperature sensitivity have all constrained the broader adoption of VLPs. Tackling these obstacles and enhancing the production process and fabrication of VLPs is essential for their increased application in vaccine development and beyond.

MAINS PRACTICE QUESTION:

Q. Discuss the Regulatory considerations when developing and approving VLP-based medical products. What is the cost-effectiveness of developing VLP-based vaccines or treatments compared to other methods?

Amit Pradhan