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By saurabh Pandey

THE HINDU

Target Mains -2024/25 -

Q "Climate change will bring new challenges in local governance by local bodies"Discuss

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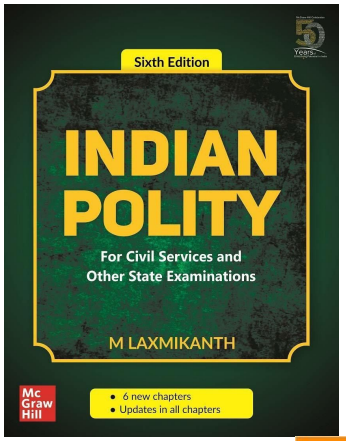

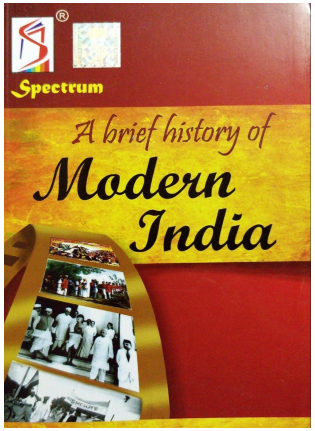

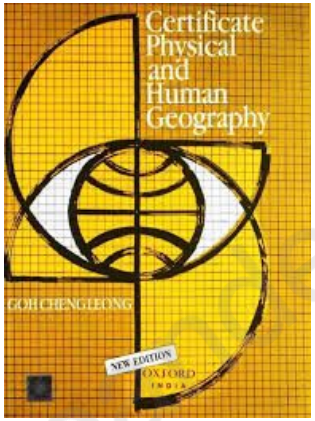

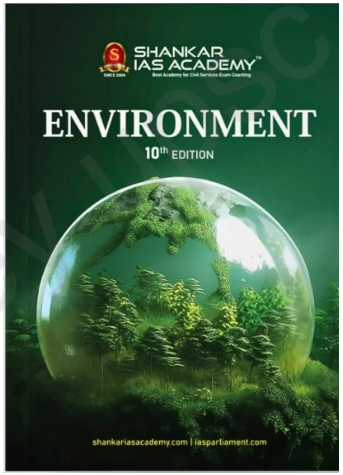

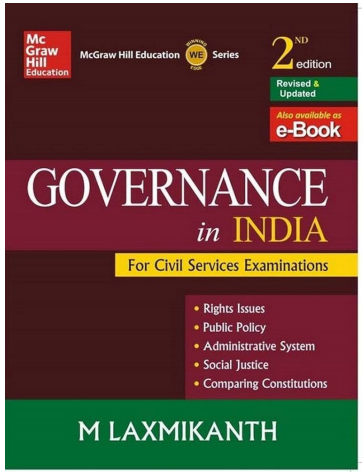

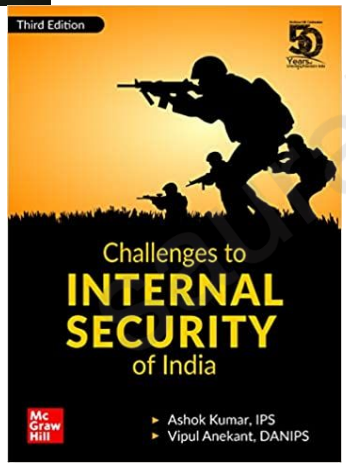

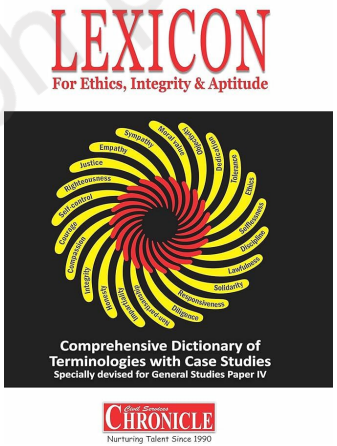

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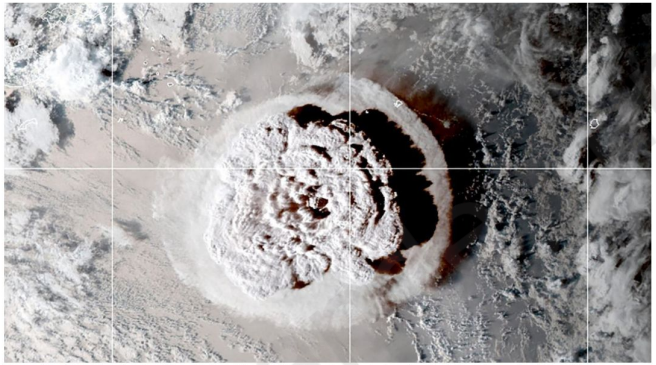
Tonga volcano could cause unusual weather for rest of decade: study

Usually, the sulphur dioxide in the smoke of a volcano cools the earth's surface for a short period. Hunga Tonga was an underwater volcano, so it produced little smoke and a lot of water vapour, which shot into the stratosphere. And in the stratosphere, water vapour is a potent greenhouse gas.

Martin Jucker



The eruption of the underwater volcano Hunga Ha'apa off Tonga in 2022. The volvano has had weather altering impact across the globe. REUTERS

THE GIST

A large ozone hole that developed from August to December 2023 was caused by Hunga Tonga. Simulations by researchers predicted that ozone hole almost two years in advance

Hunga Tonga's impact on climate change was very small. It was calcualted at only about 0.015 degrees Celsius. Consequently the high temperatures that have been measured for about a year now cannot be attributed to the eruption

Researchers' climate simulation predicts that the northern half of Australia will be colder and wetter than usual winters up to 2029. For North America, it predicts warmer than usual winters, while for Scandinavia, it again predicts colder than usual winters

Hunga Tonga-Hunga Ha'apai (Hunga Tonga for short) erupted on January 15, 2022, in the Pacific Kingdom of Tonga. It created a tsunami, which triggered warnings across the entire Pacific basin, and sent sound waves around the globe multiple times.

A new study published in the *Journal of Climate* explores the climate impacts of this eruption.

Our findings show the volcano can explain last year's extraordinarily large ozone hole as well as the much wetter than expected summer of 2024.

The eruption could have lingering effects on our winter weather for years to come.

A cooling smoke cloud

Usually, the smoke of a volcano – and in particular the sulphur dioxide contained inside the smoke cloud – ultimately leads to a cooling of the earth's surface for a short period. This is because the sulphur dioxide transforms into sulphate aerosols, which send sunlight back into space before it reaches the surface. This shading effect means the surface cools down for a while, until the sulphate falls back down to the surface or gets rained out.

This is not what happened to Hunga Tonga.

Because it was an underwater volcano, Hunga Tonga produced little smoke, but a lot of water vapour:100-150 million tonnes, or the equivalent of 60,000 Olympic swimming pools. The enormous heat of the eruption transformed huge amounts of sea water into steam, which then shot high into the atmosphere with the force of the eruption.All that water ended up in the stratosphere: a layer of the atmosphere between about 15 and 40 kilometres above the surface, which produces neither clouds nor rain because it is too dry.

Water vapour in the stratosphere has two main effects. One, it helps in the chemical reactions that destroy the ozone layer, and two, it is a very potent greenhouse gas.

There is no precedent in our observations of volcanic eruptions to know what all that water would do to our climate, and for how long. This is because the only way to measure water vapour in the entire stratosphere is via satellites. These have only existed since 1979, and there hasn't been an eruption similar to Hunga Tonga in that time.

Follow the vapour

Experts in stratospheric science around the world started examining satellite observations on the first day of the eruption. Some studies focused on the more traditional effects of volcanic eruptions, such as the amount of sulphate aerosols and their evolution after the eruption, some concentrated on the possible effects of the water vapour, and some included both.

But nobody really knew how the water vapour in the stratosphere would behave. How long will it remain in the stratosphere? Where will it go? And, most importantly, what does this mean for the climate while the water vapour is still there?

Those were exactly the questions we set out to answer.

We wanted to find out about the future, and unfortunately, it is impossible to measure that. This is why we turned to climate models, which are specifically made to look into the future.

We did two simulations with the same climate model. In one, we assumed no volcano erupted, while in the other one we manually added the 60,000 Olympic swimming pools worth of water vapour to the stratosphere. Then, we compared the two simulations, knowing that any differences must be due to the added water vapour.

What did we find out?

The large ozone hole from August to December 2023 was at least in part due to Hunga Tonga. Our simulations predicted that ozone hole almost two years in advance.

> The eruption created a tsunami which triggered warnings across the entire Pacific basin, and sent sound waves around the globe multiple times

Notably, this was the only year we would expect any influence from the volcanic eruption on the ozone hole. By then, the water vapour had just enough time to reach the polar stratosphere over Antarctica, and during any later years, there would not be enough water vapour left to enlarge the ozone hole.

As the ozone hole lasted until late December, with it came a positive phase of the Southern Annular Mode during the summer of 2024. For Australia, this meant a higher chance of a wet summer, which was exactly opposite what most people expected with the declared El Niño. Again, our model predicted these two years ahead.

In terms of global mean temperatures, which are a measure of how much climate change we are experiencing, the impact of Hunga Tonga is very small, only about 0.015 degrees Celsius. (This was independently confirmed by another study.) This means that the incredibly high temperatures we have measured for about a year now cannot be attributed to the Hunga Tonga eruption.

Disruption for the rest of the decade

But there are some surprising, lasting impacts in some regions of the planet.

For the northern half of Australia, our model predicts colder and wetter than usual winters up to about 2029. For North America, it predicts warmer than usual winters, while for Scandinavia, it again predicts colder than usual winters.

The volcano seems to change the way some waves travel through the atmosphere. And atmospheric waves are responsible for highs and lows, which directly influence our weather.

It is important here to clarify that this is only one study, and one particular way of investigating what impact the Hunga Tonga eruption might have on our weather and climate. Like any other climate model, ours is not perfect.

We also didn't include any other effects, such as the El Niño-La Niña cycle. But we hope that our study will stir scientific interest to try and understand what such a large amount of water vapour in the stratosphere might mean for our climate.

Whether it is to confirm or contradict our findings, that remains to be seen – we welcome either outcome.

(Martin Jucker is lecturer in atmospheric dynamics, UNSW Sydney. This article is republished from The Conversation.*)*

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WHAT IS IT?

Carnian pluvial episode: bounty in rain

Arkatapa Basu

The earth's climate has always been in flux. There have been ice ages, periods of scorching deserts, even seemingly endless rain.

Some 230 million years ago, during the late Triassic Period, it rained for more than a million years straight. Researchers call this slice of time the carnian pluvial episode. And right after this episode, the age of the dinosaurs began. While it wasn't as major an event as, say, any one of the planet's five mass extinctions, the carnian pluvial episode certainly altered the path of evolution of both terrestrial and marine flora and fauna.

The world's landmasses in the late Triassic consisted of the supercontinent Pangaea. Scientists have suggested that the heavy downpour was the result of volcanic activity in the Wrangellia Province, which is in the present day on the western coast of North America. This volcanic activity is expected to have wiped out approximately a third of marine life and a substantial amount of terrestrial life — but which, according to evidence scientists have found, the carnian pluvial episode may have turned around for the better.

During and after the episode, the number and diversity of species increased. Many of them played and continue to play an important role in the way the earth looks today.

At one point during the late Triassic Period, it rained for more than a million years straight.
GETTY IMAGES/ISTOCKPHOTO

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carnian pluvial

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- **This volcanic activity is expected to have wiped out approximately a third of marine life and a substantial amount of terrestrial life**
- **During and after the episode, the number and diversity of species increased.**

BIG SHOT

This picture from the Institut Botanic de Barcelona shows a fern in New Caledonia. A small, seemingly unremarkable fern that only grows on a remote Pacific island was on May 31 crowned the record-holder for having the largest genome of any organism on the earth. The New Caledonian fern (*Tmesipteris oblanceolata*) has more than 50-times more DNA packed into the nucleus of its cells than humans. AFP

New Caledonian fork fern

- In a new study published today in the journal iScience, researchers from the Royal Botanic Gardens, Kew and the Institut Botànic de Barcelona (IBB-CSIC) in Spain present a new record-holder for the largest amount of DNA stored in the nucleus of any living organism on the planet.
- Coming in at more than 100 metres of unravelled DNA, the New Caledonian fork fern species Tmesipteris oblanceolata was found to contain over 50 times more DNA than humans and has dethroned the Japanese flowering plant species Paris japonica, which has held this record since 2010.

- addition, the plant has achieved three Guinness World Records titles for Largest plant genome, Largest Genome, and Largest fern genome for the amount of DNA in the nucleus.
- T. oblanceolata is a rare species of fern found on the island nation of New Caledonia, an overseas French territory situated in the Southwest Pacific, about 750 miles east of Australia, and some of the neighbouring islands such as Vanuatu.

Does inequality lead to growth?

Several argue that inequality harms democratic processes. Some inequality, others argue, is actually beneficial, since it acts as an incentive to entrepreneurs to start businesses. This view is mistaken, for inequality can have deleterious economic effects

ECONOMIC NOTES

Rahul Menon

Rahul Gandhi's statements regarding redistribution – and the polarising rebuttal of Prime Minister Narendra Modi – have brought the topic of inequality to the forefront. Researchers from the Paris School of Economics have shown inequality in modern India to be greater than colonial times.

Several argue that inequality harms democratic processes. Some inequality, others argue, is actually beneficial, since it acts as an incentive to entrepreneurs to start businesses, thereby increasing employment and welfare for others.

This view is mistaken, for inequality can have deleterious economic effects as well. Consider one form of inequality, that of concentration of monopoly power amongst capital relative to labour. This can have negative effects on consumption, welfare, and growth. If done properly, wealth taxes and distribution can have positive effects.

Monopoly power and consumption

Billionaires draw their wealth from monopoly. Their business groups are dominant players in their specific market. This allows them to set prices instead of being determined by the market. The extent of mark-ups above the cost of production is determined by their monopoly power. Thus, for any given level of money wages, real wages – which determine purchasing power – are lower in economies with strong monopolies.

These monopoly effects are currently being experienced as the cost-of-living crises affecting the developed economies. The phenomenon of "greedflation", or companies raising prices to increase profit margins in the wake of multiple demand-and-supply shocks due to the pandemic, has been pointed to as contributing to high rates of inflation in the West. Textbook economics shows us that the profit-maximising level of output under a monopoly is less than under a competitive economy, implying a welfare loss. Thus, the presence of monopolies can lead to lower real wages and lower levels of output and investment.

ISTOCKPHOTO

Inequality and growth

Assume that a company decides to set up a new factory. Before the new capital stock is created, wages are paid out to workers to build it. The income of the workers is spent on purchasing goods, which increases the income of goods-sellers, whose increased income results in purchases of other goods, and so on. The total increase in the income of workers and goods-sellers is greater than the initial investment. This process is called the 'multiplier' effect, wherein investment raises incomes by a greater proportion than the initial investment.

When companies exercise market power, mark-ups and prices will be higher. Real wages of workers are lower, and they can only purchase lesser items. However companies, because of higher margins, will enjoy the same amount of profits from the sale of a lesser amount of goods. The increase in income from a given amount of investment will be lesser under monopoly because of reduced consumption power. Thus, investment will have a weaker effect on growth under monopoly while not affecting profits.

One can argue that consumption of the rich can help boost growth. While the absolute amount of consumption of the rich is more, they consume a smaller proportion of their incomes. The multiplier process depends on the proportion of consumption from incomes. An unequal economy will put lesser incomes in the hands of those with a greater propensity to consume, leading to weaker expansion in the economy.

Redistribution and growth

Some argue that the 'cure' of redistribution can prove more harmful than the disease of inequality by affecting job creation. Entrepreneurs would see reduced incentives for amassing wealth under a high-tax regime, resulting in a scale-back of investment and jobs.

One must make a distinction between wealth and profits. Investment occurs under the influence of future profit expectations, while wealth is accumulated past profits. As the Polish economist Michal Kalecki argued, taxes on wealth would not affect investment since it leaves expectations of future profits unchanged. For example, taxing Gautam Adani's wealth will not affect investment since expected profits from airports depends on the demand for air-travel which is independent of the value of his wealth.

No doubt, the difficulty in converting profits into wealth may deter some business-owners from undertaking investment. But an economy with high expectations of profit would ensure businesses invest even if wealth is taxed. Redistribution can generate forces to spur growth even if some billionaires pull back on investment. For one, if wealth is redistributed and increases income, the multiplier process would become stronger. Businesses would be more willing to invest where purchasing power is strong. If monopolies are curtailed, then prices would be lower and real wages higher, leading to greater demand.

Consider Thomas Piketty's proposal of taxing billionaire wealth and providing basic income. This might cause some to exit the economy, but can create a new class of entrepreneurs who can create start-ups, freed from the necessity of working for wages. Redistribution is not a silver bullet, and too high a rate of taxation can become a net drain on an economy. Used in conjunction with other policy measures, curtailing inequality can lead to a healthier economy.

THE GIST

- Rahul Gandhi's statements regarding redistribution — and the polarising rebuttal of Prime Minister Narendra Modi — have brought the topic of inequality to the forefront.
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Wealth and inequality

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- **Thus, for any given level of money wages, real wages — which determine purchasing power — are lower in economies with strong monopolies.**

- These monopoly effects are currently being experienced as the cost-of-living crises affecting the developed economies.
- The phenomenon of “greedflation”, or companies raising prices to increase profit margins in the wake of multiple demand-and-supply shocks due to the pandemic, has been pointed to as contributing to high rates of inflation in the West.
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- **Inequality and growth**
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Can domestic MFs invest in their overseas counterparts?

What does a proposed framework by SEBI put forward? What are some of the concerns?

Saptaparno Ghosh

The story so far:

The Securities and Exchange Board of India (SEBI) on May 17 floated a consultation paper proposing a framework for facilitating investments by domestic Mutual Funds (MFs) in their overseas counterparts, or Unit Trusts (UTs) that invest a certain portion of their assets in Indian securities. Comments about the framework are solicited until June 7.

What is the framework's purpose?

Noting India's strong economic growth prospects, SEBI observes that Indian securities offer an attractive investment opportunity for foreign funds. SEBI says this has led to several international indices, exchange traded funds (ETFs), MFs, and UTs allocating a part of their assets towards Indian securities. In the consultation paper, MSCI Emerging Markets Index was noted to hold 18.08% exposure to Indian securities.

Indian mutual funds, somewhat conversely, diversify their portfolios by launching 'feeder funds' which invest in overseas instruments such as (units of) MF, UTs, ETFs and/or index funds. Other than diversification, it eases the path to make global investments. However, ambiguity remains about investments which have Indian exposures, which deters domestic MFs from investing in these instruments. SEBI's cumulative assessment sees merit in potentially allowing investments of this kind with "limited exposure to Indian securities." Within the proposed framework, the markets regulator also intends to place essential safeguards which would keep the Indian instruments "true to their label" and enable investors to take desired exposure in overseas securities. If the fund has significant exposure to Indian securities, the purpose of making an overseas investment is defeated.

What proposals has SEBI tabled?

Significantly, the upper limit for investments made by overseas instruments (in India) has been capped at 20% of their net assets. That is, overseas instruments being considered must not have an exposure of more than 20% in Indian securities. Deeming the cap "appropriate," SEBI explains that this would help "strike a balance between facilitating investments in overseas funds with exposure to India and preventing excessive exposure." The markets regulator has also sought that Indian mutual funds ensure contributions of all investors of the overseas MF/UT is pooled into a single investment vehicle. Other than this, Indian mutual funds must also ensure that all investors of the overseas instrument are receiving gains proportionate to their contribution – and in no order of preference. SEBI stresses that these investments are to be made autonomously by the manager (of the overseas instrument) without any influence from the investors or undisclosed parties. SEBI is also seeking public disclosures of the portfolios of such overseas MF/UTs periodically for the sake of transparency. Finally, it warns against the existence of any advisory agreement between the Indian mutual fund and the overseas MF/UT. This is to prevent conflict of interest and avoid any undue advantage.

What happens when overseas instruments breach the limit?

If the overseas instrument breaches the 20% limit, the Indian mutual fund scheme which is investing in the overseas fund would slip into a six-month observance period. This period is to be utilised by the overseas instrument/fund to rebalance its portfolio adhering to the cap. Further investment in the overseas instrument would be allowed only when the exposure drops below the limit. If the portfolio is not rebalanced within this period, the MF must liquidate its investment in the overseas instrument within six months.

Are there other considerations?

The first consideration is RBI's upper limit for overseas investment by mutual funds. RBI Governor Shaktikanta Das stated that there was no proposal to increase the investment limit. In light of this, Suresh Soni, CEO at Baroda BNP Paribas Mutual Fund told *The Hindu*, "The changes to regulations would not have any practical impact immediately, as the overall industry limit for overseas investments is effectively exhausted." Mr. Soni says such investments provide diversification opportunities to Indian investors.

THE GIST

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- **Other than diversification, it eases the path to make global investments.**
- **A feeder fund (“Feeder”) is an investment vehicle, often a limited partnership, that pools capital commitments of investors and invests or “feeds” such capital into an umbrella fund, often called a master fund (“Master”),**

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BEIJING

China probe successfully lands on far side of moon to collect samples

REUTERS

China's Chang'e-6 lunar probe successfully landed on Sunday on the far side of the moon to collect samples, state media reported — the latest leap for Beijing's decades-old space programme. The Chang'e-6 set down in the immense South Pole-Aitken Basin, one of the largest known impact craters in the solar system. AFP

Chang'e 6

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Chang'e 6

Chang'e 6 is a robotic lunar exploration mission by the China National Space Administration.

As China's second sample return mission, it will attempt to obtain a sample of soil and rock from the far side of the Moon, while it conducts scientific experiments on the lunar surface.

The Chinese Lunar Exploration Program is designed to be conducted in four phases of incremental technological advancement:

- The goal of the first phase was to reach lunar orbit. This was completed by Chang'e 1 in 2007 and by Chang'e 2 in 2010.
- The second phase sought to land and rove on the Moon, a feat that was accomplished by Chang'e 3 in 2013 and by Chang'e 4 in 2019.

- The third phase involves the collection of lunar samples and sending them to Earth, first completed by Chang'e 5 in 2020 and planned for Chang'e 6.
- The fourth phase consists of the development of a robotic research station near the Moon's south pole.
- The program aims to facilitate crewed lunar landings in the 2030s and possibly build a crewed outpost near the lunar south pole.

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Roman Baths may harbour novel antimicrobial natural products

The Hindu Bureau

The world-famous Roman Baths are home to a diverse range of microorganisms which could be critical in the global fight against antimicrobial resistance, a new study suggests. The investigation of extreme ecological niches, such as hot springs, has gained recent interest due to their unique ecosystems, increasing the chance for novel antimicrobial natural product discovery. The study, published in the journal *The Microbe*, is the first to provide a detailed examination of the bacterial and archaeal communities found within the waters of the popular tourist attraction in the city of Bath (U.K.).

Scientists collected samples of water, sediment and biofilm from locations within the Roman Baths complex including the King's Spring (where the waters reach around 45 degree C) and the Great Bath, where the temperatures are closer to 30 degree C. The samples were then analysed using cutting edge sequencing technology and traditional culturing techniques were employed to isolate bacteria with antibiotic activity.

Around 300 distinct types of bacteria were isolated across the Roman Baths site with different examples being more prominent within the varying water temperatures. Further tests showed 15 of these isolates – including examples of Proteobacteria and Firmicutes – showed varying levels of inhibition against human pathogens including *E.coli*, *Staphylococcus Aureus* and *Shigella flexneri*.

"From initial isolation experiments, 297 isolates were purified, of which 15 showed broad spectrum activity against human pathogens, though interestingly these were not from target genera in the *Actinobacteria*. From these data, there is clear potential for novel antimicrobial natural products discovery from the Roman Baths, as has been demonstrated from other thermal hot springs globally," the authors write.

The research comes at a time when the need for new sources of antibiotics is at unprecedented levels, with resistance of bacteria to currently used medication estimated to be responsible for more than 1.25 million deaths globally each year. The researchers say a significant amount of additional investigation is required before the microorganisms found in the Roman Baths can be applied in the fight against disease and infection globally. However, they add that this initial study has shown there is clear potential for novel antimicrobial natural products contained within its hot springs to be explored further for that purpose.

Roman Baths

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- **The investigation of extreme ecological niches, such as hot springs, has gained recent interest due to their unique ecosystems, increasing the chance for novel antimicrobial natural product discovery**

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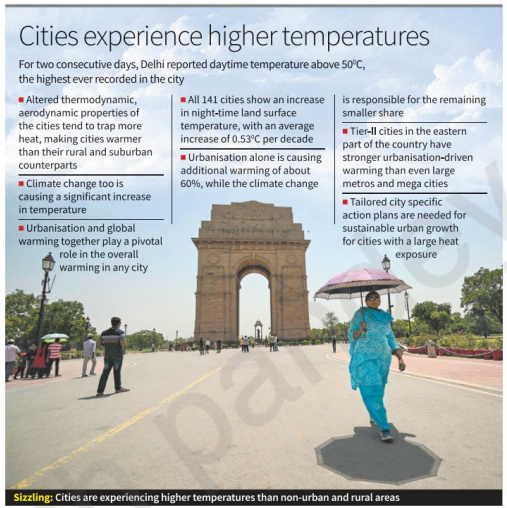
Cities warming due to effect of urbanisation, climate change

The rate of warming in cities is nearly twice that of the rest of the country, with local-scale urbanisation alone causing additional warming of about 60%

V. Vinoj
S.S. Sethi



Sizzling: Cities are experiencing higher temperatures than non-urban and rural areas

Recently, for two consecutive days, Delhi reported daytime temperatures above 50 degrees C, the highest ever recorded in the city. There is a reason why cities are experiencing higher temperatures than non-urban and rural areas. The ongoing climate change and rapid urbanisation are now defining the Anthropocene, with the cities experiencing both thereby making the urban population vulnerable to the compounding impact. India's urban landscape (especially population) is projected to double by 2050, adding more than 450 million residents. This rise outnumbers the present total population of the United States and the European Union, signaling a huge historical shift. Given the breakneck urbanisation, our cities must be prepared for future challenges.

The altered thermodynamic, and aerodynamic properties of the cities tend to trap more heat, making cities warmer than their rural and suburban counterparts, a phenomenon well-known as the urban heat island (UHI) effect. In addition, climate change is causing a significant increase in record-breaking temperatures and frequent prolonged heat waves. Therefore, the overall warming in any city tends to be complex with both urbanisation and global warming playing a pivotal role. This alters the resultant micro-climate of the cities with an influence on heat, rainfall distribution and even air pollution dispersion with implications for public health.

In a study published recently, we seek to separate the warming caused by local scale urbanisation and regional scale climate change in the context of 141 major cities in India and quantify their relative contributions. This kind of segregation is scientifically quite complex. One strategy is to determine the contributions of various factors to warming over time. These factors include information on concrete structures, roads, industries, parks, water bodies, residential activities, air conditioning, vehicular activities, and so on. Such detailed analysis requires enormous time, effort and investment, even for just one city and has to be incorporated into models or combined with extremely high-resolution satellite images for further analysis. A much simpler approach was followed using high-resolution night-time land surface temperature from MODIS, a sensor aboard Aqua satellite in NASA's A-train constellation. Under the assumption that the observed changes in warming (2003 to 2020) over the rural areas are driven primarily by regional climate change, the warming over the urban built-up areas for each city was compared to its rural counterpart at every one sq. km area. Thus, after the removal of regional warming signatures from the urban areas, the signal related to urbanisation was estimated for 141 major and minor cities providing first-time information on global warming-free urbanisation signatures.

Overall, the rate of warming in cities is near twice that of the rest of the country, with local-scale urbanisation alone causing additional warming of about 60%. While all cities showed an increase in night-time land surface temperature, with an average increase of 0.53 degree C per decade, a large divide among cities was seen. The tier-II cities in the eastern part of the country have stronger urbanisation-driven warming, surprisingly not seen even for the larger metros and mega cities. This may be indicating a window of opportunity.

India is aggressively acting to reduce emissions and shift to non-fossil fuel based energy sources as clearly stated in the updated nationally determined contribution (NDC) working towards climate justice. State level heat action plans and implementation of early warning and forecasting systems for heat-waves show India's commitment to saving lives by reducing heat related mortality.

Based on the predominant contribution to warming, the study emphasises that urban heat management must follow a differential approach for each city.Cities with a large urbanisation contribution may benefit from local scale interventions – use of sustainable materials like cool roofs and cool/permeable pavements, green infrastructures, creation of maintenance of lakes and parks, urban forests, and comprehensive emission reduction strategies. While other cities may require more regional scale efforts – national or regional level emission reduction, large-scale afforestation/plantation, rejuvenation of surrounding water bodies – for effective warming mitigation with both having implications for extreme urban rainfall, floods, air pollution, etc.

(V. Vinoj is Associate Professor, School of Earth, Ocean and Climate Sciences, IIT Bhubaneswar, and S.S. Sethi is PhD scholar at the School of Earth, Ocean and Climate Sciences, IIT Bhubaneswar)

Cities experience higher temperatures

For two consecutive days, Delhi reported daytime temperature above 50^{0}C, the highest ever recorded in the city

- Altered thermodynamic, aerodynamic properties of the cities tend to trap more heat, making cities warmer than their rural and suburban counterparts
- Climate change too is causing a significant increase in temperature
- Urbanisation and global warming together play a pivotal role in the overall warming in any city
- All 141 cities show an increase in night-time land surface temperature, with an average increase of 0.53^{0}C per decade
- Urbanisation alone is causing additional warming of about 60%, while the climate change is responsible for the remaining smaller share
- Tier-II cities in the eastern part of the country have stronger urbanisation-driven warming than even large metros and mega cities
- Tailored city specific action plans are needed for sustainable urban growth for cities with a large heat exposure

Why some cuckoo birds have higher rates of speciation

Cuckoos, which lay their eggs in nests of other birds, have higher speciation rates when they lay their eggs in a broader range of host bird species' nests. This higher speciation rate is driven by host rejection and cuckoo selection for mimetic nestling traits. In some species, cuckoo chicks kick the host young from the nest, whereas in others, cuckoo birds are reared alongside the host young. This variation places a high selective pressure on hosts to develop defenses and the emergence of counter adaptations in cuckoos.

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- This variation places a high selective pressure on hosts to develop defenses and the emergence of counter adaptations in cuckoos.

What is speciation ??

- Speciation occurs when a group within a species separates from other members of its species and develops its own unique characteristics.
- The demands of a different environment or the characteristics of the members of the new group will differentiate the new species from their ancestors

A history of Zika virus raises risk of symptomatic dengue

People who have already been exposed to the Zika virus are more vulnerable to symptomatic infections with some types of dengue virus later on, according to a comprehensive study in Nicaragua during an unusual dengue outbreak in 2022. The results, which involved more than 3,400 participants, support the idea that the interplay between Zika and dengue can influence the risk of severe dengue infections in vulnerable populations – a finding with implications for the safe rollout of vaccination campaigns.

Zika Virus

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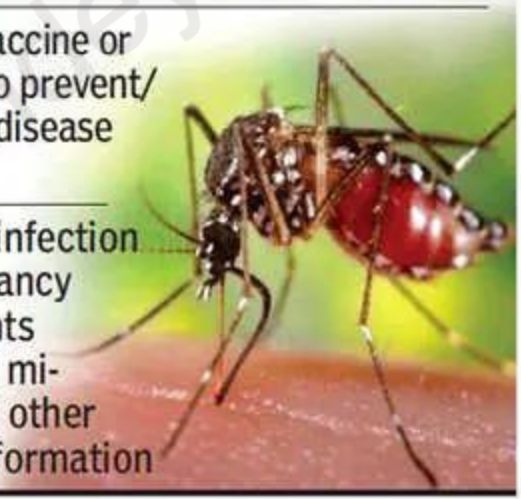
ALL ABOUT ZIKA VIRUS DISEASE

Zika virus disease is an emerging viral disease transmitted through the bite of an infected Aedes mosquito

Symptoms

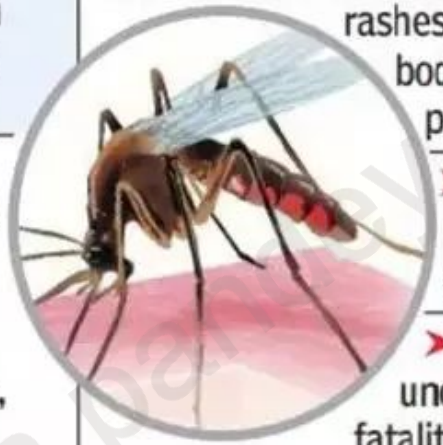
- Most of those infected with Zika virus disease either remain asymptomatic or show mild symptoms of fever, rash, conjunctivitis, body ache, joint pain
- Severe forms of disease requiring hospitalization is uncommon and fatalities are rare
- There is no vaccine or drug available to prevent/treat Zika virus disease at present
- Zika virus infection during pregnancy can cause infants to be born with microcephaly and other congenital malformation



NO VAX YET, BUT FATALITIES RARE

What Is Zika Disease

- Zika, a mosquito-borne virus, first identified in monkeys in Uganda in 1947
- In 2007, first outbreak in the Pacific region. Subsequent outbreaks reported from Africa, America, Asia, French Polynesia, Western Pacific and Brazil
- Transmitted by Aedes aegypti mosquitoes, also the vector for dengue and chikungunya
- Infection in a pregnant woman can cause birth defects in the newborn



Symptoms ➤ Most remain asymptomatic or show mild fever, rashes, conjunctivitis, body ache, joint pain

- **Only 1 in 4** may develop the symptoms
- Hospitalisation uncommon, fatalities rare
- **No vaccine or drug available**

The State Scenario

- Maharashtra has reported fewer than 5 cases, including in Pune, Palghar. The Palghar patient was a 7-year-old girl from Jhai ashramshala
- This is the first case in Mumbai

Question Corner

Blood proteins

Besides the red pigment, what material was used in the red paint by people of Peru's Sicán culture?

Thirty years ago, archeologists excavated the tomb of an elite 40-50-year-old man from the Sicán culture of Peru, a society that predated the Incas. The man's seated, upside-down skeleton was painted bright red. Researchers analysed the paint and found that it contains human blood and bird egg proteins in addition to a red pigment. The study began when researchers wondered what the Sicán people had used in the paint mix as a binding material. As per a release, the researchers analysed a small sample of the mask's red paint. Using sophisticated equipment they found that the sample contained proteins, so proteomic analysis was done, which revealed six proteins from human blood in the red paint, including serum albumin and immunoglobulin G. Other proteins, such as ovalbumin, came from egg whites. Because the proteins were degraded, the researchers could not identify the exact species of bird's egg used to make the paint, but likely is the Muscovy duck.

Readers may send their questions / answers to questioncorner@thehindu.co.in

The Sicán culture

- The Sicán culture inhabited what is now the north coast of Peru between about 750 CE and 1375 CE.
- They succeeded the Moche culture, but there is still controversy among archeologists and anthropologists over whether the two are separate cultures.
- The Sican culture is the name that archaeologist Izumi Shimada gave to the culture that inhabited what is now the north coast of Peru between about 750 and 1375 CE.
- According to Shimada, Sican means "temple of the Moon". The Sican culture is also referred to as Lambayeque culture, after the name of the region in Peru

What grade of coal does India produce?

Why does it need imported coal? What is the status of the country's transition away from the fossil fuel?

Jacob Koshy

The story so far:

A recent report by the Organised Crime and Corruption Reporting Project, a venture backed by billionaire hedge fund manager and philanthropist, George Soros, furnished new documents to allege that in 2014, the Adani Group claimed 'low grade' coal, imported from Indonesia, to be 'high-quality' coal, inflated its value and sold it to Tamil Nadu's power generation company, TANGEDCO (Tamil Nadu Generation and Distribution Company).

What is 'high grade' and 'low grade' coal?

High and low quality are relative terms and only meaningful in the context of where the coal is used and how they are processed. The Gross Calorific Value (GCV), or the amount of heat or energy that can be generated from burning the coal, determines the gradation of coal. Coal being a fossil fuel is a mixture of carbon, ash, moisture and a host of other impurities. The higher the available carbon in a unit of coal, the greater is its quality or 'grade.' There are 17 grades of coal by this metric from grade 1, or top quality coal, with a kilo of it yielding higher than 7,000 kcal, and the lowest producing anywhere between 2,200-2,500 kcal, as per a classification by the Coal Ministry. However, the calorific value is not a useful metric on its own. The most important uses of coal are in running thermal power plants or powering a blast furnace to produce steel and both require different kinds of coal. 'Coking' coal is the kind needed to produce coke – an essential component of steel making – and thus requires minimal ash content. Non-coking coal, despite its ash content, can be used to generate enough useful heat to run a boiler and turbine.

There are two ways to get clean coal. Coal plants can have 'washing plants' on site to process the coal and reduce its ash and moisture content. The other method is coal gasification

What are the characteristics of Indian coal?

Indian coal has historically been evaluated as being high in ash content and low in calorific value compared to imported coal. The average GCV of domestic thermal coal ranges from 3,500-4,000 kcal/kg compared to imported thermal coals of >6,000 kcal/kg of GCV. Also the average ash content of Indian coals is more than 40% compared to imported coal which has less than 10% ash content. The consequence of this is that high-ash coal when burnt results in higher particulate matter, nitrogen and sulphur dioxide. Given this, the government, since 1954, has controlled the price of coal in a way that power companies were disincentivised to use high-grade coking coal for power generation.

Thus in the pursuit of balancing India's needs for coal production, power plants and pollution, the government has recommended the use of imported coal with lower ash and moisture content. The Central Electricity Authority (CEA) in 2012 recommended, and which still stands, that about 10-15% blending of imported coal can usually be safely used in Indian power boilers, which are designed for low quality Indian coal.

What is clean coal?

Broadly, we get clean coal when the carbon content has been increased by reducing its ash content. Coal plants have 'washing plants' on site which can process the coal in ways that reduce ash and moisture content. They employ huge blowers or a 'bath' to remove fine, coarse ash. However, deploying such equipment is expensive and adds to the cost of power. The other method to clean coal – again requiring significant investment – is coal gasification. Here, the need to directly burn coal is bypassed by converting it into gas. By relying on an integrated gasification combined cycle (IGCC) system, steam and hot pressurised air or oxygen combine with coal in a reaction that forces carbon molecules apart. The resulting syngas, a mixture of carbon monoxide, hydrogen, CO2 and water vapour, is then cleaned and burned in a gas turbine to make electricity. Since IGCC power plants create two forms of energy (steam from the gasification process apart from syngas as fuel), they increase efficiency of the coal used.

What is the future of coal in India?

Official data says that India in 2023-24 produced 997 million tonnes of coal, an 11% growth over the previous year. Most of this was produced by the state-owned Coal India Ltd and its subsidiaries.

As of March 2024, India produced 261 tonnes of coal, of which 58 million tonnes was coking coal. Despite stated commitments to transition India's electricity sector away from fossil fuel, coal is the mainstay of India's energy economy. Change, however, is in the air as for the first time this year, renewable energy accounted for 71.5% of the record 13.6 GW power generation capacity added by India in the first quarter of this year, while coal's share (including lignite) of total power capacity dropped below 50% for the first time since the 1960s.

Coal in india

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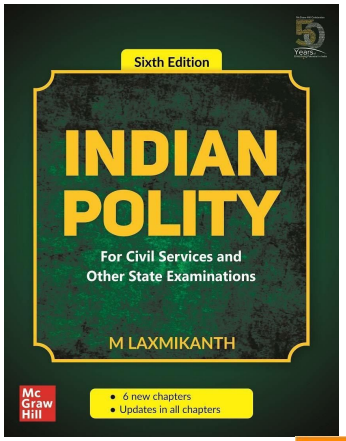

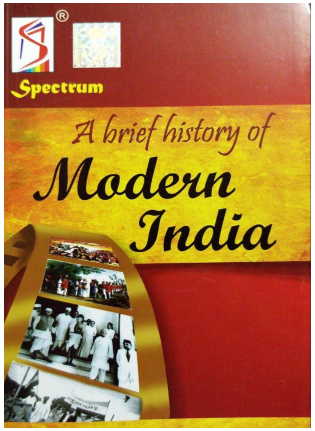

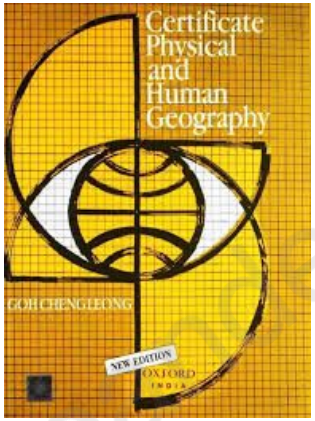

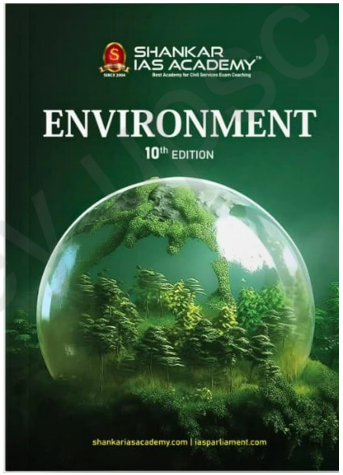

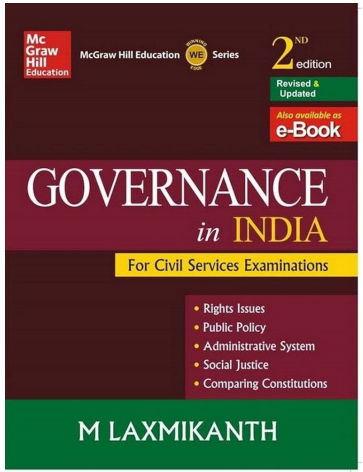

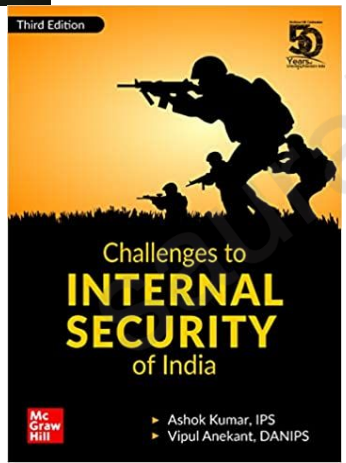

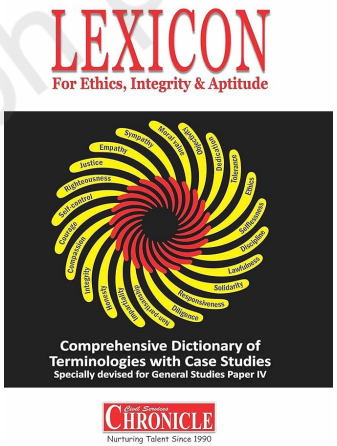

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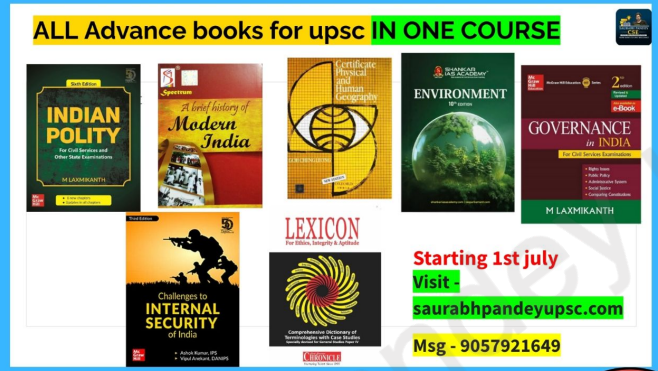

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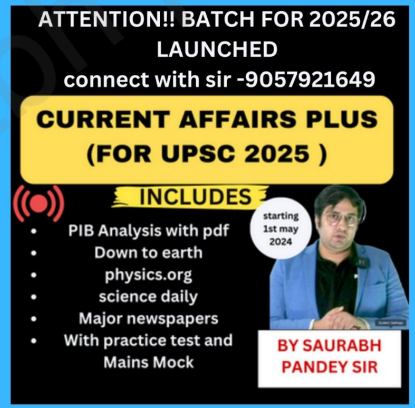

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