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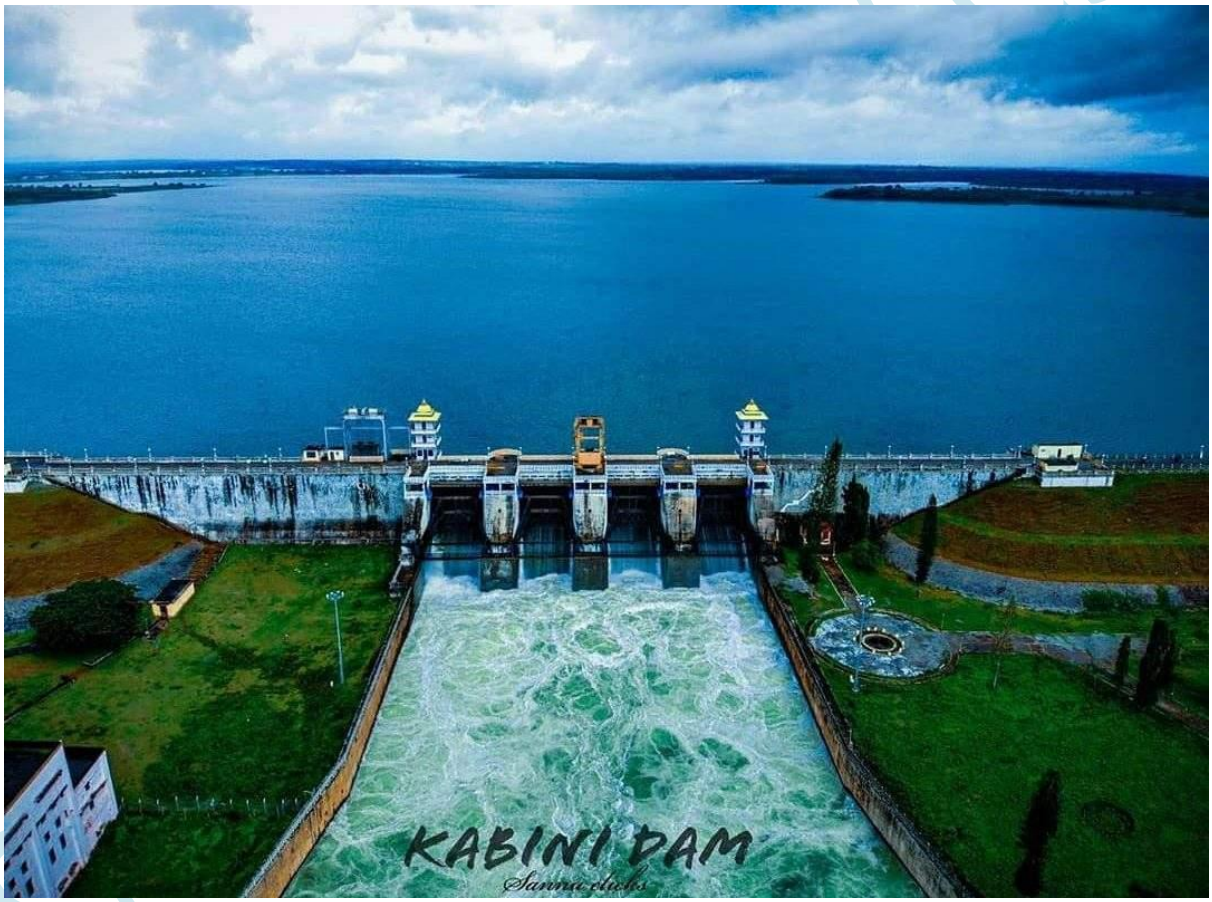
The Kabini Dam

The Kabini Dam is a significant dam located in the southern Indian state of Karnataka. It is part of a larger irrigation project that plays a crucial role in the state's economy and agriculture.

The dam is situated on the Kabini River, a tributary of the Cauvery River, and it is one of the several reservoirs that help manage the water resources in the region.



Tarang Shakti

The Indian Air Force (IAF) is all set to host its largest multilateral exercise, Tarang Shakti, in two phases in August and September. Eighteen countries, 10 of them with air assets, will join the exercise, which will see a total of 150

aircraft, both foreign and IAF, soar into the skies over Suluur and Jodhpur. The exercise will be a landmark event and has no particular nation or theme "in mind"."Invitations have been extended to 51 countries. Ten countries will be participating with assets and 18 as observers with one more country likely to join,

Besides the observer countries, Germany, France, Spain, and the U.K. are scheduled to take part in Phase-1, while Phase-2 will see participation of Australia, Bangladesh, Greece, Singapore, the United Arab Emirates and the U.S.Each phase of the exercise will see participation of 70-80 air assets. Phase-1 will be held from August 6-14 at Sulur in Tamil Nadu, and see participation of 32 foreign aircraft.

Similarly, Phase-2, to be held from September 1-14 at Jodhpur, will see participation of 27 fighters, two refueling aircraft, two airborne early warning aircraft, and four C-130 Special Forces aircraft from foreign countries,

Seine River

The Seine River is a major river in France, flowing through the city of Paris and playing a significant role in the country's history, culture, and economy. It is approximately 777 kilometers (483 miles) long and is a vital waterway for transportation, tourism, and water supply.

The Seine River has its source in the Langres plateau in the Haute-Marne department of northeastern France.

It flows through various regions, including Champagne, before reaching the Paris region, where it becomes the Seine Maritime and eventually empties into the English Channel at Le Havre.Paris, one of the most visited cities in the world, is built on both banks of the Seine. The river is a central feature of the city's landscape, with many famous landmarks and historical sites situated

along its banks, including the Louvre Museum, Notre-Dame Cathedral, and the Eiffel Tower.The Seine River has played a crucial role in the development of Paris and France.

Retroviruses /zombie gene

Retroviruses have an RNA genome; can reverse-transcribe it to DNA and thus insert it into the host's genome.Their name comes from a unique enzyme they possess, called reverse transcriptase. It's the one with the ability to convert the virus's RNA into a corresponding DNA sequence.

Teams led by Howard Temin at the University of Wisconsin-Madison and David Baltimore at the Massachusetts Institute of Technology reported its discovery in 1971. It spawned a widespread search for viruses that have this enzyme.

The knowledge that these viruses could cause cancer was even then well-known, even if the mechanism wasn't clear until the 1971 teams' reports.In the life cycle of a retrovirus, the reverse-transcribed DNA is integrated into the host's DNA along with another key enzyme called integrase, which acts like glue to bind the two DNA genomes.

Once bound, the viral DNA is called a provirus, and is complete with all the ingredients it needs to be functional. At the end of this process, the virus practically hijacks human cells and turns them into virus-making factories.

It's typically not possible for a person to inherit retrovirus infections or even the provirus because these integrations usually damage only a subset of cells. However, such genome invasions can sometimes mess up the integration process, causing 'zombie' regions in the host's genome.

These parts are called endogenous retroviruses (ERVs). ERVs usually can't replicate and produce functional proteins since they lack their regulatory regions. A good example of their influence are the syncytins, a class of genes

thought to be descended from an ERV.

Syncytins are important genes involved in placental development; many ERVs are also highly expressed in the placenta. ERVs are also involved in cell-type differentiation. In the early stages of embryo development, cells transition from totipotency (the ability to become any cell type) to pluripotency (the ability to become the three primary germ cell types). This transition is important because it produces pluripotent stem cells that can form different cell types.Scientists recently discovered a protein called MERVL-gag derived from an ERV.

They found MERVL-gag plays a key role in controlling some other proteins during this transition. They also found MERVL-gag works closely with another protein called URI, which helps the embryo transition from totipotency to pluripotency

One human ERV element or a portion of its DNA called LTR10 signicantly aects the formation of tumours in colorectal cancer.

The LTR10 retroelement seems to have been integrated into the genome some 30 million years ago.

Pandemic treaty

The idea of a pandemic treaty or an international agreement on pandemic preparedness and response gained momentum following the COVID-19 pandemic, which highlighted the need for improved global cooperation and coordination in health emergencies.

The WHO and various stakeholders have been working on proposals to strengthen international health regulations and mechanisms for pandemic preparedness and response.Enhanced surveillance and early warning systems

to detect potential pandemics at their source.

Improved mechanisms for sharing information and data, including genetic sequences of pathogens. Agreements on intellectual property rights for vaccines, treatments, and other medical countermeasures to ensure equitable access. Strengthened regulatory frameworks for the rapid development, approval, and distribution of health technologies.

Commitments to increase funding for pandemic preparedness and research.Plans for coordinated international responses to health emergencies, including the deployment of resources and personnel.Guidelines for the management of borders and travel restrictions to balance public health concerns with economic and social impacts.

The development of such a treaty or agreement is complex and requires negotiation and consensus among nations with different interests, priorities, and levels of development. There are also challenges related to sovereignty, as countries may be hesitant to cede control over their health policies to international bodies.

AI Winter

AI winter refers to a period of reduced funding and interest in artificial intelligence (AI) research and development. The term is an analogy to the concept of a nuclear winter, suggesting a period of stagnation or decline in the field of AI.

There have been two notable AI winters in the history of AI development:

The first AI winter occurred in the late 1970s and early 1980s, following the Lighthill report in the UK and the ALPAC report in the US, which criticized

the lack of progress in AI and the overhyped expectations that had led to significant public and private investments in the field. As a result, funding for AI research dried up, and many AI projects were abandoned.

The second AI winter took place in the early 1990s, after a period of renewed optimism and investment in AI during the 1980s, particularly due to the success of expert systems. However, the limitations of these systems became apparent, and once again, funding for AI research decreased.

During AI winters, many researchers and practitioners left the field, and progress in AI development slowed down. These periods were characterized by a lack of significant breakthroughs and a shift in public perception of AI from being a promising technology to one that was overhyped and under delivered.

Large Language Models (LLMs)

Large Language Models (LLMs) are a type of artificial intelligence (AI) system designed to understand and generate human language.

These models are "large" in the sense that they are typically trained on vast amounts of text data and consist of millions or even billions of parameters, which are the parts of the model that are adjusted during training to improve performance.

LLMs are based on deep learning architectures, particularly Transformer models, which were introduced in a 2017 paper by Vaswani et al. The Transformer architecture allows for parallel processing of data, making it more efficient and effective for handling sequential data like text.

Some of the most well-known Large Language Models include:

GPT (Generative Pre-trained Transformer) series by OpenAI, which includes GPT-3 (the third version), GPT-2, and GPT-4 .BERT (Bidirectional Encoder Representations from Transformers) by Google, which was designed for understanding the context of words in a sentence.T5 (Text-to-Text Transfer Transformer) by Google, which frames all NLP tasks as text-to-text problems.

These models are used for a wide range of applications, including:

Text generation: Writing stories, articles, and poetry.
Language translation: Translating text from one language to another.
Question answering: Providing answers to questions based on provided text.
Summarization: Creating concise summaries of longer texts.
Sentiment analysis: Determining the sentiment or emotional tone behind text.

LA NINA (Geography)

La Niña is a climate phenomenon characterized by a cooling of the sea surface temperatures in the central and eastern equatorial Pacific Ocean. It is one phase of the El Niño-Southern Oscillation (ENSO) in the Earth's climate system.

La Niña typically develops during the late summer or early fall and can last for several months, sometimes longer. The term "La Niña" translates to "the little girl" in Spanish, often used in contrast to El Niño, which translates to "the little boy.Cold Water Anomalies: The central and eastern equatorial Pacific experience a drop in sea surface temperatures, which can be 3-5 degrees Celsius below normal.

Shifts in Atmospheric Pressure: La Niña is associated with a strengthening of the trade winds, which blow from east to west across the Pacific. This leads to higher atmospheric pressure in the western Pacific and lower pressure in the

eastern Pacific.

Weather Patterns: The changes in sea surface temperatures and atmospheric pressure can lead to shifts in weather patterns around the globe. For example, La Niña can result in wetter conditions in the southern United States and drier conditions in the northwest.

Impact on Global Climate: La Niña can influence global temperatures, sometimes offsetting the effects of global warming for short periods. However, it is important to note that La Niña does not halt or reverse the long-term trend of global warming.

Effects of La Niña:

Agriculture: La Niña can lead to droughts in some areas and excessive rainfall in others, affecting crop yields and food availability. It can also influence the distribution and abundance of fish stocks, impacting fisheries.

Water Resources: The altered precipitation patterns can lead to water shortages or floods, depending on the region, affecting water supply and water management systems.

Weather Extremes: La Niña can contribute to the frequency and intensity of extreme weather events, such as heavy rainfall, storms, and even changes in the path of hurricanes and typhoons.

Economic Impacts: The agricultural, water resource, and weather-related effects of La Niña can have significant economic consequences, including impacts on food prices, insurance costs, and overall economic stability.

Public Health: Changes in weather patterns can affect the prevalence and distribution of diseases, such as malaria, dengue fever, and cholera, which are

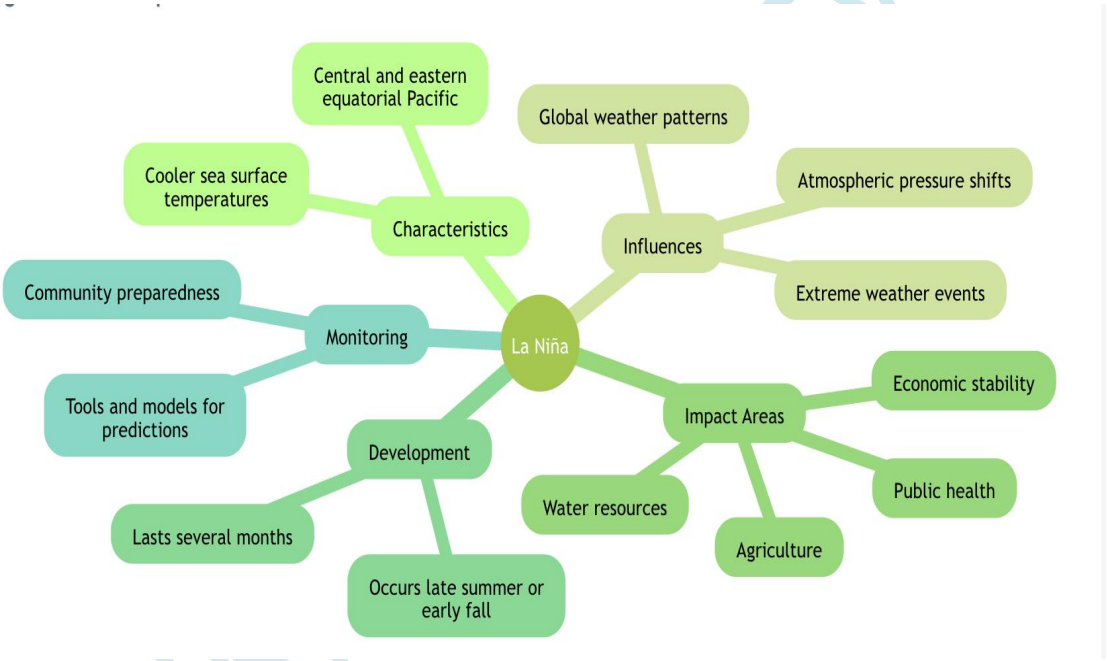
sensitive to climate conditions.

Prediction and Monitoring:

Scientists use various tools and models to predict the onset and intensity of La Niña events.

These include satellite observations, buoy data, and climate models.

The NOAA Climate Prediction Center and other international climate agencies provide regular updates and forecasts to help governments and communities prepare for potential impacts.



Gestational diabetes (science and tech)

Gestational diabetes is a type of diabetes that develops during pregnancy. It is a condition in which a woman's body becomes resistant to insulin, a hormone that regulates the amount of sugar in the blood.As a result, the body cannot effectively use insulin to maintain normal blood sugar levels, leading to high blood sugar.

The exact cause of gestational diabetes is not fully understood, but it is believed to be related to the action of hormones that the placenta produces during pregnancy. These hormones can make the body more resistant to insulin.

Pumped storage (science)

Pumped storage, also known as pumped-storage hydroelectricity (PSH), is a type of hydroelectric energy storage used by electric power systems for load balancing.

The technique stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to an elevated storage during off-peak electrical demand periods. During peak demand, the stored water is released back into the lower reservoir through turbines to produce electricity.

How Pumped Storage Works:

Off-Peak Hours: When electricity demand is low (off-peak hours), excess electricity from the grid is used to power electric motors that drive pumps. These pumps move water from a lower reservoir to an upper reservoir.

Peak Hours: During periods of high electricity demand (peak hours), the water stored in the upper reservoir is released back into the lower reservoir through turbines. The turbines spin as the water passes through them, generating electricity. The electricity is then fed back into the grid for consumption.

Advantages of Pumped Storage:

Energy Storage: Pumped storage is one of the most efficient and cost-effective

methods for storing large amounts of electrical energy. It can store energy for long periods without significant losses.

Load Balancing: It helps to balance the supply and demand of electricity by storing energy during low-demand periods and releasing it during high-demand periods.

Renewable Integration: Pumped storage can facilitate the integration of intermittent renewable energy sources such as wind and solar by storing excess energy generated during favorable conditions for later use.

Flexibility: It provides flexibility to the power system, allowing for quick adjustments to meet changing electricity demand.

Environmental Impact: Compared to some other energy storage technologies, pumped storage has a relatively low environmental impact, especially when the reservoirs are already in place for other purposes.

Challenges and Limitations

Geographical Constraints: Pumped storage requires specific geographical features, such as two reservoirs at different elevations in close proximity, which limits the locations where it can be implemented.

Capital Intensive: The construction of pumped storage facilities requires significant upfront investment, which can be a barrier to new projects.

Environmental Concerns: While the environmental impact is generally lower than some alternatives, there can still be concerns related to habitat disruption, water quality, and the footprint of the reservoirs.

Energy Efficiency: The round-trip efficiency of pumped storage is typically between 70% and 85%, meaning that some energy is lost in the process of pumping and generating.Despite these challenges, pumped storage remains an

important technology in the energy industry, offering a reliable and efficient means of energy storage that can complement other renewable energy sources and help to stabilize electricity grids. As the demand for renewable energy increases and the need for grid stability becomes more critical, pumped storage is likely to remain a key component of energy systems worldwide.

Why is pumped storage important?

India has planned to create an ambitious 500GW of non-fossil fuel energy by 2030. In around two years, from 2021 to 2023, it created some 23GW of non-fossil generation capacity. Out of the total 10GW added in eight months in 2023-24, 7.5GW were from wind and solar energy, pointing to how renewables will account for most of the new power generation that will be added in India. The share of actual renewable power generation will increase in times to come, but this power will necessarily vary and will be "infirm".

- Does India have pumped storage?

India has 3.3GW of pumped storage. Main ones are in Nagarjunasagar, Kadana, Kadamparai, Panchet and Bhira. China leads the world with 50GW of pumped storage supporting 1,300GW of wind and solar energy. India would need to ramp up its pumped storage capacity by several times if it wants to meet its renewable power generation targets.

Pumped storage is of two types: on river and off river.

On-river is like any hydroelectric project supplied by a river. Off-river projects are those that have two reservoirs at two different levels to which the water can be pumped up or let down under gravity in a closed loop.

When there is surplus power, water is pumped up from the lower reservoir to the upper, and when power is needed the water can flow down to turn the

turbines and generate power. One such project is at Kadamparai, Tamil Nadu.

The Axiom Mission

The Axiom Mission refers to a series of planned private missions to the International Space Station (ISS) organized by Axiom Space, a company that aims to play a significant role in the future of commercial spaceflight.

Axiom Space is developing its own space station and is also working on the Axiom Segment, an addition to the ISS that will eventually become the Axiom Space Station.

The Axiom Mission 1 (Ax-1), which launched in April 2022, was the first private astronaut mission to the ISS and was carried out in partnership with SpaceX.

The crew included Michael López-Alegría (a former NASA astronaut and the mission commander), Larry Connor, Mark Pathy, and Eytan Stibbe. The mission lasted about eight days and involved conducting scientific research and other activities on the ISS.

Future Axiom Missions are expected to continue the trend of private astronaut missions, potentially including more extensive stays on the ISS and eventually on the Axiom Space Station once it is operational.

These missions are part of a broader trend towards commercial spaceflight and are opening up new opportunities for space tourism, scientific research, and other activities in low Earth orbit.

Indian astronaut-designates Group Captain Shubhanshu Shukla and Group Captain Prasanth Balakrishnan Nair have been shortlisted to go to the U.S. to train for the Axiom-4 mission to the International Space Station (ISS).

The Bosphorus Strait

The Bosphorus Strait, also known as the Istanbul Strait, is a significant waterway that connects the Black Sea to the Sea of Marmara in northwestern Turkey.

It forms part of the continental boundary between Europe and Asia, with the city of Istanbul straddling both continents on either side of the strait.

The Bosphorus is approximately 30 kilometers (about 19 miles) long, with a width that varies between 700 meters (about 2,300 feet) and 3,700 meters (about 12,100 feet).

International Maritime Traffic:

The Bosphorus is one of the busiest waterways in the world, with a high volume of maritime traffic, including commercial ships, tankers, and passenger vessels.

It is essential for the transportation of goods, energy resources, and passengers, linking the Black Sea ports with the rest of the world.

Environmental and Urban Challenges:

The heavy maritime traffic and the proximity of the strait to Istanbul, one of the largest cities in the world, pose environmental and urban challenges. Issues such as pollution, the risk of accidents, and the impact on the local ecosystem and marine life are of concern.

Additionally, the urban development along the shores of the Bosphorus and the need for infrastructure to support the growing population add to the challenges of managing the strait

Control and Regulation:

The control and regulation of the Bosphorus Strait are governed by international treaties, most notably the Montreux Convention Regarding the Regime of the Straits, which was signed in 1936.

This convention determines the conditions for warships and commercial vessels passing through the straits, ensuring freedom of passage under certain conditions while also addressing security concerns.

An Ecologically Sensitive Area (ESA)

An Ecologically Sensitive Area (ESA) is a region or zone that is designated by regulatory bodies or governments as being particularly sensitive to ecological disturbance.

These areas are often characterized by unique, rare, or threatened ecosystems, high biodiversity, and/or critical environmental functions.

The designation of an area as ecologically sensitive is intended to restrict or regulate human activities that could harm the environment or disrupt

ecosystem services in the area.

Key Characteristics of Ecologically Sensitive Areas:

Biodiversity Hotspots: ESAs often contain a high concentration of endemic species, rare species, or species of particular ecological importance.

Fragile Ecosystems: They may include ecosystems that are particularly vulnerable to disturbance, such as wetlands, mangroves, coral reefs, and alpine meadows.

Environmental Services: ESAs provide critical ecosystem services such as water purification, carbon sequestration, and natural flood protection.

Cultural and Historical Significance: Some ESAs are also important for their cultural or historical value, serving as habitats for indigenous species or containing archaeological sites.

Regulation and Management:

The management of ESAs typically involves creating a set of regulations that limit or prohibit certain activities within the area.

These regulations may include restrictions on development, industrial activities, mining, logging, and other practices that could negatively impact the environment.

The goal is to balance the need for conservation with sustainable use of natural resources.

Examples of ESAs:

Protected Areas: **Many national parks, wildlife reserves, and biosphere reserves are designated as ESAs.**

Coastal Zones: **Coastal areas, especially those with coral reefs, mangroves, and other sensitive habitats, are often classified as ESAs.**

Wetlands: **Wetland areas that are important for water purification and as habitats for aquatic species are frequently designated as ESAs.**

The designation of an area as ecologically sensitive is a critical step in environmental conservation and sustainable management.

It helps to ensure that the unique and important ecological features of an area are protected for future generations, while also allowing for the sustainable use of natural resources.

Disaster and local factors

Tragedies like that in Wayanad on July 30 tend to repeat themselves partly because their lessons are not always brought to bear on our understanding of the local amplifiers of extreme events. Simple changes in land-use patterns could lead to a crushing cloudburst or a punishing hailstorm.

Mitigating disasters requires climate outlooks that go out to a decade.

These broad warnings cannot, however, be translated into specific actions and cannot get rid of extreme events. Some events, like landslides, will occur because the risk is never zero

Predictions made by models will always be imperfect. An understanding of local drivers is required to improve the ability to predict extreme events.

Climate extremes are driven by events in distant places but are usually exacerbated by factors location-specific

The Western Ghats in Wayanad, Kerala.Weather predictions with a lead time

of a few weeks could help disaster management personnel mobilize towards local threats with high-intensity risk and avoid surprises. Disaster management and recovery play a crucial role in alleviating the pain of natural disasters. Unfortunately, however, a blame game may follow asking whether earlier warnings could have averted the tragedy

Local top-down efforts by legal authorities and communities can help bolster disaster recovery strategies using mitigation efforts. Governments can also prioritize the funding to the area to deal with such natural and typical risks.

Adopting location-specific measures like legal protections for biodiversity can help mitigate disasters. Governments can also bolster their regulatory strategies using predictions of the climate up to a decade in the future and combining each prediction with hyperlocal risks.

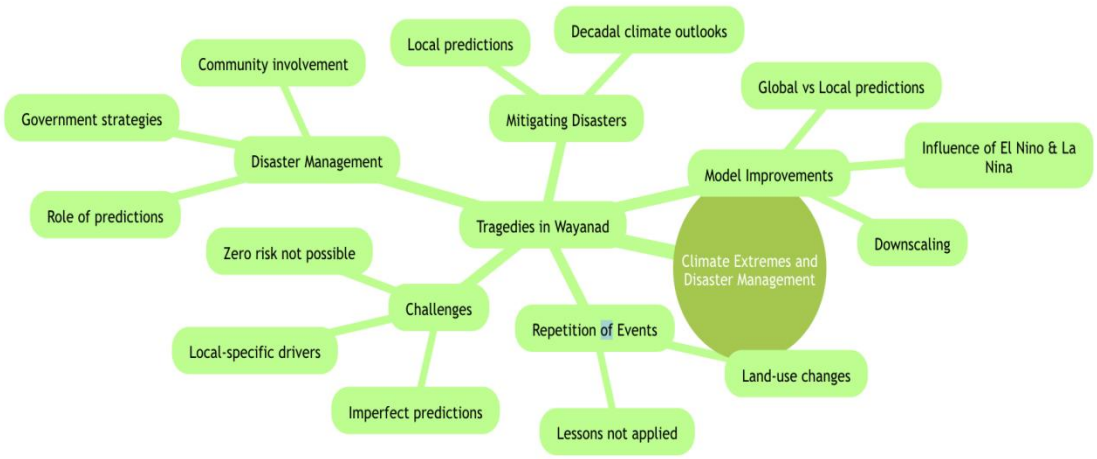
Global models provide seasonal outlooks and predictions at the short (3 days), medium (3-10 days), and extended (2-4 weeks) range.

They have been getting better at forecasting thanks to the exhaustive research, the El-Nino and La Nina, and other extreme weather events.

Monsoons are influenced in significantly different non-linear fashions by cascading and national importance's in these models diagnose live aberrations in the anatomy and report them.

One particular approach to improving the models is called downscaling, especially in dense predictions of extreme events like small-scale heavy rain. In downscaling, researchers use a global model to create local predictions in regions where the weather satellites that the global model will miss.

figures:
figure 1.1 mindmap:



Ceramics

Ceramics can typically withstand very hot or acidic environments, many forms of chemical erosion, and are hard and difficult to compress. But they are also brittle i.e. can shatter and don't handle shear, or sliding, stress well.

The science of preparing and studying ceramics' microscopic properties is called ceramography.In modernity, scientists have used ceramics on space shuttles (as part of the heat shield during atmospheric reentry) to produce heat in microwave furnaces, as abrasives, in the production of varistors and semiconductors, as nuclear fuel, in fighter aircrafts' windows, and in tomographic scanners, among other settings.

The discovery of high-temperature superconductivity in some ceramic materials won two scientists the 1987 physics Nobel Prize

Glacier du Tour

A depression filled with meltwater lies on the ice of the Glacier du Tour, its

snow tinged pink by dust from the Sahara, near the glacier's terminus near Chamonix, France.

The roughly 5-km-long Glacier du Tour, one of many glaciers in the Mont Blanc massif, is melting fast and glaciologists say climate change is to blame. The Glacier du Tour is a glacier located in the Mont Blanc massif in the French Alps. It is situated in the Chamonix Valley, near the town of Chamonix-Mont-Blanc, which is a popular destination for mountaineering and winter sports.

Competition and sustainability

Competition cannot remain insulated from sustainability. Combating climate change requires adapting and adopting newer technology that reduces resource consumption and increases innovation through sustainability policies. For India, to reach its pledged state of net zero emissions, every economic sector must contribute to greener means of production.

The CCI can enforce competition policies that improve innovation while considering environmental concerns.

Competition policy should integrate sustainability economics while considering market failures and collective action problems. Through actions like issuing guidelines, the benefits of sustainability will outweigh the potential negative effects on competition.

Including sustainability considerations in assessments of cooperation among competitors can be a strong measure of benefitting sustainability in markets.During the pandemic, the CCI issued an advisory and acknowledged that COVID-19 had caused disruptions in supply chains. It also noted that information sharing may be required by businesses to ensure fair distribution

of products and services.

The Competition Act, 2002 has built-in safeguards to protect businesses from sanctions. The CCI only considered such businesses that were necessary to address concerns arising from COVID-19. The CCI can consider releasing advisories where enterprises can be exempted if collaborations are for sustainable goals or greener technological innovations when necessary and proportionate.

Under Section 49(3) of the Competition Act, 2002, the CCI may take measures to promote competition advocacy and awareness. It may also participate in formulating economic policies that will touch upon competition and sustainability. The CCI can emphasise on sustainability policies and enterprise collaboration for greener innovations and release guidance notes on sustainability agreements and exemption methods under the Competition Act, 2002.

Anusandhan National Research Foundation (ANRF)

The Anusandhan National Research Foundation (ANRF) has been established with Anusandhan National Research Foundation (ANRF) 2023 Act.

The ANRF aims to seed, grow and promote research and development (R&D) and foster a culture of research and innovation throughout India's universities, colleges, research institutions, and R&D laboratories. ANRF will act as an apex body to provide high-level strategic direction of scientific research in the country as per recommendations of the National Education Policy (NEP).

With the establishment of ANRF, the Science and Engineering Research Board (SERB) established by an act of Parliament in 2008 has been subsumed

into ANRF.

ANRF will forge collaborations among the industry, academia, and government departments and research institutions, and create an interface mechanism for participation and contribution of industries and State governments in addition to the scientific and line ministries.

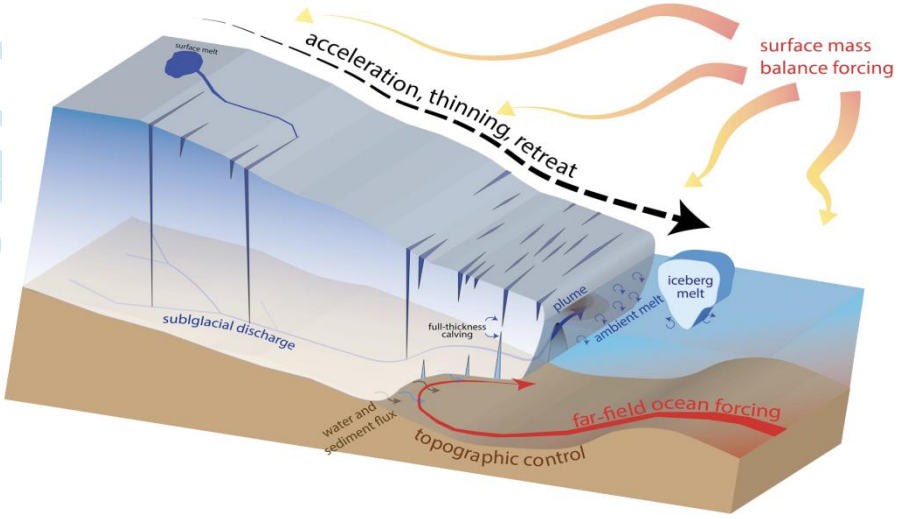
Basal melt in Antarctica

An ice shelf is a mass of glacial ice, fed from land by tributary glaciers, that floats in the sea above an ice shelf cavity. Dotson Ice Shelf is part of the West Antarctic ice sheet and next to Thwaites Glacier, which is considered to have a potentially large impact on future sea level rise due to its size and location.

Brought to the Amundsen Sea through ocean circulation, warm salty water is a significant driver of ice meltand, thus, sea level rise.

This bottom-up melting, called basal melt, thins and hollows out cavities at the base of floating ice shelves, reducing or eliminating structural support for grounded ice that flows into them.

Now, researchers have described basal melt patterns at the base of the Dotson Ice Shelf (DIS) located in West Antarctica's Amundsen Sea



- **What is Basal melt ??**

Basal melt refers to the melting of ice or snow that occurs at the base of a glacier or ice sheet.

This process is a critical component of the overall mass balance of glaciers and ice sheets, which in turn affects sea level rise and regional water resources.

Basal melt is influenced by several factors, including:

Geothermal Heat: The Earth's internal heat can warm the base of a glacier or ice sheet, leading to melting.

Pressure: The weight of the overlying ice can increase the pressure at the base, lowering the melting point of ice through a process known as pressure melting.

Frictional Heat: As the glacier moves over its bed, friction can generate heat, contributing to basal melting.

Subglacial Hydrology: The circulation of water at the base of a glacier can transport heat and influence the rate of basal melt.

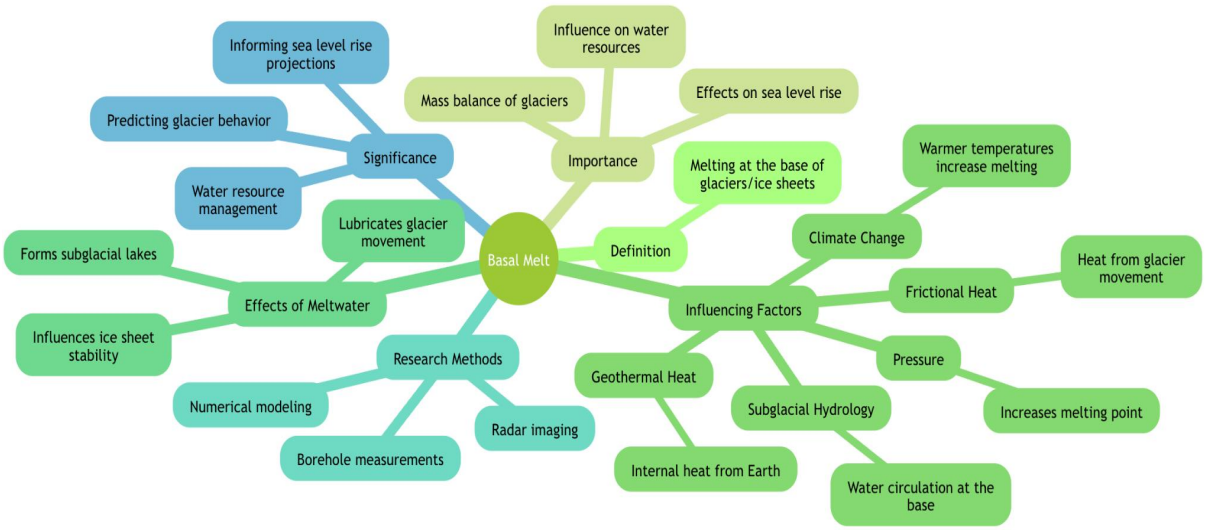
Climate Change: Increasing global temperatures can lead to warmer air and water temperatures, which can penetrate to the base of glaciers and accelerate basal melt.

The meltwater produced at the base of a glacier can play a significant role in the dynamics of the glacier by lubricating the interface between the ice and the underlying bedrock or sediments, potentially leading to faster glacier movement.

This meltwater can also contribute to the formation of subglacial lakes, which can influence the stability of ice sheets and the potential for rapid ice discharge.Understanding basal melt is essential for predicting the behavior of

glaciers and ice sheets in a changing climate.

Scientists use a variety of methods to study basal melt, including borehole measurements, radar imaging, and numerical modeling. These studies help to inform projections of sea level rise and water resource management strategies in glacier-fed river systems.



EL NINO and spread of cholera

A study suggests that an El-Niño event may have aided the establishment and spread of a novel cholera strain during a 20th-century pandemic; climate anomalies could create opportunities for the emergence of new strains.

The study revealed that anomalous patterns of cholera deaths from 1904 to 1907 occurred alongside out-of-the-ordinary seasonal temperatures and rainfall levels associated with an El Niño event. The timing correlates with the establishment of a new strain during the sixth pandemic.

- Heart failure with a preserved ejection fraction (HFpEF)

A small study has revealed the impact of obesity on muscle structure in patients having a form of heart failure called heart failure with a preserved ejection fraction (HFpEF). Originally, this form of heart disease was associated with having a high blood pressure and excess muscle growth to help counter the pressures.

How do high-altitude birds take to the air when thin air offers little lift?

In high altitudes, despite the air being of low density, which makes the bird wings produce less lift and more difficult to remain aloft, high-altitude birds have been seen at high altitudes of over 6,000metres.

One possibility of how birds at high altitudes take to the air may be simply flying faster to compensate for the lower air density

Vaccine against Malaria

Bharat Biotech, which has already been working on some malaria-related vaccines, has tied up with GSK-PATH for technology transfer for long-term supply of 'Mosquirix', and hopes to manufacture and supply it to people in India by 2026.

In 2021, the WHO also recommended the R21/Matrix vaccine.

DEET

N,N-Diethyl-meta-toluamide, commonly known as DEET, is a chemical compound used as the active ingredient in many insect repellents.

It was developed by the U.S. Army in 1946 and has been widely used since then to protect against mosquitoes, ticks, fleas, and other insects. DEET is effective against a broad range of insects and has been shown to provide long-

lasting protection against bites

Promoter and Enhancer

A gene is a stretch of a few thousand base-pairs. A cell 'reads' this sequence as an instruction to make a specific protein. Next to the protein-coding sequence is another sequence called the promoter.

The promoter allows the cell to express the relevant gene. Other sequences called enhancers, located tens to thousands of base-pairs away from the gene, influence the activity of nearby promoters. These promoter-enhancer interactions influence gene expression in different types of cells.

Derivatives

Derivatives are financial instruments that derive their value from an underlying asset or group of assets. The underlying asset can be stocks, bonds, commodities, currencies, interest rates, or even market indices.Derivatives are used for a variety of purposes, including hedging against price movements, speculating on future price movements, and providing leverage.

There are several types of derivatives, including:

- **Futures Contracts: A legal agreement to buy or sell a particular commodity or financial instrument at a predetermined price at a specified time in the future.**
- **Options: Contracts that give the buyer the right, but not the obligation, to buy (call option) or sell (put option) an asset at a specified price within a certain period.**
- **Swaps: Contracts in which two parties exchange cash flows or assets for**

a certain period. Common types include interest rate swaps and currency swaps.

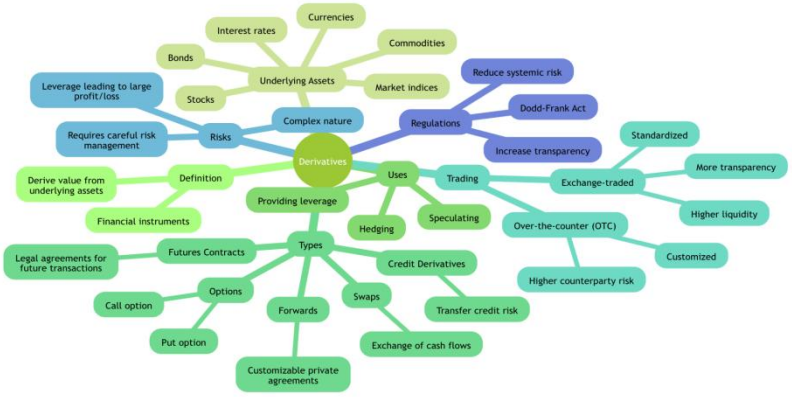
- **Forwards:** Similar to futures contracts, but they are customizable private agreements between two parties, not traded on an exchange.
- **Credit Derivatives:** Instruments designed to transfer credit risk, such as credit default swaps (CDS).

Derivatives can be traded on exchanges or over-the-counter (OTC). Exchange-traded derivatives are standardized and offer more transparency and liquidity, while OTC derivatives are customized and can carry higher counterparty risk.

Derivatives are complex financial instruments and can be risky, especially when used for speculation.They are often leveraged, meaning that a small movement in the price of the underlying asset can lead to a large profit or loss for the derivative holder.

As a result, derivatives trading requires careful risk management.

Regulatory frameworks have been established to oversee the derivatives market, such as the Dodd-Frank Act in the United States, which was enacted in response to the financial crisis of 2007-2008 to increase transparency and reduce systemic risk.



Power sector /energy demand

Three key milestones India has achieved in the last decade.

First, near-universal electrification through the Saubhagya scheme, with independent surveys by the Council on Energy, Environment, and Water (CEEW) suggesting that approximately 97% of households were electrified in 2020.

Second, the country saw a five-fold increase in installed renewable energy (RE) capacity, making India the fourth-largest country globally by RE capacity.

Third, there was a 40% drop in aggregate losses of power distribution companies (discoms), to an all-time low of about 15% in 2022-23.

Our annual electricity demand has been growing by 7-9% every year since the COVID-19 pandemic, But our peak demand is rising even faster.

Climate change-induced weather extremes further exacerbate these challenges.

For discoms, meeting unplanned surges through affordable options and existing network capacity is challenging, resulting in power outages.

Steps

First, the government must raise targets for renewable energy and storage systems to go beyond 500 GW in 2030.

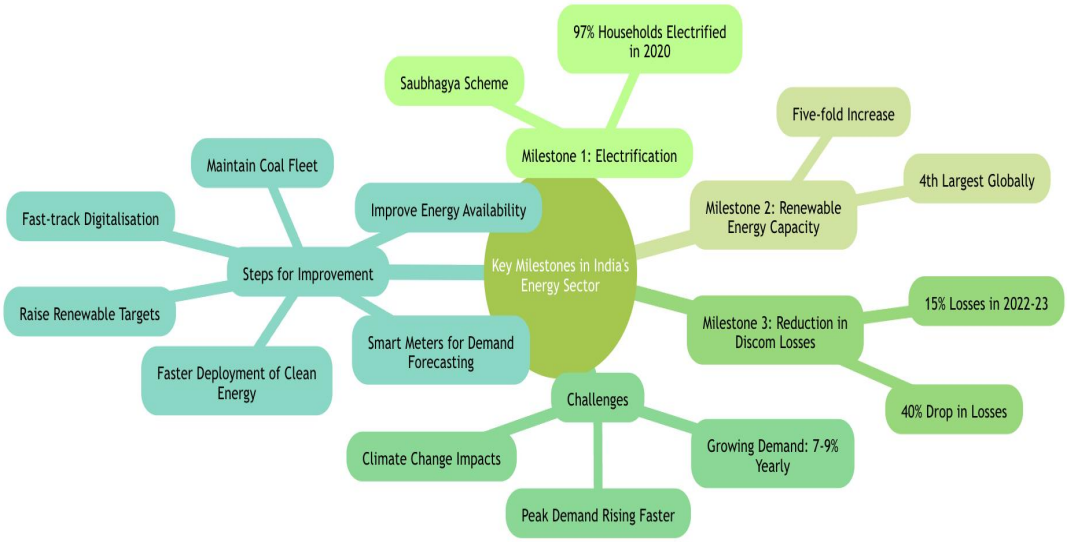
Second, steer faster deployment of diverse clean energy resources.

Third, implement measures to improve the availability of energy.

Fourth, ensure effective maintenance and utilization of the coal fleet.

Finally, fast-track digitalisation to empower discoms and consumers to play an active role in India's energy transition.

Smart meters would enable discoms to forecast power demand accurately, plan networks better, and integrate renewables cost-effectively



What are laboratory chemicals?

Imported chemicals, reagents, and enzymes come under the category of laboratory chemicals and are vital to experimental research across nearly every domain of scientific research.

They comprise oxidisers, corrosive acids, and compressed gas, that are used by researchers to conduct experiments and even make new products.

Outside of research settings, the medical diagnostics industry is run on laboratory chemicals. Closely affiliated to these chemicals are laboratory instruments such as funnels, beakers, test tubes and burners.

Because these chemical compounds have a wide range of properties and are potentially hazardous, they are regulated and their imports scrutinised. Most of such chemicals are niche products and can be fairly expensive.

The Customs Department defines laboratory chemicals as "all chemicals, organic or inorganic, whether or not chemically defined, imported in packings not exceeding 500 gms or 500 millilitres and which can be identified with reference to the purity, makings or other features to show them to be meant

for use solely as laboratory chemicals

The Budget documents released on July 23, silently hiked the Basic Customs Duty (BCD) on these chemicals to 150% from the existing 10%. The customs department did this as it wanted to reign in imports of ethanol that were being brought in as 'laboratory chemicals'. The Finance Ministry has now withdrawn the customs duty hike on imported laboratory chemicals

Atomic clocks

Atomic clocks are incredibly precise timekeeping devices that measure time by monitoring the natural vibrations of atoms, typically cesium-133.

These clocks are the most accurate time and frequency standards known, and they are used to define the second, the base unit of time in the International System of Units (SI).

The principle behind atomic clocks is based on the quantum mechanical property of atoms that allows them to absorb and emit electromagnetic radiation at very specific frequencies.

This phenomenon is used to stabilize the frequency of an electronic oscillator, which is then used to measure time.

Here's a simplified explanation of how an atomic clock works:

- **Atomic Transition: Atoms of a particular element (e.g., cesium-133) are excited by electromagnetic radiation at a specific frequency. This causes the electrons of the atoms to transition between two energy levels.**
- **Microwave Cavity: The atoms are held in a microwave cavity where they are bombarded with microwave radiation. The frequency of this radiation is precisely controlled and tuned to the exact frequency at**

which the atoms transition between energy levels.

- **Feedback Loop: The microwave frequency is adjusted until a maximum number of atoms are detected in the higher energy state. This frequency is then locked in and used as the reference frequency for the clock.**
- **Time Measurement: The locked frequency is used to control an electronic oscillator, which generates a highly stable frequency. This frequency is then divided down to produce a one-second pulse, which can be used to display time.**

Atomic clocks are critical for various applications that require precise timekeeping, including:

- **Global Navigation Satellite Systems (GNSS), such as GPS, GLONASS, Galileo, and BeiDou, which rely on atomic clocks to provide accurate positioning, navigation, and timing services.**
- **Telecommunications networks, which use atomic clocks to synchronize data transmission.**
- **Scientific research, including physics, astronomy, and metrology.**
- **International time distribution, where atomic clocks are used to define Coordinated Universal Time (UTC).**
- **The accuracy of atomic clocks is typically measured in terms of fractional frequency error, and they can achieve uncertainties of less than a second in billions of years.**
- **Advances in atomic clock technology are ongoing, with researchers exploring new types of atomic clocks, such as optical atomic clocks, which operate at higher frequencies and promise even greater precision.**

Minerals in Congo

The Democratic Republic of Congo (DRC), often referred to simply as Congo, is one of the world's richest countries in terms of mineral resources. It is home to a vast array of minerals that are crucial for various industries, including electronics, construction, and energy. Some of the key minerals found in Congo include:

Cobalt: Congo is the world's leading producer of cobalt, which is essential for the manufacturing of rechargeable batteries used in smartphones, laptops, and electric vehicles.

Coltan (Columbite-tantalite): This mineral is a source of tantalum, which is used in the production of capacitors for electronic devices, making it a critical component in many modern technologies.

Copper: Congo is also a significant producer of copper, which is widely used in electrical wiring and various industrial applications.

Diamonds: The country is known for its diamond production, and diamonds from Congo have played a significant role in the global gemstone market.

Gold: Congo produces gold, which is used not only in jewelry but also in electronics and as a store of value in the financial markets.

Tin: The country has deposits of tin, which is used in soldering, plating, and the production of alloys.

Manganese: Congo is a major producer of manganese, which is vital for steel production and has other industrial uses.Despite its wealth of mineral resources, Congo faces challenges in effectively managing and benefiting from these resources.

Issues such as corruption, conflict, and poor governance have historically

hindered the development of the mining sector and the broader economy. Efforts to improve transparency and ensure that the revenues from mineral extraction benefit the Congolese people are ongoing.

The international community has also been involved in initiatives aimed at improving the governance of mineral resources in Congo, such as the Kimberley Process Certification Scheme for rough diamonds and the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.

These initiatives seek to prevent the trade of conflict minerals and promote responsible mining practices

Lashio

Lashio is a city located in the Shan State of Myanmar (formerly known as Burma). It is an important transport hub, situated on the main road and rail routes between Myanmar's largest city, Yangon, and the Chinese border. Lashio is also known for its role in the history of World War II, particularly as a base for Allied forces during the conflict.

During World War II, Lashio was a key location due to its proximity to the Burma Road, a vital supply route between China and the outside world.

The road was crucial for transporting supplies and equipment to support the Chinese resistance against Japanese forces.The Japanese invasion of Burma in 1942 led to the capture of Lashio, which effectively cut off the supply route and had significant strategic implications for the war effort in the region.

Why in news ??

Myanmar's military regime acknowledged on Monday it had lost

communications with the commanders of a strategically important Army headquarters in the northeast.

The fall of the Army's Northeast Command in Lashio would be a significant blow to Myanmar's military government this year as an offensive launched by an alliance of powerful militias of ethnic minority groups continues to make broad gains in the country's civil war

Sucralose

A recent study from India examining the effects of replacing sucrose or table sugar with an artificial sweetener, sucralose, in coffee and tea, found no adverse impact on glucose or HbA1c levels, and in fact indicated a slight improvement in body weight, waist circumference and body mass index (BMI).

Sucralose is a synthetic, non-caloric artificial sweetener.

It is approximately 600 times sweeter than sugar, making it a popular choice for use in a variety of food and beverage products as a sugar substitute.Sucralose is produced by chlorinating sucrose, a process that replaces three hydroxyl groups with chlorine atoms.

Key points about sucralose include:

Zero Calories: Sucralose does not provide calories when consumed, making it an attractive option for those looking to reduce their calorie intake.

Stability: It is heat-stable and does not break down when exposed to high temperatures, which means it can be used in baking and cooking.

Digestion: Sucralose is not metabolized by the body, and most of it is excreted unchanged in the feces. Only a small amount is absorbed into the bloodstream and is eventually excreted in the urine.

Safety: **Sucralose has been extensively studied and is generally recognized as safe (GRAS) by the U.S. Food and Drug Administration (FDA) and other regulatory agencies worldwide. It has been approved for use in over 100 countries.**

Environmental Impact: **There has been some concern about the environmental impact of sucralose, particularly its persistence in water sources. It is not effectively removed by conventional water treatment methods, and its long-term effects on aquatic ecosystems are still being studied.**

Use in Products: **Sucralose is used in a wide range of products, including soft drinks, tabletop sweeteners, baked goods, ice cream, and other desserts. It is often marketed under brand names such as Splenda.**

Regulatory Approval: **The approval process for sucralose involved extensive toxicological studies to ensure its safety for human consumption. It was first approved for use in the United States in 1998 and has since been approved for use in many other countries.**

While sucralose is considered safe for consumption by regulatory bodies, some individuals may have concerns about the use of artificial sweeteners.

As with any food additive, some people may experience adverse reactions or prefer to avoid it for personal reasons

Earthquake and river course

Researchers found two large sand dikes.

These were the first proof that earthquakes can move rivers. In June 2024, they reported that an earthquake of magnitude 7 to 8 was responsible for shifting the Ganga more than two millennia ago

- **To date these events, a technique called optically stimulated luminescence dating was used.**
- **This method estimates how long a mineral grain has been buried by measuring the natural radiation stored in it**
- **The discovery that earthquakes can trigger avulsions suggests they can be far more devastating than previously thought. 'The impact can be severe for populated regions like the Ganges-Meghna-Brahmaputra delta**
- **Sand Dikes**
- **Sand dikes, also known as sand dykes, are geological features that form when sand is injected into fractures or other openings in sedimentary rocks.**
- **This process, known as sedimentary dike formation, can occur when the sand is under high pressure, often due to tectonic forces or the weight of overlying sediments.**
- **The sand that forms these dikes can come from various sources, including nearby sandstones or unconsolidated sediments**

- **These features are of interest to geologists because they can provide insights into the stress conditions and fluid flow within sedimentary basins.**
- **They can also be important for understanding the diagenetic processes that affect sedimentary rocks and the potential for hydrocarbon traps in oil and gas exploration.**
- **Sand dikes are not to be confused with coastal dikes, which are human-made structures designed to protect land from flooding by the sea.**

- **Coastal dikes are part of flood control infrastructure and are not related to the geological features discussed here.**

- **Optically Stimulated Luminescence (OSL)**
- **Optically Stimulated Luminescence (OSL) dating is a method used to determine the age of sediments, typically ranging from a few decades to about 100,000 years.**
- **It is particularly useful for dating materials that were once buried but are now exposed, such as those found in archaeological sites or sedimentary deposits that have been eroded and redeposited.**
- **The basic principle of OSL dating is that when sediments are exposed to sunlight, they accumulate energy from ionizing radiation in the natural environment (from cosmic rays and radioactive decay of elements in the surrounding sediments and rocks).**
- **This energy is trapped in the lattice structure of certain minerals, such as quartz and feldspar, which are common in sedimentary rocks.**

- **When these minerals are exposed to light (usually from the sun), the trapped energy is released in the form of luminescence (light).**
- **The intensity of this luminescence is proportional to the amount of radiation the mineral has been exposed to since it was last exposed to light.**
- **To date a sediment using OSL, a sample is taken from the site and kept in light-tight conditions to prevent any additional exposure to light.**

- **In the laboratory, the sample is stimulated with light (usually from a laser or LED), and the resulting luminescence is measured.**
- **The amount of luminescence is used to calculate the equivalent dose (De), which is the amount of radiation the sample has absorbed since it was last exposed to light.**
- **The dose rate (Dr) is also measured, which is the rate at which the sample is exposed to radiation in its current environment. The age of the sediment can then be calculated using the formula:**
    - **Age = De / Dr**
- **OSL dating is a valuable tool in fields such as archaeology, geology, and geomorphology, as it can provide accurate ages for events such as the deposition of sediments, the construction of archaeological features, or the timing of landscape changes.**
- **It is particularly useful in situations where other dating methods, such as radiocarbon dating, are not applicable or provide insufficient resolution**

D-state

Dreams are primarily associated with REM and activated EEG. A combined duration of the REM-EEG condition called the D-state takes up 25% of normal sleep. The D-state depends on an area within the brain stem known as the pontine tegmentum.

It is associated with a mechanism involving a chemical called norepinephrine. Other stages of sleep involve another chemical, serotonin, in the brain. The D-state is associated with variability in breathing, heart rate, and relaxation of skeletal muscles and reduction of electrical activity in muscles near the base of

the tongue. Research has found dreaming is associated with REM sleep.

The term "REM-EEG condition" likely refers to the electroencephalogram (EEG) patterns observed during the rapid eye movement (REM) sleep stage.

REM sleep is one of the stages of sleep in mammals and birds, and it is characterized by rapid eye movements, increased brain activity (as measured by EEG), and sometimes vivid dreams.

During REM sleep, the EEG shows a pattern that is similar to the brain activity seen during wakefulness, with mixed-frequency activity that includes theta, alpha, and beta waves.

This contrasts with the slower, more synchronized delta waves seen in deep non-REM sleep. The REM-EEG condition can be an important marker for sleep researchers and clinicians, as it helps to identify this distinctive sleep stage. Monitoring EEG patterns during REM sleep can also be useful in diagnosing sleep disorders and assessing sleep quality.

Cryoconite

Cryoconite is a dark-colored, powdery substance found on the surface of glaciers and ice sheets. It is composed of a mixture of fine sediment, organic matter, and sometimes cyanobacteria or algae. Cryoconite forms in small, irregularly shaped holes known as cryoconite holes, which are essentially meltwater pools on the ice surface that have accumulated sediment and organic material.

The dark color of cryoconite absorbs more solar radiation than the surrounding ice, creating a localized warming effect that increases melting.

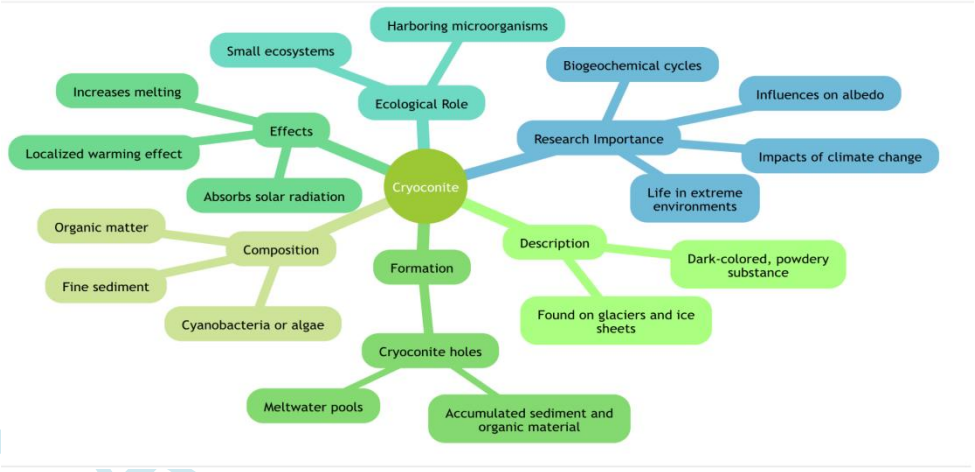
This process contributes to the formation and growth of cryoconite holes, which can act as small ecosystems, harboring a variety of microorganisms.

Cryoconite plays a role in the ecology of glaciers and ice sheets, and it is also of interest to scientists studying the impacts of climate change on polar and alpine environments.

The presence of cryoconite can influence the albedo (reflectivity) of ice surfaces, potentially affecting the rate of ice melt and contributing to feedback mechanisms in the climate system.

Research on cryoconite has implications for understanding the biogeochemical cycles of polar regions and the overall health of glacial ecosystems.

It is also relevant to the study of life in extreme environments, as the organisms living in cryoconite holes must adapt to the harsh conditions of high UV radiation, low temperatures, and limited nutrients.



Oestrogen

Osteoporosis is a condition in which the body's bones become weak and brittle. There are more than 10 million cases of osteoporosis every year in India, and it disproportionately affects ageing women more than men. The hormone

oestrogen plays a crucial role in this condition because it stimulates the growth and formation of new bone

Oestrogen plays a crucial osteoanabolic role: it stimulates the growth and formation of new bone. Specific neurons, called KISS1 neurons, used the CCN3 hormone to maintain bone mineralisation during lactation.

CCN3 belongs to the CCN family of proteins. They are involved in several biological processes, including embryonic development, tissue repair, wound healing, and cancer progression. Estrogen, also spelled oestrogen, is a hormone that plays a critical role in the regulation of female reproductive health, but it also has important functions in males and is essential for the proper development and maintenance of various bodily systems.

There are three primary types of estrogens in humans:

Estradiol (E2): This is the most potent and prevalent form of estrogen in premenopausal women. It is responsible for the development of female secondary sexual characteristics during puberty and plays a key role in the menstrual cycle and fertility.

Estrone (E1): This is the most abundant estrogen in postmenopausal women. It is produced in smaller amounts by the ovaries and is also derived from the conversion of androgens in adipose (fat) tissue.

Estriol (E3): This is the weakest of the three estrogens and is produced in large quantities during pregnancy by the placenta. It helps to maintain the pregnancy and prepares the body for childbirth.

Functions of estrogen include:

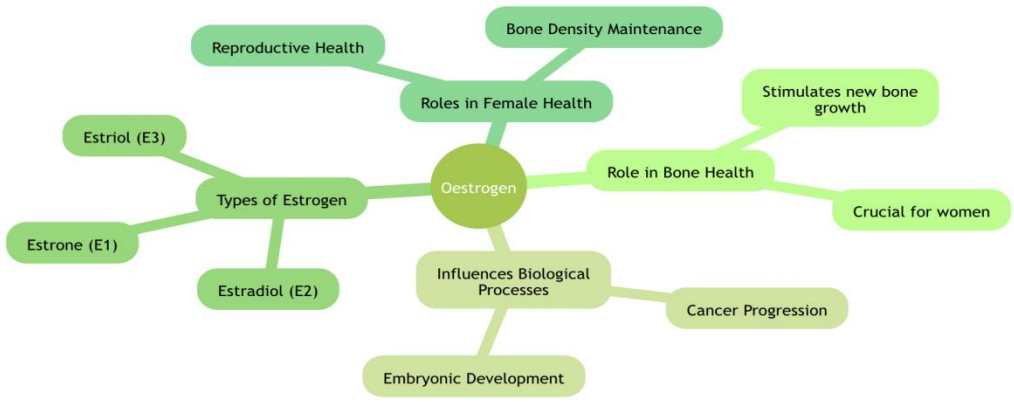
Regulating the menstrual cycle in females.Promoting the development of

secondary sexual characteristics such as breast growth and the distribution of body fat.Maintaining bone density and strength, which is important for preventing osteoporosis.

Influencing mood and behavior.Playing a role in the metabolism of lipids and carbohydrates.Affecting the cardiovascular system by promoting the dilation of blood vessels.

figures:

figure 1.1 mindmap:



Bio -Bitumen

Bio-bitumen, also known as bio-asphalt or green bitumen, is a type of bituminous material that is partially or fully derived from renewable biomass sources rather than fossil fuels. Traditional bitumen is a byproduct of the oil refining process and is used as a binder in asphalt for road construction and maintenance.

Bio-bitumen aims to reduce the carbon footprint associated with traditional bitumen by using sustainable and environmentally friendly feedstocks.

Bio-bitumen can be produced through various methods, including:

Pyrolysis: This process involves heating biomass in the absence of oxygen to

produce a bio-oil that can be used as a bio-bitumen feedstock.

Gasification: Biomass is converted into a synthesis gas (syngas), which can then be processed into bio-oil or other chemical intermediates for bio-bitumen production.

Hydrothermal Upgrading: This method involves treating wet biomass at elevated temperatures and pressures in the presence of water to produce a bio-crude oil.

Direct Blending: Bio-based oils or additives can be blended with traditional bitumen to create a bio-bitumen product. Bio-bitumen offers several potential benefits over traditional bitumen, including:

Reduced Greenhouse Gas Emissions: By using biomass as a feedstock, bio-bitumen can reduce the net carbon dioxide emissions associated with road construction and maintenance, as the carbon dioxide released during the production and use of bio-bitumen is offset by the carbon dioxide absorbed by the growing biomass.

Sustainability: Bio-bitumen can help to promote the use of renewable resources and reduce dependence on fossil fuels.

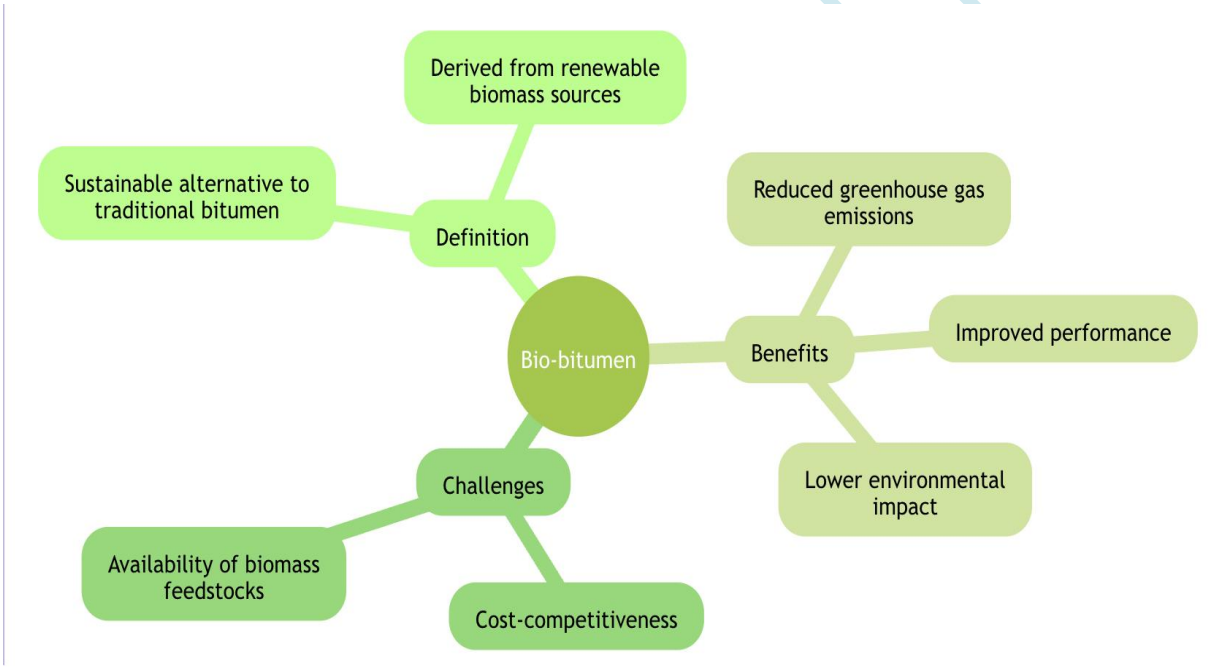
Performance: Some bio-bitumen products may offer improved performance characteristics, such as enhanced durability or flexibility, depending on the production method and biomass source used.

Environmental Impact: Bio-bitumen can have a lower environmental impact

compared to traditional bitumen, with reduced emissions of volatile organic compounds (VOCs) and other pollutants during production and use.

Despite these advantages, bio-bitumen is still in the development and testing phases in many regions, and its widespread adoption depends on factors such as cost-competitiveness with traditional bitumen, technical performance, and the availability of sustainable biomass feedstocks.

Research and development in this area are ongoing to improve the production processes and to ensure that bio-bitumen can meet the performance and environmental standards required for road construction.



Palawan

Palawan is an island province of the Philippines that is known for its stunning natural beauty, rich biodiversity, and pristine beaches. It is the largest province in the country in terms of land area, and it is located in the southwestern part of the Philippines, stretching from the South China Sea in

the northeast to the Sulu Sea in the southwest.

The island is home to a variety of ecosystems, including tropical rainforests, mangrove forests, and coral reefs, making it a haven for wildlife and a popular destination for ecotourism.

- **Some of the notable natural attractions in Palawan include:**

Puerto Princesa Subterranean River National Park: This park is famous for its navigable underground river, which is one of the New7Wonders of Nature. The river is surrounded by a dense rainforest and is home to various species of flora and fauna.

El Nido: Known for its picturesque limestone karsts and white sandy beaches, El Nido is a top tourist destination in Palawan. It offers numerous islands and beaches for island hopping, snorkeling, and diving.

Coron: Another popular tourist spot, Coron is known for its World War II shipwrecks, coral reefs, and hot springs. It is also famous for its beautiful lakes and the nearby Coron Island.

Honda Bay: This bay is known for its crystal-clear waters and nearby islands that are perfect for island hopping and swimming.

Tubbataha Reefs Natural Park: A UNESCO World Heritage Site, Tubbataha Reefs is a marine sanctuary that is renowned for its coral reefs and marine biodiversity. It is a popular spot for diving and snorkeling.

Palawan is also recognized for its efforts in environmental conservation.

Quantum Computing

Quantum Computing: Unraveling the Future of Technology

Section 1: Understanding Quantum Mechanics

Page 1.1: Quantum Physics Fundamentals

- **Wave-Particle Duality: Quantum mechanics challenges classical physics by revealing that particles like electrons and photons exhibit both wave-like and particle-like behavior, leading to phenomena such as interference and superposition.**
- **Quantum Superposition: Unlike classical bits, quantum bits or qubits can exist in a superposition of states, representing multiple possibilities simultaneously, which forms the basis of quantum computing's computational power.**
- **Entanglement: The entanglement of qubits enables instantaneous correlation, where the state of one qubit is directly related to the state of another, regardless of the distance between them, offering unprecedented potential for information processing.**

Quantum Computing Principles

- **Quantum Gates and Circuits: Quantum gates manipulate qubits, and their combinations form quantum circuits, enabling complex operations such as entanglement and superposition to perform computations.**
- **Quantum Parallelism: Quantum computers leverage superposition to process multiple inputs simultaneously, exponentially increasing computational capacity for certain problems compared to classical computers.**
- **Quantum Decoherence: The challenge of maintaining the delicate quantum states of qubits, as they are highly susceptible to environmental interference, necessitating error correction and fault-tolerant designs.**

Quantum Algorithms and Complexity

- **Shor's Algorithm: Shor's algorithm demonstrates quantum computing's potential by efficiently factoring large numbers, posing a significant threat to current cryptographic systems and underlining the need for quantum-resistant cryptography.**
- **Grover's Algorithm: Grover's algorithm showcases quantum computing's ability to search unsorted databases exponentially faster than classical algorithms, revolutionizing data retrieval and optimization problems.**
- **Quantum Complexity Classes: Quantum computing introduces complexity classes such as BQP, representing problems solvable efficiently by quantum computers, offering a new perspective on computational complexity**

Principles of Quantum Computing

Page 2.1: Quantum Hardware Components

- **Qubit Implementations: Quantum computers utilize various qubit implementations, including superconducting circuits, trapped ions, and topological qubits, each with distinct advantages and challenges.**
- **Quantum Control and Measurement: Precise control and measurement of qubits are essential for executing quantum operations and obtaining accurate results, requiring advanced experimental techniques and instrumentation.**
- **Quantum Interconnects: The development of quantum interconnects is crucial for linking qubits and enabling the creation of large-scale quantum processors, facilitating complex computations and simulations.**

Applications and Future Implications

Page 3.1: Quantum Computing Landscape

- **Industry Adoption and Investment:** Industries such as finance, healthcare, and logistics are exploring quantum computing applications, with significant investments in quantum research and development to unlock transformative capabilities.
- **Quantum Cloud Services:** Cloud providers are offering quantum computing resources and services, democratizing access to quantum technologies and fostering a vibrant ecosystem of quantum developers and researchers.
- **Quantum Computing Ecosystem:** The emergence of quantum startups, research collaborations, and educational initiatives is shaping a dynamic quantum computing ecosystem, driving innovation and knowledge dissemination.

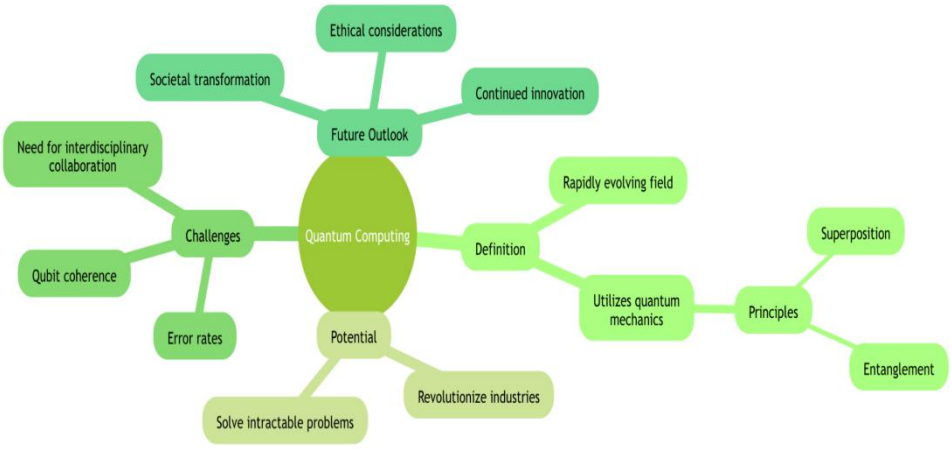
Quantum Computing Challenges

- **Technical Hurdles and Milestones:** Overcoming technical challenges such as qubit coherence, error rates, and fault tolerance is crucial for achieving practical quantum advantage and realizing the full potential of quantum computing.
- **Algorithmic Innovations:** Continued research into quantum algorithms, error correction, and quantum software is essential for expanding the scope of quantum applications and addressing real-world problems effectively.

- **Interdisciplinary Collaboration: Quantum computing requires interdisciplinary collaboration across physics, computer science, and engineering to tackle complex challenges and drive holistic advancements in the field.**

Quantum Computing Future Outlook

- **Societal Impact and Transformation: Quantum computing has the potential to revolutionize industries, drive scientific discoveries, and address global challenges, shaping a future where quantum technologies are integral to everyday life.**
- **Ethical and Policy Considerations: Addressing ethical, privacy, and security implications of quantum technologies requires proactive policy development and**



- **international collaboration to ensure responsible and equitable quantum advancement.**
- **Continued Innovation and Exploration: The ongoing exploration of quantum phenomena, the development of quantum technologies, and the pursuit of quantum advantage will define the future trajectory of**

quantum computing, unlocking new frontiers of knowledge and capabilities.

What is DNA PROFILING??

What is DNA Profiling?

- **Definition: DNA profiling, also known as DNA fingerprinting, is a forensic technique used to identify individuals based on their unique DNA characteristics. It involves comparing DNA samples to assess the likelihood of a match.**
- **Principles: DNA profiling relies on the fact that no two individuals (except identical twins) have the same DNA sequence, making it a powerful tool for identification and criminal investigations.**
- **Historical Context: The concept of DNA profiling was first introduced by Sir Alec Jeffreys in the 1980s, revolutionizing forensic science and genetic analysis**

: Process of DNA Profiling

- **Sample Collection: DNA samples can be obtained from various sources, such as blood, hair, saliva, or other bodily fluids, and even from crime scene evidence.**
- **DNA Analysis: The collected samples undergo a series of tests and techniques to extract and evaluate the genetic information contained within an individual's cells.**
- **Creating a Profile: Through Polymerase Chain Reaction (PCR) analysis, a unique DNA profile is created, which can be used for identification and comparison.**

Importance in Forensic Investigations

- **Criminal Investigations: DNA profiling is a crucial tool in solving criminal cases, helping to link suspects to a crime scene or identify potential perpetrators.**
- **Establishing Identity: It is used to establish the identity of individuals from samples of DNA, aiding in paternity tests, custody disputes, and missing persons cases.**
- **Limitations: Sometimes, the DNA from crime scene evidence is in a very small quantity, poorly preserved, or highly degraded, resulting in partial DNA profiles.**

Applications of DNA Profiling

Forensic Applications

- **Crime Scene Analysis: DNA profiling is used to identify potential suspects and link them to a crime, aiding in the resolution of criminal cases.**
- **Forensic Medicine: It plays a crucial role in establishing the custody of a child through paternity testing and resolving other legal and medical issues.**
- **State-of-the-Art Facilities: Forensic DNA profiling facilities provide advanced DNA analysis services for both human and nonhuman DNA.**

Medical and Research Applications

- **Diagnosing Disorders: DNA profiling is used to diagnose inherited disorders and human diseases, contributing to advancements in medical diagnostics and treatment.**

- **Research Advancements: It continues to play a pivotal role in genetic research, including studies on population genetics, evolutionary biology, and disease susceptibility.**
- **Future Possibilities: The list of additional uses for DNA profiling continues to grow, with potential applications in personalized medicine and precision healthcare.**

Ethical Considerations in DNA Profiling

- **Informed Consent: Ethical guidelines emphasize the importance of obtaining informed consent for DNA profiling, ensuring respect for individual autonomy and privacy.**
- **Data Security: Safeguarding genetic data from unauthorized access and misuse is a critical ethical consideration in the era of widespread DNA profiling.**
- **Equitable Access: Ensuring equitable access to DNA profiling technologies and services is essential for mitigating disparities and promoting social justice.**

- 

Trichophyton indotineae /rDNA

- **Trichophyton indotineae is a species of fungus that belongs to the genus Trichophyton.**
- **This genus includes several species that are known to cause dermatophytosis, a common fungal infection of the skin, hair, and nails in humans and animals. Dermatophytosis is often referred to as ringworm in humans and is characterized by red, itchy, scaly patches on the skin.**
- **Ribosomal DNA (rDNA)**

Ribosomal DNA (rDNA) is a type of DNA that codes for ribosomal RNA (rRNA), which is a key component of ribosomes, the cellular structures responsible for protein synthesis.

Ribosomes are found in all living cells, and they are essential for the translation of messenger RNA (mRNA) into proteins, a process known as translation.

The rDNA typically consists of multiple copies of the genes for the different

types of rRNA, which include the 5.8S, 18S, and 28S rRNAs in eukaryotes, and the 16S and 23S rRNAs in prokaryotes.

These genes are often arranged in clusters known as rDNA operons or rDNA repeats.The arrangement and number of rDNA repeats can vary greatly among different organisms. For example, in humans, rDNA is located on the short arm of chromosome 1 and contains hundreds of repeats of the rRNA genes.

The exact number of repeats can differ among individuals.

rDNA is transcribed by RNA polymerase I in eukaryotes to produce the precursor rRNA, which is then processed to yield the mature rRNA molecules. These rRNA molecules, along with ribosomal proteins, assemble to form the ribosome's subunits.

Due to its conserved nature and the presence of both highly conserved and variable regions, rDNA is often used in molecular biology and systematics for phylogenetic studies to determine the evolutionary relationships among organisms.

It is also used in the identification and classification of species, as the sequence of rDNA can be highly specific to a particular organism or group of organisms. Additionally, rDNA can be used as a target for genetic engineering techniques, such as CRISPR-Cas9, to modify the expression of rRNA genes, which can affect the efficiency of protein synthesis in cells.

The Internal Transcribed Spacer (ITS) region

These spacers are transcribed along with the rRNA genes but are removed during the processing of the rRNA precursor into mature rRNA molecules.

- **The ITS region is important for several reasons:**

Species Identification: The ITS region is often used in molecular systematics

and taxonomy for the identification and classification of species. The sequences of ITS1 and ITS2 are highly variable among species, making them useful for distinguishing between closely related organisms.

Phylogenetic Studies: Due to their variability, ITS sequences are valuable for reconstructing phylogenetic relationships among species and higher taxonomic groups. They provide insights into the evolutionary history and diversification of eukaryotic lineages.

Barcoding: The ITS region, particularly ITS2, is used as a barcode for fungal identification in the field of mycology. It is part of the standard for fungal DNA barcoding recommended by the Consortium for the Barcode of Life (CBOL).

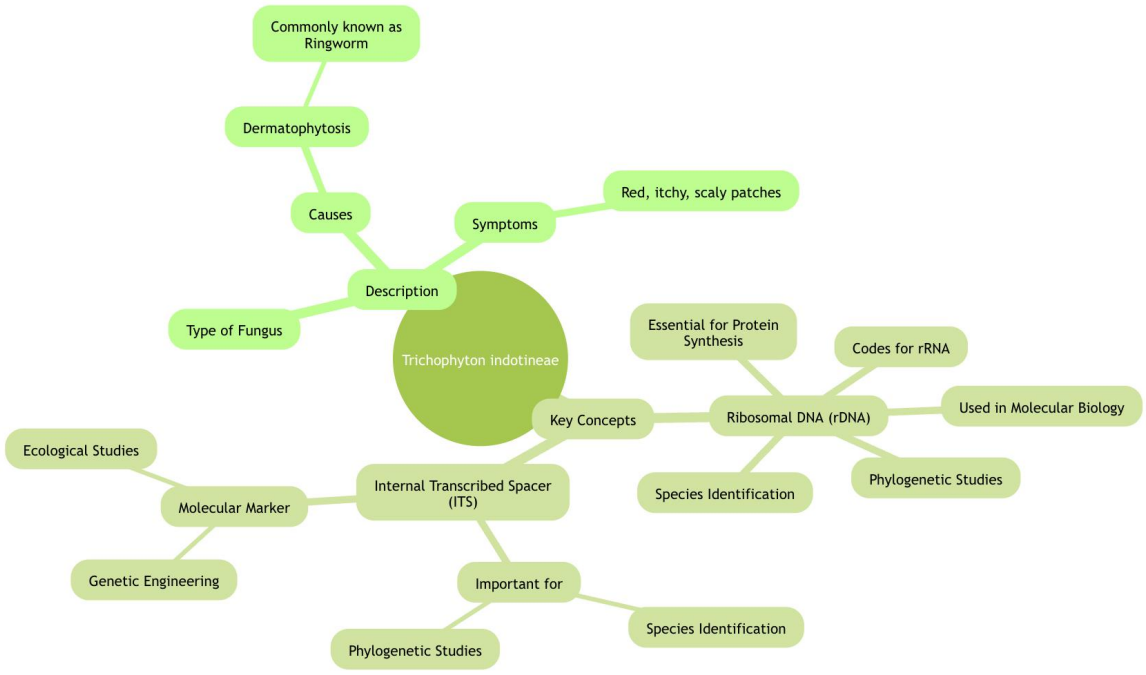
Secondary Structure: The ITS regions can form complex secondary structures that may play a role in the regulation of rRNA processing and translation.

Molecular Markers: ITS sequences are commonly used as molecular markers in ecological studies to assess biodiversity and community composition, especially in microbial ecology.

Genetic Engineering: In genetic engineering, the ITS region can be targeted for the insertion of foreign DNA into the rDNA repeat, which can affect the expression of rRNA genes and, consequently, the efficiency of protein synthesis.

The ITS region is an essential tool in molecular biology, providing researchers with a powerful means to identify, classify, and study the evolutionary relationships among eukaryotic organisms.

figures:
figure 1.1 mindmap:



Development on himalayan Region

What is happening in IHR towns?

Almost all Himalayan towns, including State capitals, struggle with managing civic issues.

For example, cities like Srinagar, Guwahati, Shillong, and Shimla, as well as smaller towns, face significant challenges in managing sanitation, solid and liquid waste, and water.

Planning institutions in these States often fail because they use models copied from the plains and have only limited capacities to implement these plans.

Why is this happening?

The IHR faces increasing pressure from urbanisation and development, compounded by high-intensity tourism, unsustainable infrastructure, and resource use (land and water), further aggravated by climatic variations like changing precipitation patterns and rising temperatures.

This has led to water scarcity, deforestation, land degradation, biodiversity loss, and increased pollution, including plastics. These pressures have the potential to disrupt lives and livelihoods, impacting the socio-ecological fabric of the Himalayas.

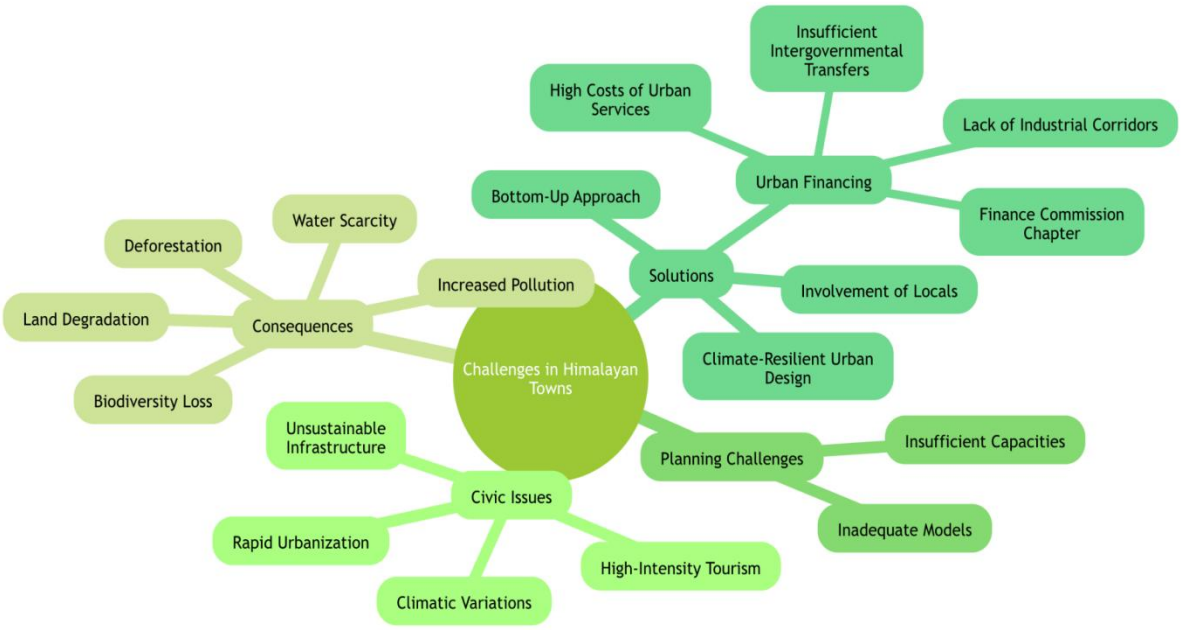
Over the past few decades, tourism in the IHR has continued to expand and diversify, with an anticipated average annual growth rate of 7.9% from 2013 to 2023

What needs to be done?

Planning institutions in IHR cities are still guided by land-use principles. Every town needs to be mapped, with layers identifying vulnerabilities from geological and hydrological perspectives. Climate-induced disasters annually erode infrastructures built without such mapping. Therefore, the planning process should involve locals and follow a bottom-up approach.

Consultant-driven urban planning processes should be shelved for Himalayan towns, with the urban design based on climate resilience.Additionally, none of the cities in the IHR can generate capital for their infrastructure needs.

The Finance Commission must include a separate chapter on urban financing for the IHR. The high costs of urban services and the lack of industrial corridors place these towns in a unique financial situation. Current intergovernmental transfers from the centre to urban local bodies constitute a mere 0.5% of GDP; this should be increased to at least 1%.



The Tungabhadra River

The Tungabhadra River is a significant river in India, flowing through the states of Karnataka and Andhra Pradesh. It is formed by the confluence of two rivers, the Tunga and the Bhadra, near Kudli in the Shimoga district of Karnataka.

The Tunga originates near the Western Ghats in the Balekundri village, while the Bhadra rises near Gangamoola in the Western Ghats. After their confluence, the combined river is known as the Tungabhadra.

The Tungabhadra River is about 355 kilometers (220 miles) long and is an important source of water for irrigation, drinking water supply, and hydroelectric power generation.

Several dams have been built across the river, the most notable being the Tungabhadra Dam, which is situated near Hosapete (formerly Hospet) in Karnataka. The dam creates a large reservoir, the Tungabhadra Reservoir,

which is used for irrigation and power generation.

The river basin is home to a diverse population and supports agriculture, with the river playing a crucial role in the livelihoods of the people in the region. The Tungabhadra River also has cultural and historical significance, with several historical sites and temples located along its banks, including the famous Vijayanagara Empire ruins at Hampi, which is a UNESCO World Heritage Site.

The river is also known for its ecological importance, supporting a variety of flora and fauna, including several species of fish, birds, and other wildlife. However, like many rivers in India, the Tungabhadra faces challenges such as pollution, siltation, and over-extraction of water, which impact its ecological health and the well-being of the communities that depend on it.
Efforts are being made to manage and conserve the river's resources to ensure its sustainability for future generations.

Nitrogen Use Efficiency (NUE)

Nitrogen Use Efficiency (NUE) in crops refers to the ability of plants to take up nitrogen from the soil and convert it into usable forms for growth and development, and ultimately into yield. It is a critical aspect of sustainable agriculture, as nitrogen is one of the essential nutrients for plant growth, and its efficient use can lead to higher crop productivity while minimizing environmental impacts and reducing costs for farmers.

Factors Affecting Nitrogen Use Efficiency:

Genetic Factors: Different crop varieties have varying abilities to take up and utilize nitrogen. Plant breeding programs focus on developing varieties with higher NUE.

Soil Conditions: Soil type, pH, organic matter content, and the presence of other nutrients can affect how efficiently plants can take up nitrogen.

Nitrogen Availability: The form and timing of nitrogen application, as well as the total amount, influence NUE. Excessive nitrogen application can lead to leaching, runoff, and environmental pollution.

Crop Management Practices: Techniques such as no-till farming, cover cropping, and integrated nutrient management can improve NUE by enhancing soil health and reducing nitrogen losses.

Climatic Conditions: Temperature, precipitation, and humidity affect nitrogen cycling in the soil and can impact the efficiency with which crops use nitrogen.

Measuring Nitrogen Use Efficiency:

NUE is often expressed as the ratio of crop yield to the amount of nitrogen applied or taken up by the plant. It can be measured in several ways, including:

Agronomic Nitrogen Use Efficiency (ANUE): The increase in yield per unit of nitrogen applied.

Physiological Nitrogen Use Efficiency (PNUE): The increase in yield per unit of nitrogen taken up by the plant.

Internal Nitrogen Use Efficiency (INUE): The efficiency with which plants convert absorbed nitrogen into biomass or yield.

Strategies to Improve Nitrogen Use Efficiency:

Precision Agriculture: Using tools like GPS and field data maps to apply nitrogen only where and when it is needed.

Crop Rotation: Alternating crops with different nitrogen requirements can improve soil nitrogen levels and reduce the need for fertilizer.

Use of Nitrogen-Fixing Crops: Legumes and other nitrogen-fixing plants can replenish soil nitrogen through symbiotic relationships with bacteria.

Advanced Fertilizers: Slow-release and controlled-release fertilizers can improve NUE by matching nitrogen release to crop demand.

- **Improving nitrogen use efficiency is a complex challenge that requires a multifaceted approach, involving plant breeding, agronomic practices, and policy measures.**
- **By enhancing NUE, agriculture can become more sustainable, reducing its environmental footprint while maintaining or increasing productivity**

Facts

- **"Cereals consume two thirds of all urea in India, led by rice. Poor nitrogen use efficiency (NUE) wastes N (nitrogen)-fertilizers worth ₹1 trillion a year in India and over $170 billion per year globally.**
- **N-fertilizers are the main source of nitrous oxide and ammonia pollution of air and nitrate/ammonium pollution of water, affecting our health, biodiversity, and climate change.**

Radiocarbon

Radiocarbon released into the atmosphere from nuclear tests bonds with oxygen to form CO2. Plants absorb this CO2 during photosynthesis to produce food and, ultimately, energy Models show carbon stored in

vegetation ranges from 43–76 billion to 80 billion tonnes per year. If the higher value is accurate, plants must be shedding carbon sooner.

'The whole system is cycling faster than we thought before' Scientists agree that radiocarbon needs to be better represented in climate predictions.

So far it has been plagued by 'limited resources available for model development and observational research'

Radiocarbon, also known as carbon-14 (14C), is a radioactive isotope of carbon. It is naturally present in trace amounts in the Earth's atmosphere and is constantly being produced in the upper atmosphere by the interaction of cosmic rays with nitrogen-14 (14N) atoms. Radiocarbon is important in the field of archaeology and geology for its use in radiocarbon dating, a method used to determine the age of organic materials

Production and Cycle:

The production of radiocarbon in the atmosphere involves the following nuclear reaction:

- **$^{14}N + {}^{1}n \rightarrow {}^{14}C + {}^{1}H$**

Here, a neutron (^1n) from cosmic radiation collides with a nitrogen-14 (^14N) atom, resulting in the formation of carbon-14 (^14C) and a hydrogen atom (^1H).

Once formed, the radiocarbon atoms become part of the carbon cycle. They are oxidized to form carbon dioxide (CO_2), which is then absorbed by plants during photosynthesis.

Animals, in turn, consume these plants, incorporating the radiocarbon into their tissues. When an organism dies, it stops exchanging carbon with the environment, and the radiocarbon within its remains starts to decay.

Radiocarbon Dating:

Radiocarbon dating is based on the fact that ^14C decays over time with a half-life of about 5,730 years. This decay occurs through beta decay, where the ^14C atom emits an electron and an antineutrino, transforming into a nitrogen-14 (^14N) atom:

By measuring the amount of ^14C remaining in a sample and comparing it to the amount expected in a living organism, scientists can estimate the age of the sample. This technique is particularly useful for dating organic materials like wood, charcoal, bone, and plant remains that are up to about 50,000 years old.

Limitations

Radiocarbon dating has its limitations.

It cannot be used for materials older than about 50,000 years, as the amount of ^14C remaining becomes too small to measure accurately.

Additionally, the method assumes that the rate of ^14C production in the atmosphere has been constant over time, which is not entirely accurate. Fluctuations in solar activity and the Earth's magnetic field can influence the production rate of ^14C, necessitating calibration against other dating methods and reference materials to achieve accurate results.

Despite these limitations, radiocarbon dating remains a vital tool in archaeology, geology, and other fields for determining the ages of organic materials and understanding past environmental and climatic conditions.

Perseid meteors

A meteor shower is a raining-down of meteors over the earth from space at a particular time of year. The Perseid meteors are debris left behind by the

comet Swift-Tuttle, which orbits the Sun in an elliptical path that takes 133 years to complete once.

When the earth moves through the cloud of debris intersecting its path around the Sun, its gravity pulls the debris towards itself, producing the meteor shower.

The Perseids shower itself doesn't threaten the earth: most meteors burn up in the atmosphere.

The Perseid meteor shower is one of the most popular and celebrated meteor showers of the year, known for its reliability and the number of meteors visible during its peak.

It occurs every year in mid-July to late August, with its peak typically occurring around August 12 or 13.The Perseids are associated with the comet Swift-Tuttle, and they are named after the constellation Perseus, from which the meteors appear to originate.

Here are some key points about the Perseid meteor shower:

Origin: The Perseids are the result of the Earth passing through the debris left behind by the comet Swift-Tuttle, which orbits the Sun once every 133 years.

As the Earth moves through this debris field, small particles (meteoroids) enter the Earth's atmosphere at high speeds, causing them to burn up and create bright streaks of light across the sky, known as meteors or "shooting stars."

Peak Activity: The peak activity of the Perseids can produce up to 60 to 70 meteors per hour under ideal conditions, with clear, dark skies and the radiant (the point from which the meteors appear to originate) high in the sky.

However, the number of meteors visible can be significantly lower in locations with light pollution or under less than ideal weather conditions.

Bright Meteors: The Perseids are known for producing bright meteors, and it is not uncommon to see fireballs (brighter meteors) during the peak of the shower.

Moon Phase: The visibility of meteors during the Perseids can be affected by the phase of the Moon. A bright Moon can wash out the fainter meteors, making them harder to see. In years when the Moon is new or waxing crescent around the peak of the shower, the viewing conditions are optimal.

Environmental Factors: Weather conditions can greatly affect the visibility of meteors. Clear, cloudless skies are essential for a good view. Additionally, the shower can be affected by dust or debris in the Earth's atmosphere, such as from volcanic eruptions or space events.

The Perseid meteor shower is a celestial event that offers a spectacular display for skywatchers around the world, providing a unique opportunity to witness the collision of cometary debris with our planet's atmosphere.

figure 1.2: table

- **Waqf Board of india**

Working of Waqf Board in India

Overview

Waqf Board: An organization managing properties donated for Islamic purposes.

Purpose: To promote social welfare through the management of waqf properties.

Key Functions

Property Management: Oversees the maintenance and utilization of waqf properties.Legal Affairs: Handles litigations related to waqf properties.

Revenue Generation: Aims to generate income for charitable purposes.

Recent Developments

Waqf Amendment Bill, 2024: Proposes changes to strengthen governance and inclusivity.

Tighter Control: New regulations impose stricter oversight on waqf property

management.

Inclusivity: More women and non-Muslims to be included in the board.

Challenges Faced

Litigations: Ongoing legal disputes over property claims.

Mismanagement: Some boards are criticized for poor management practices.

Political Controversies: Recent political debates surrounding waqf property governance

Overview of the Waqf Act

What is the Waqf Act?

Definition and Purpose of Waqf: The Waqf Act, 1995, governs the administration and regulation of waqf properties, which are religious endowments under Islamic law, established for charitable purposes. It plays a crucial role in societal welfare and preservation of cultural heritage.

Role of Waqf Boards: The Act establishes Waqf Boards to manage and supervise waqf properties, ensuring their proper utilization for the benefit of the Muslim community and other beneficiaries. This section will delve into the historical significance and the fundamental principles of waqf properties.

Challenges and Governance: Over the years, the Act has faced challenges related to transparency, governance, and the effective management of waqf properties. Understanding these challenges is essential for comprehending the need for amendments.

Significance of Waqf Properties

Cultural and Religious Heritage: These properties often hold significant

historical and religious value, representing an integral part of the cultural and religious heritage of the Muslim community. Exploring the historical and cultural significance will provide students with a deeper understanding of waqf properties.

Legal Framework and Governance: The Waqf Act provides the legal framework for the governance and administration of these properties, ensuring their preservation and effective utilization. This section will focus on the legal aspects and the governance framework of waqf properties.

Role of Waqf Boards

- **Administrative Functions**: Waqf Boards are responsible for the management, maintenance, and protection of waqf properties, as well as the generation of revenue for charitable and religious purposes. This section will detail the specific administrative functions and responsibilities of Waqf Boards.
- **Community Representation**: The boards represent the interests of the Muslim community and other beneficiaries, safeguarding the rights and welfare associated with waqf properties. Exploring the representation and community involvement will provide insights into the inclusive nature of waqf governance.
- **Regulatory Oversight**: They exercise regulatory authority to prevent encroachment, misuse, and unauthorized transactions related to waqf properties, ensuring their sustained benefit to society. This section will highlight the regulatory role of Waqf Boards in preserving the integrity of waqf properties.

Challenges and Reforms

- **Transparency and Accountability**: The existing framework has faced

challenges related to transparency, accountability, and the prevention of mismanagement and encroachment of waqf properties. This section will delve into the specific challenges and the need for reforms to address these issues.

- **Need for Modernization**: The changing socio-economic landscape necessitates reforms to enhance the governance, utilization, and preservation of waqf properties in a more efficient and transparent manner. Exploring the need for modernization will provide context for the proposed amendments.
- **Community Empowerment**: Reforms should aim to empower the Muslim community and other beneficiaries, ensuring their active participation in the management and decision-making processes related to waqf properties. This section will focus on the empowerment aspect of the proposed reforms.

Section 2: Proposed Amendments to the Waqf Act

Key Changes in the Waqf (Amendment) Bill

- **Amendment of the Waqf Act**: The proposed amendments seek to substantially alter the existing framework of the Waqf Act, 1995, to address governance, transparency, and administrative issues. This section will outline the key changes proposed in the Amendment Bill.
- **Unified Waqf Management**: The draft legislation aims to rename the Act as the Unified Waqf Management, Empowerment, Efficiency, and Development Act, 2024, heralding a comprehensive approach to waqf management. Exploring the unified approach will provide insights into the comprehensive nature of the proposed amendments.
- **Government Oversight**: The amendments introduce provisions for increased government oversight and regulatory control over waqf properties,

aiming to enhance transparency and accountability. This section will focus on the implications of increased government oversight.

Reforms in Property Management

- **Revocation of Clauses**: The bill proposes to revoke several clauses in the existing Waqf Act, particularly those related to the powers of Waqf Boards, with the intention of streamlining and strengthening property management. This section will detail the specific clauses targeted for revocation and their implications.
- **Enhanced Governance Framework**: The amendments aim to establish a more robust governance framework, addressing issues of encroachment, misuse, and mismanagement of waqf properties, ensuring their effective utilization for charitable purposes. This section will focus on the enhanced governance framework proposed in the amendments.
- **Inclusion of Women and Non-Muslim Members**: The bill introduces provisions for the inclusion of women and non-Muslim members in Waqf Boards, reflecting a more inclusive and diverse approach to waqf administration. Exploring the inclusive nature of the proposed amendments will provide students with insights into the broader representation in waqf governance.

Implications for Community Representation

- **Empowerment and Participation**: The proposed amendments seek to empower the Muslim community and other beneficiaries, ensuring their active representation and participation in the decision-making processes related to waqf properties. This section will emphasize the empowerment aspect and the implications for community participation.

- **Inclusive Governance**: The inclusion of women and non-Muslim members in Waqf Boards reflects a more inclusive and diverse approach to governance, fostering broader community representation and engagement. Exploring the inclusive nature of governance will provide students with insights into the broader representation in waqf governance.
- **Strengthening Social Welfare**: The reforms aim to strengthen the social welfare impact of waqf properties, ensuring their sustained contribution to education, healthcare, and support for the underprivileged. This section will focus on the social welfare impact of the proposed amendment

Addressing Controversies

- **Concerns and Criticisms**: The proposed amendments have sparked debates and controversies, particularly regarding the extent of government oversight, the revocation of existing clauses, and the implications for community representation. This section will outline the specific concerns and criticisms raised in response to the proposed amendments.
- **Balancing Government Control**: The bill aims to strike a balance between government oversight and community autonomy, ensuring effective governance while safeguarding the interests and rights of the Muslim community and other beneficiaries. This section will focus on the need for a balanced approach in waqf governance.
- **Dialogue and Consultation**: The controversies surrounding the amendments highlight the need for constructive dialogue and consultation to address concerns and ensure the equitable and effective management of waqf properties. This section will emphasize the importance of dialogue and consultation in addressing controversies.

Implications and Controversies

Page 3.1: Impact on Waqf Property Management

Enhanced Transparency: The amendments aim to enhance transparency and accountability in the management of waqf properties, addressing historical challenges related to governance and misuse. This section will focus on the implications of enhanced transparency in waqf property management.

Government Oversight: The increased regulatory control by the government raises questions about the balance between oversight and community autonomy in the administration of waqf properties. This section will explore the implications of increased government oversight on community autonomy.

Community Empowerment: The reforms seek to empower the Muslim community and other beneficiaries, ensuring their active participation in the decision-making processes related to waqf properties. This section will emphasize the empowerment aspect and its implications.

GOOGLE Monopoly Antitrust

Overview

Key Issues: Illegal monopoly, search engine dominance, antitrust laws

Recent Developments: Court rulings, implications for Big Tech

Stakeholders: Google, DOJ, users, competitors

Recent court rulings have affirmed that Google maintains an illegal monopoly over internet search, leading to significant implications for antitrust enforcement against Big Tech companies.

Key Findings

Court Rulings:

Judges have ruled that Google has violated antitrust laws.

Landmark cases emphasize the need for regulatory action against monopolistic practices.

Implications for Big Tech:

The ruling sets a precedent for future antitrust cases.

Potential changes in market dynamics and competition levels.

Public Reaction:

Mixed responses from users, some concerned about the implications for service quality and choice

Key Findings

Court Rulings:

Judges have ruled that Google has violated antitrust laws.

Landmark cases emphasize the need for regulatory action against monopolistic practices.

Implications for Big Tech:

The ruling sets a precedent for future antitrust cases.

Potential changes in market dynamics and competition levels.

Public Reaction:

Mixed responses from users, some concerned about the implications for service quality and choice. Gene responsible for prickles in eggplants discovered

Scientists have discovered the gene responsible for prickles in eggplants, a

trait that complicates farming.

They identified the Prickly Eggplant gene on chromosome 6 and pinpointed SmLOG1 gene as the key factor.

CRISPR-Cas9 gene editing confirmed that disabling the gene SmLOG1 eliminates prickles, paving the way for prickle-free eggplant varieties.

This not only sheds light on prickle development but promises to streamline cultivation and harvesting

The emergence of mpox

- **The emergence of mpox in the DRC is caused by a new clade of the virus, clade Ib, which emerged late last year and is characterised by severe disease and higher mortality. Broadly, the monkeypox virus has two clades.**
- **Clade I has been present in the DRC for several years causing sporadic outbreaks, while clade II (previously the West African clade) and specifically IIb emerged during the global mpox outbreak that attracted global attention in 2022.**
- **The clades are also characterised by distinct disease severity, with clade I known to be associated with severe disease and mortality compared to clade II, which has a mortality rate of less than 4%.**

Gaganyaan

Gaganyaan: India's first crewed space mission aiming for human spaceflight.

Objective: Demonstrate India's capabilities in human space exploration.

Launch Timeline:

Uncrewed test flight in July 2024

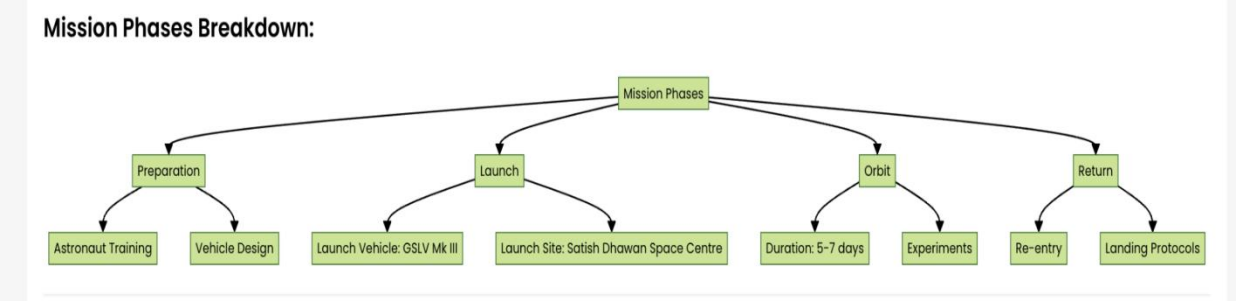
Crewed flight anticipated in 2025

Crew: Four astronauts selected for the mission

Significance: Strengthening international collaborations and enhancing technological capabilities

Mission Phases

- **Preparation**
  - **Astronaut Training**
  - **Vehicle Design**
- **Launch**
  - **Launch Vehicle: GSLV Mk III**
  - **Launch Site: Satish Dhawan Space Centre**
- **Orbit**
  - **Duration: 5-7 days in low Earth orbit**
  - **Experiments: Scientific and technological experiments**
- **Return**
  - **Safe re-entry and landing protocols**



On February 27, Mr. Modi announced the names of the four astronaut candidates for the Gaganyaan mission. The other two, apart from Mr. Shukla and Mr. Nair, were Group Captains Ajit Krishnan and Angad Pratap.

What are mission parameters?

According to ISRO's statement, its Human Spaceight Centre has signed an agreement with Axiom Space, Inc. "for its upcoming Axiom-4 mission to the

ISS".

The mission, colloquially called Ax-4, is the fourth crewed mission to the ISS organised by Axiom Space, a private company based in Houston. I

Axiom plans to operate the world's first commercial space station and currently offers human spaceflight services.

Topic- Deep Drill Core Insights into Earth's Mantle

Overview

- **Understanding the Earth's mantle**
- **Importance of deep drilling**
- **New geological insights**
- **Recent Findings:**
- **1.2km drill core provides unique insight into Earth's mantle**
- **Deepest-ever samples of rock from Earth's mantle unveiled**
- **Scientists uncover clues to life's origins through deep drilling**
- **Finding**
- **A record-breaking 1,268-metre drill core into Earth's mantle, collected from the Mid-Atlantic Ridge in the North Atlantic, has provided a detailed mineralogical glimpse of the oceanic mantle.**
- **The findings reveal new insights into mantle composition and earth's deep geology. Contrary to common models, melt migration was found to be oblique to mantle upwelling.**
- **The researchers observed hydrothermal fluid-rock interaction throughout the core, with oxidative weathering down to 200 meters.**

- **Cyberthreat**

It is indeed true that spreading disinformation has become far easier with the advent of AI. Deep fakes, comprising digitally manipulated video, audio, or images, repeatedly hit the headlines today, causing a miasma of disinformation.

The truth is revealed much later and after the damage has been done.

A 'glitch' in a software update concerning Microsoft Windows caused a massive outage, which initially affected parts of the United States, but rapidly spread to different parts of the globe, including India.

It disrupted flight operations, air traffic, stock exchanges and more.

The Indian Computer Emergency Response Team (CERT-IN) issued a severity rating of 'critical' for the incident.

- **This was, however, not a cyberattack, but it provided a preview of the kind of disruption that could take place in the event of a cyberattack**
- **widespread disruption that occurred in 2017 in the wake of the WannaCry ransomware attack employing the WannaCry ransomware cryptoworm, which infected well over 2,30,000 computers in 150**

countries, resulting in damage amounting to billions of dollars.

- **The same year witnessed another cyberattack using the Shamoon Computer Virus which was directed mainly against oil companies such as SA ARAMCO (Saudi Arabia) and RasGas (Qatar), and was labelled, at the time, as the 'biggest hack in history'.**
- **Again, around the same period, a cyber attack involving the 'Petya' Malware severely affected banks, electricity grids and a host of other institutions across Europe and the United Kingdom, as also the U.S. and Australia.**
- **Few cyberattacks have, however, had a more devastating impact than that caused by the Stuxnet 'attack' in 2010. Over 2,00,000 computers were impacted and physically degraded as a result.**
- **Stuxnet was a malicious computer worm, believed to have been in development for nearly five years, and specifically targeting supervisory control and data acquisition systems.**
- **The target in this case was the Iran nuclear programme, leading to the inference that it was state sponsored**

Steps to overcome cyber threat

One of the most widespread cyber frauds is 'phishing', that involves stealing personal information such as customer ID, credit\debit card numbers, and even PIN.

Industry and private institutions, however, appear to be lagging behind. It is the latter segment that is, perhaps, the most vulnerable to digital attacks. Having in place rewalls, antivirus defences and a good back-up and disaster recovery system are not enough.

Most CEOs of companies, again, are not adequately equipped to deal with

digital threats.

Hence it might be useful to have a chief information and security ocer to look at their systems and advise them as to what they should do.

Awareness of the growing danger of digital threats is but the first step in the battle against cyber and AI-directed threats.

Unauthorised use of Generative AI content has already become the stock-in-trade of digital bullying.Preventing this demands a great deal of effort and adequate budgetary allocations whether in the private or public domain.

Overview

Cybersecurity is crucial to protect sensitive information.

Awareness and proactive measures are key to combatting threats.

Main Steps:

Awareness

Understanding types of cyber threats.

Educating employees about phishing and scams.

Risk Assessment

Identify vulnerabilities within systems.

Evaluate the potential impact of threats.

Implementation of Security Measures

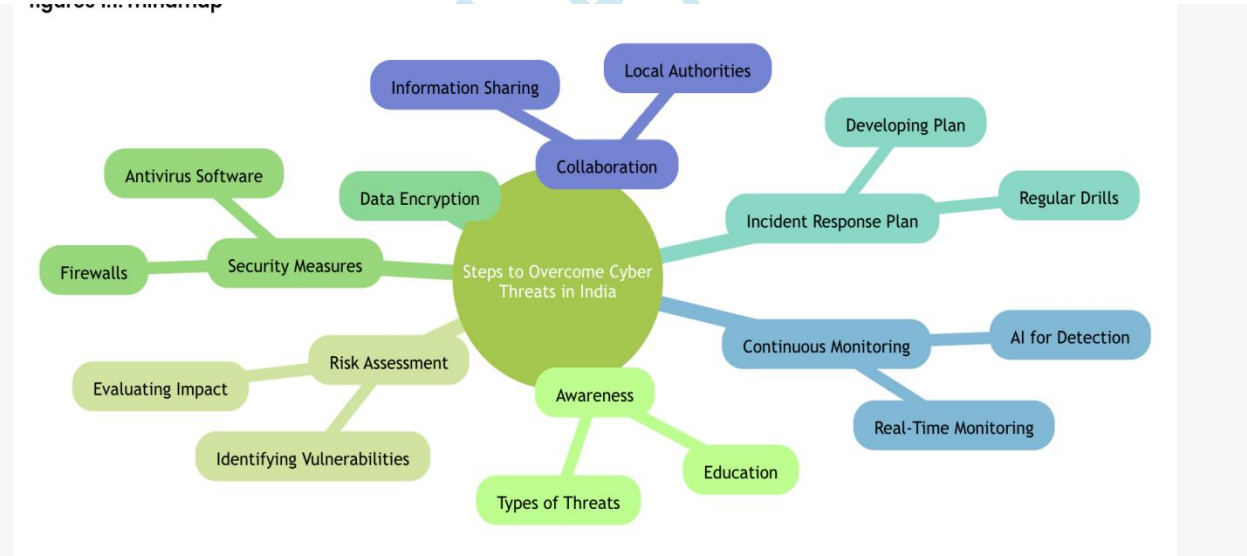
Firewalls and Antivirus Software.

Regular updates and patches to software.

- **Data Encryption**

Encrypt sensitive data to prevent unauthorized access.

- **Incident Response Plan**
  - **Develop a plan for responding to cyber incidents.**
  - **Regular drills to test the effectiveness of the plan.**
-
- **Continuous Monitoring**
  - **Implement systems for real-time monitoring of network traffic.**
  - **Use AI and machine learning for threat detection.**
- **Collaboration with Authorities**
  - **Work with local and national cybersecurity agencies.**
  - **Share information about potential threats and incidents.The importance of cybersecurity continues to rise, especially in countries like India with a growing digital landscape**



National Cyber Security Policy 2013

- **Policy Objectives: The National Cyber Security Policy 2013 aims to**

establish a secure computing environment, foster trust in electronic transactions, and guide the implementation of robust cybersecurity measures across sectors.

- **Framework for Safeguarding: The policy outlines a comprehensive framework to fortify the nation's cyber infrastructure and protect against cyber-attacks, emphasizing the importance of secure communication and electronic transactions.**
- **Evolution of Cyber Threats: The policy acknowledges the dynamic nature of cyber threats and provides a strategic approach to address emerging challenges in the**

Cybersecurity Awareness and Education

- **Cyber Literacy: Promoting cyber awareness and education initiatives is critical for empowering individuals with the knowledge and skills to protect themselves from cyber threats and contribute to a secure digital ecosystem.**
- **Role of Educational Institutions: Integrating cybersecurity education into academic curricula equips students with the necessary skills and knowledge to pursue careers in cybersecurity and contribute to national cyber resilience.**
- **Youth Empowerment: Fostering a culture of cyber awareness and resilience among the youth is essential for nurturing the next generation of cybersecurity professionals and advocates.**

Chandipura virus (CHPV)

- **Chandipura virus (CHPV) is a member of the genus Vesiculovirus within the family Rhabdoviridae.**
- **It is a negative-sense, single-stranded RNA virus. CHPV was first isolated in 1965 from the brains of children who had died of encephalitis in the Chandipura village of Bihar, India, hence its name.**
- **The virus is primarily transmitted through the bite of infected Aedes mosquitoes, and it can cause severe disease in humans, particularly affecting the central nervous system.**
- **Chandipura virus infection in humans can lead to a range of symptoms, including fever, headache, nausea, vomiting, and in severe cases, encephalitis, which can be fatal.**
- **The virus has been reported to cause outbreaks with high case fatality rates, particularly among children under the age of 15.**
- **There is no specific treatment for Chandipura virus infection, and management is supportive, focusing on relieving symptoms and complications.**
- **Epidemiologically, CHPV has been associated with regions in India, particularly the states of Bihar, Uttar Pradesh, and Gujarat.**
- **There have been sporadic outbreaks reported, with the virus remaining a public health concern due to its potential to cause severe disease and the lack of specific treatments or vaccines.**
- **Surveillance and control measures, including mosquito control programs, are important to prevent the spread of CHPV.**

- **Additionally, research into the development of vaccines and antiviral therapies is ongoing to address this and other emerging infectious diseases.**

Long Range Glide Bomb (LRGB) - Gaurav

Overview

Definition: Long Range Glide Bomb (LRGB) is an advanced precision-guided munition designed for extended range targeting.

Purpose: Enhance strike capabilities of air forces, particularly in precision targeting.

Key Features

Range: Capable of striking targets from significant distances.

Guidance System: Utilizes GPS and advanced navigation systems for accuracy.

Delivery Platform: Compatible with multiple aircraft, including Sukhoi-30MKI.

Development

Developer: Developed by DRDO (Defense Research and Development Organization), India.

Significance: Represents a significant step in indigenous defense technology.

Testing and Validation

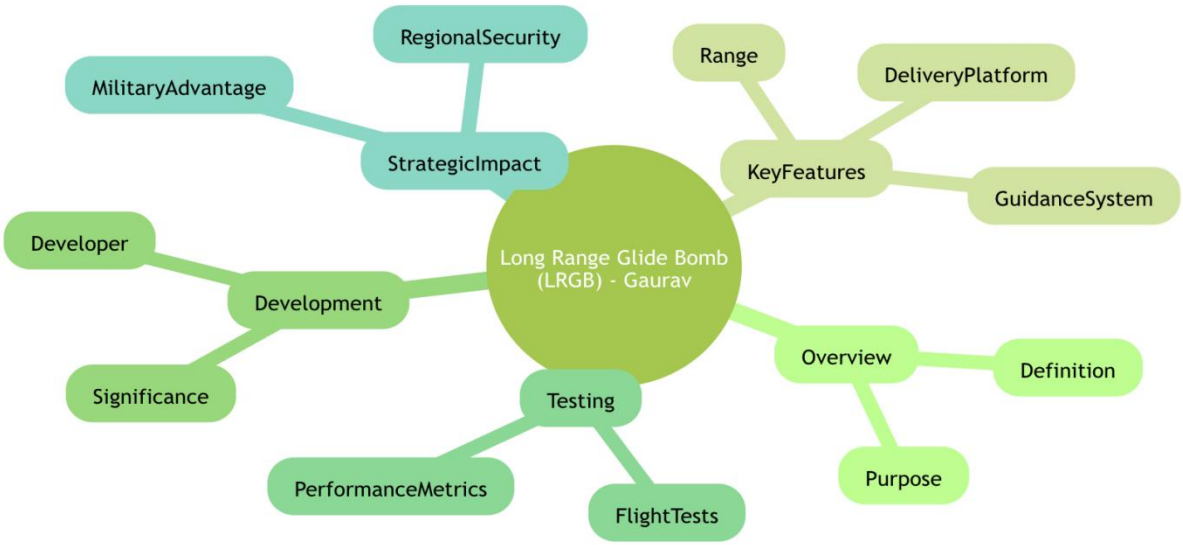
Flight Tests: Successful maiden test flights conducted from Sukhoi fighter jets.

Performance Metrics: Focus on accuracy, range, and payload capacity.

Strategic Impact

Military Advantage: Enhances deterrence capabilities against adversaries.

Regional Security: Strengthens national defense posture in the region.



Polar ice melts and Lengthening of day

When polar ice melts, the water flows to the equator, which makes the earth bulge out slightly.

This increases the moment of inertia, and the rotation rate slows, increasing the time taken to complete a rotation and thus lengthening our day

The moment of inertia is a measure of how resistant an object is to changes in

its rotational motion.

Over the last two decades, climate's effects on sea levels around the equator have slowed the rate of the earth's rotation by around 1.3 milliseconds per century.

If high emissions persist, this rate will change to 2.6 ms. These studies prove that climate change is interfering with something as fundamental as how the earth spins around its axis.

Scientists found that the location where the earth's axis intersects the crust is moving ever so slightly over time

Mount Vesuvius

- **Mount Vesuvius is one of the most famous volcanoes in the world, primarily due to its eruption in 79 AD, which destroyed the Roman cities of Pompeii and Herculaneum.**
- **Located on the Gulf of Naples in Italy, about 9 kilometers (5.6 mi) east of Naples, Vesuvius is the only active volcano on the European mainland.**

- **It is also one of the most densely populated volcanic regions in the world, with several million people living in the vicinity of the volcano.**

Geological Characteristics:

- **Mount Vesuvius is a stratovolcano, which means it is composed of layers of solidified lava, volcanic ash, and other materials.**
- **Its shape is a classic volcanic cone, and it stands about 1,281 meters (4,203 feet) above sea level.**
- **The volcano has had several periods of activity, with the most famous eruption occurring in 79 AD, which was classified as a Plinian eruption, characterized by its explosive nature and the ejection of pumice and volcanic ash.**

Ballast water

The story so far:

- **The Tamil Nadu Water Resources Department (WRD) has informed the National Green Tribunal that it has sought ₹160 crore from the Kamarajar Port in Ennore, Tamil Nadu, to facilitate the removing of invasive mussels on the coast near the port in connection with an ongoing case on the proliferation of Mytella strigata, or charru mussel that harms marine ecosystems and hinders fisher boat movements, affecting their livelihood.**

What is ballast water?

- **Ships need to have a certain level of immersion into the sea to be stable. When a ship discharges cargo, it rises up in the water and therefore, to**

keep a minimum level of immersion, ship staff take in sea water called ballast water inside tanks in the ship.

- **And when the ship loads cargo, leading to more immersion, the ballast water is pumped out of the ship.**
- **Until recently, there was no bar on taking in and pumping out of ballast water at ports, in the ocean, along the coast and so on.**
- **Since ballast water carries invasive species into other countries that destroy ecosystems, global shipping has sought to regulate ballast water discharge.**

What are global regulations?

- **The Ballast Water Management (BWM) Convention of the International Maritime Organization (IMO) came into force in 2017 to help prevent the spread of potentially harmful aquatic organisms and pathogens in ships' ballast water.**
- **From September 8, 2017, ships must manage their ballast water so that aquatic organisms and pathogens are removed or rendered harmless before the ballast water is released in a new location**

International Focus on Ballast Water

- **IMO's Ballast Water Management Convention**: The International Maritime Organization (IMO) has established regulations to prevent the spread of harmful aquatic organisms through ships' ballast water.
- **Compliance Requirements**: The convention outlines standards and procedures for the management and treatment of ballast water to minimize the risk of invasive species transfer.
- **India's Obligations**: India, as a signatory to the convention, is obligated to

implement measures to ensure compliance with the international standards for ballast water management.

Indian Regulations on Ballast Water

- **National Legislation**: India has enacted laws and regulations to address ballast water management, aligning with the IMO's standards and guidelines.
- **Compliance Framework**: The Directorate General of Shipping, Government of India, has issued guidelines and circulars to ensure compliance with the Ballast Water Management Convention.
- **Enforcement and Oversight**: Indian authorities oversee the implementation of ballast water regulations to prevent the introduction of invasive species in Indian waters.

Impacts, Mitigation, and Educational Outreach

Ecological Impacts of Ballast Water

- **Invasive Species Introduction**: Improper ballast water management can lead to the introduction of non-native species, disrupting local ecosystems and biodiversity.
- **Economic Consequences**: The ecological impacts of invasive species can have far-reaching economic implications, affecting fisheries, aquaculture, and coastal industries.
- **Educational Case Studies**: Exploring real-world examples of invasive species introductions can illustrate the importance of effective ballast water management.

About The Charru mussel

- **The Charru mussel, scientifically known as Mytella charruana, is a species of marine bivalve mollusk that belongs to the family Mytilidae, commonly known as the mussel family.**
- **This species is native to the South American Atlantic coast, especially in the Rio de la Plata region, which includes parts of Argentina, Uruguay, and southern Brazil.**
- **Mytella charruana is an important species in its ecosystem, providing food for various marine organisms and contributing to the biodiversity of coastal habitats. Like other mussels, it attaches itself to hard substrates using strong byssal threads, which it secretes to anchor itself.**
- **The potential for aquaculture of Mytella charruana comes with environmental considerations, as the introduction of mussels to new areas can sometimes lead to the disruption of local ecosystems, especially if the species becomes invasive.**

• Salar de Olaroz

Salar de Olaroz is a salt flat located in the Jujuy province of Argentina, within the Puna region of the Andes. This area is part of the "Lithium Triangle," a region that spans across Argentina, Bolivia, and Chile and is known for its

rich reserves of lithium.

Lithium is a soft, silver-white metal that is highly reactive, and it is a key component in the manufacture of lithium-ion batteries, which are used in a variety of applications, including electric vehicles, portable electronics, and energy storage systems.

The demand for lithium has been increasing rapidly due to the global shift towards renewable energy and the electrification of transportation.Salar de Olaroz, along with other salt flats in the region, contains brine pools that are rich in lithium.

The process of extracting lithium from these brines typically involves pumping the brine to the surface, followed by a series of evaporation ponds where the water evaporates, concentrating the lithium and other minerals.
Once the brine reaches a high enough concentration, the lithium is extracted through additional chemical processes to produce lithium carbonate or lithium hydroxide, which are the primary forms of lithium used in battery manufacturing.

The lithium extraction process at Salar de Olaroz is conducted by companies that specialize in mining and processing lithium, such as Orocobre Limited and Toyota Tsusho Corporation, which have formed a partnership to develop the resources at the site.
Environmental concerns and the management of water resources are critical issues in lithium extraction, especially in arid regions like the Puna. The mining industry and governments are working to develop sustainable

practices to ensure that lithium extraction does not negatively impact local ecosystems and communities that rely on these areas for their livelihoods.

New Ramsar sites in India

Three more wetlands in India had been designated Ramsar sites. This brings the total number of such sites in India to 85.

The new sites are the Nanjarayan and Kazhuveli bird sanctuaries in Tamil Nadu and the Tawa reservoir in Madhya Pradesh.

Nanjarayan Bird Sanctuary:

Nanjarayan Bird Sanctuary is situated in the Tiruvannamalai district of Tamil Nadu.

It is a relatively small sanctuary but is significant for its role in protecting the local avifauna.

The sanctuary serves as a breeding ground for several bird species and also attracts migratory birds during different seasons. Efforts are made to ensure the sanctuary remains free from disturbances to support the nesting and breeding activities of the birds.

Kazhuveli Bird Sanctuary:

Kazhuveli Bird Sanctuary is located in the Ramanathapuram district of Tamil Nadu, near the Gulf of Mannar. It is an important wetland habitat that supports a wide range of bird species, including several migratory species that visit the sanctuary during their migration routes.

The sanctuary is known for its scenic beauty and the opportunity it offers for

birdwatching and nature photography.

India is one of the "contracting parties" to the Ramsar Convention, signed in Ramsar, Iran, in 1971. It became a signatory in 1982.India's Ramsar wetlands make up around 10% of the total wetland area in the country across 18 States. No other South Asian country has as many sites though this has much to do with India's geographical breadth and tropical diversity.

The United Kingdom (175) and Mexico (142) smaller countries than India have the most Ramsar sites, whereas Bolivia spans the largest area, with 1,48,000 sq. km under the convention's protection.

Being designated a Ramsar site does not necessarily invite extra international

funds, but the Centre and States must ensure these tracts of land are conserved and saved from man-made encroachment.

Acquiring this label also helps with a locale's tourism potential and its international visibility. To be a Ramsar site, a wetland must meet at least one of the nine criteria defined by the Ramsar Convention such as supporting vulnerable, endangered, or critically endangered species or threatened ecological communities; regularly supporting 20,000 or more waterbirds; or is an important source of food for fish, spawning ground, nursery and/or migration path on which fish stocks are dependent upon

Extremophiles

There are several types of extremophiles, categorized based on the extreme conditions they can tolerate:

Thermophiles: Organisms that live in high-temperature environments, such as hot springs and hydrothermal vents. Some can survive temperatures above 100°C (212°F).

Psychrophiles: These are organisms that thrive in cold environments, such as glaciers and the deep sea. They can survive and reproduce at temperatures well below freezing.

Acidophiles: Organisms that can live in acidic environments with low pH levels, often found in acidic hot springs or acid mine drainage.

Alkaliphiles: These organisms are adapted to environments with high pH levels, such as soda lakes and highly alkaline soils.

Halophiles: **Organisms that require high salt concentrations to grow, commonly found in salt lakes and hypersaline environments.**

Barophiles: **Also known as piezophiles, these organisms prefer high-pressure environments, such as the deep sea.**

Xerophiles: **Organisms that can survive in extremely dry conditions, often found in deserts or other arid environments.**

Oligotrophs: **Organisms that can survive in environments with low levels of nutrients or organic matter.**

Radiophiles: **Organisms that are resistant to high levels of radiation, such as those found in the vicinity of nuclear reactors or in space.**

Extremophiles are not only of interest for their ability to survive in extreme conditions but also for their potential biotechnological applications. For example, the enzymes produced by thermophiles can be used in industrial processes that require high temperatures, such as in the production of biofuels and detergents.

Advantage to understanding how extremophiles adapt lies in a number of biological and industrial applications.

For example, in the 1960s, U.S. researchers isolated a new species of bacteria from a hot spring at Yellowstone National Park and named it Thermus aquaticus. This microbe is able to produce a heat-resistant enzyme called Taq DNA polymerase.

This enzyme is an important and valuable workhorse of molecular biology because of its application in the polymerase chain reaction (PCR).

In a 2020 study, scientists reported that Deinococcus radiodurans, an earth-born bacteria, could survive in outer space for more than three years, stuck to

the outside of the International Space Station and being blasted with ultraviolet radiation

NASA's InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport)

NASA's InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) lander is a robotic spacecraft designed to study the deep interior of Mars.

Launched on May 5, 2018, from Vandenberg Air Force Base in California, InSight successfully landed on Mars on November 26, 2018.

It touched down in Elysium Planitia, a flat, smooth plain near Mars' equator.

The primary mission of InSight was to investigate the planet's subsurface, including its crust, mantle, and core, by detecting marsquakes and other seismic activities.

The lander was equipped with a suite of instruments to carry out these studies:

Seismic Experiment for Interior Structure (SEIS): A sensitive seismometer provided by the French Space Agency (CNES) and the German Aerospace Center (DLR) to detect seismic waves and provide data on the planet's internal structure.

Heat Flow and Physical Properties Package (HP3): A "self-hammering" probe nicknamed "the mole," designed to burrow into the Martian soil to measure the planet's heat flow, which can reveal information about Mars' formation and thermal evolution.

Radiometer (RISE): A radio science experiment to track the location of InSight on the Martian surface, providing information about the planet's

rotation and helping to understand its internal structure.

The lander provided valuable data on Mars' seismic activity, heat flow, and surface properties, contributing to our understanding of the planet's geological history and its]potential to have once supported life.

- **Despite the successful deployment of SEIS and the radiometer, the HP3 probe encountered difficulties in penetrating the Martian soil, which was harder than expected. After several attempts, the "mole" was unable to burrow deeply enough to measure the heat flow accurately.**

CEPA

Definition: A CEPA is a trade agreement between countries to enhance economic cooperation.

Objectives:

- **Enhance trade and investment.**
- **Promote economic growth and development.**
- **Strengthen bilateral relations.**

Tariff Reduction: Lowering or eliminating tariffs on goods.

Market Access: Improved access to each other's markets.

Investment Protection: Safeguards for investors.

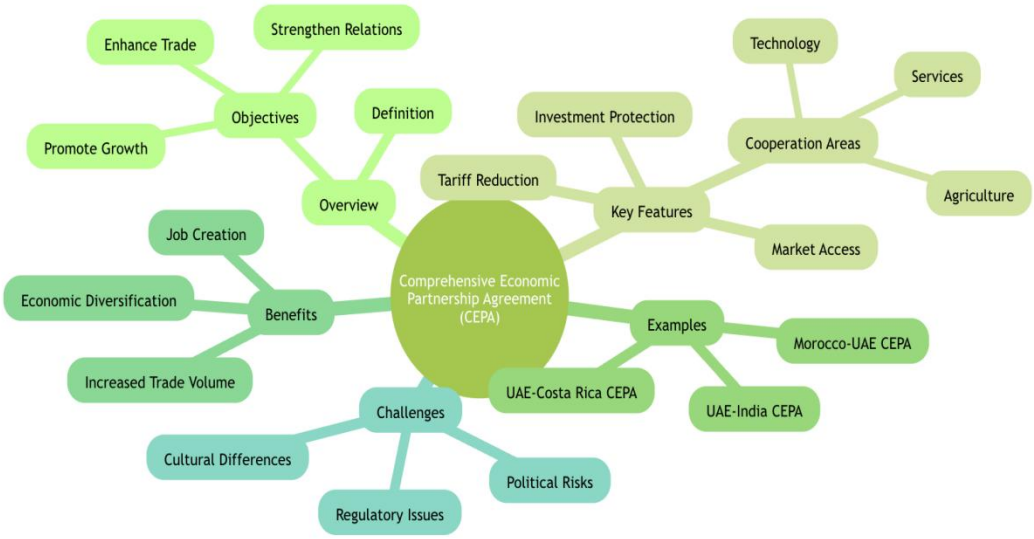
Cooperation Areas: Focus on sectors like technology, services, and agriculture.

- **Economic Sectors**
  - **Trade in Goods**
  - **Services**
  - **Investment**
  - **Technology Transfer**

- **Rules and Regulations**
  - **Rules of Origin**
  - **Tariff Reductions**
  - **Non-Tariff Barriers**

- **Recent Developments**
  - **India seeks review with UAE on CEPA terms[^1].**
  - **Kenya and UAE forge comprehensive agreement.**
  - **Morocco signs CEPA with UAE[^3].**
- **Challenges**
  - **Implementation Issues**
  - **Compliance with regulations**
  - **Divergent interests among countries**

- **Future Prospects**
- **Expansion of agreements**
  - **New partnerships**
  - **Increased trade volume**



Notable Copper Mines

Escondida Mine, Chile

World's Largest Copper Mine: The Escondida mine's status as the largest copper mine underscores its significance in global copper production.

Operational Scale: The mine's annual output and operational scale contribute significantly to Chile's dominance in copper mining.

Challenges and Innovations: Addressing environmental and operational challenges, the Escondida mine exemplifies the industry's pursuit of sustainable practices.

Morenci Mine, United States

- **Historical Legacy: The Morenci mine's historical legacy and continued operations reflect the enduring significance of copper mining in the U.S.**
- **Technological Advancements: The integration of advanced technologies and sustainable practices characterizes the mine's modern operations.**

- **Community Engagement: The Morenci mine's engagement with local communities exemplifies the social and economic impact of copper mining.**

Oyu Tolgoi Mine, Mongolia

- **Global Significance: The Oyu Tolgoi mine's emergence as a major copper producer highlights Mongolia's growing presence in the global mining landscape.**
- **International Collaboration: The mine's development involves international partnerships and investments, shaping its operational and economic dynamics.**
- **Sustainable Development: Oyu Tolgoi's commitment to sustainable development aligns with global trends in responsible mining practices.**

Grasberg Mine, Indonesia

- **Complex Operations: The Grasberg mine's complex operations and unique geological characteristics present distinctive challenges and opportunities in copper mining.**
- **Environmental Considerations: Addressing environmental impacts and conservation efforts is integral to the mine's long-term operational strategy.**
- **Economic and Social Impact: The Grasberg mine's contributions to local economies and communities underscore the multifaceted impact of copper mining.**

major copper-producing countries and regions:

Chile: The world's leading copper producer, accounting for

approximately 28% of global copper mine production. Chile has some of the largest copper reserves in the world and is home to several major copper mines.

Peru: Another significant producer in South America, with copper being one of its main exports. Peru's copper production ranks among the top in the world.

China: While China is not among the top copper reserve holders, it is a major producer and the world's largest consumer of copper due to its extensive industrial and infrastructure development.

Democratic Republic of Congo (DRC): Africa's largest copper producer, with significant reserves and several active mining projects.

United States: Despite a decline in production, the United States remains a significant copper producer, with major mines located in Arizona, Utah, New Mexico, and Montana.

Australia: Known for its vast mineral resources, Australia is a substantial copper producer with significant exports.

Zambia: Often referred to as the "Copperbelt," Zambia is a major African producer of copper, with the industry playing a crucial role in its economy.

Russia: Russia has significant copper reserves and is among the top producers globally, with major mining operations contributing to its status as a key player in the copper market.

- **Mexico:** With its rich mineral deposits, Mexico ranks among the top copper-producing countries, contributing to the global supply of this essential metal.
- **Kazakhstan:** Although better known for its oil and uranium, Kazakhstan also has significant copper reserves and is a notable

producer.

The Namdapha National Park

- **The Namdapha National Park and Tiger Reserve, located in the northeastern state of Arunachal Pradesh in India, is a significant protected area known for its rich biodiversity and as a critical habitat for the Bengal tiger.**
- **Established in 1974, the park covers an area of approximately 2,000 square kilometers and is situated in the eastern Himalayas, bordering Myanmar.**
- **Namdapha is notable for its diverse ecosystems, which include tropical rainforests, sub-tropical forests, temperate broadleaf forests, coniferous forests, and alpine meadows.**
- **This diversity supports a wide array of flora and fauna, making it one of the richest biodiversity hotspots in the country.**
- **The park is home to numerous species of mammals, birds, reptiles, amphibians, and plants, many of which are endemic or threatened.**
- **The Bengal tiger is a key species in the reserve, and conservation efforts are focused on protecting this apex predator and its habitat.**
- **The park also supports other large mammals such as the Indian elephant, gaur, and several species of deer, as well as a variety of smaller mammals and birds.**
- **Namdapha National Park is also recognized for its importance in preserving tribal cultures and traditional practices of the local communities, who have**

State/UT	National Park	Year of Establishment	Area (km2)
1. Ladakh	Hemis NP	1981	3,350.00
2. Rajasthan	Desert NP	1992	3,162.00
3. Uttarakhand	Gangotri NP	1989	2,390.02
4. Arunachal Pradesh	Namdapha NP	1983	1,807.82
5. Sikkim	Khangchendzonga NP	1977	1,784.00
6. Chhattisgarh	Guru Ghasidas (Sanjay) NP	1981	1,440.71
7. West Bengal	Sunderban NP	1984	1,330.10
8. Chhattisgarh	Indravati (Kutru) NP	1982	1,258.37
9. Andhra Pradesh	Papikonda NP	2008	1,012.86
10.Madhya Pradesh	Kanha NP	1955	940.00

The Union government launched the National Pest Surveillance System (NPSS) powered by artificial intelligence (AI) to help farmers to connect with agriculture scientists and experts by mobile phones for controlling pests.

The NPSS will analyse latest data using AI tools to help farmers and experts in pest control and management.This system will help in identifying pests and controlling them. The benefit of this technology must go to farmers

This system can help cure diseases at the proper time using technology. It will help in accurate diagnosis and accurate treatment. This will build confidence among farmers and production will also increase.

This can save the soil too. It is a technological platform and needs no

additional funding,

All About Wolbachia Bacteria

Overview

Wolbachia is a genus of bacteria that infects a wide variety of arthropods, including insects and nematodes.It is known for its role in influencing the reproductive processes of its hosts.

Key Aspects of Wolbachia Bacteria

Infection Types:

***Diversity*: Various strains infect different species.**

***Supergroups*: Classified into different groups (A, B, etc.).**

Effects on Hosts:

***Male Sterility*: Causes reproductive issues in male hosts.**

***Asexual Reproduction*: Induces asexual reproduction in some insects.**

***Enhanced Fertility*: Can increase fertility in certain insect hosts.**

Applications in Disease Control:

***Dengue Control*: Utilized in genetically modified mosquitoes to combat dengue fever.**

***Zika Virus*: Research shows potential in fighting Zika virus through mosquito**

modification.

Research Studies:

- ***Antiviral Effects*: Studies examining how Wolbachia might protect insects from viruses.**
- ***Horizontal Gene Transfer*: Investigates the transfer of Wolbachia between different species.**

Recent Discoveries and News

- ***Brazil's Initiative*: Using Wolbachia-infected mosquitoes to combat dengue outbreaks.**
- ***Ecological Impact*: Exploring the role of Wolbachia in mosquito populations and its effects on ecosystems.**
- ***Scientific Community*: Ongoing research to understand its full potential in controlling diseases.**

Figure 1.1: mindmap

One of the most significant impacts of Wolbachia is its ability to spread through populations of its hosts by manipulating their reproduction in various

ways:

Cytoplasmic Incompatibility (CI): This is the most common effect of Wolbachia infection. It results in the inability of uninfected females to produce viable offspring when mated with Wolbachia-infected males. However, Wolbachia-infected females can reproduce with both infected and uninfected males, giving them a reproductive advantage. This leads to the rapid spread of Wolbachia through insect populations.

Feminization: In some species, Wolbachia can convert genetically male embryos into phenotypic females, leading to a population with a high proportion of females, which can be beneficial for the spread of Wolbachia.

Parthenogenesis Induction: Certain Wolbachia strains can induce parthenogenesis (reproduction without fertilization) in their hosts, allowing infected females to reproduce asexually, which can lead to uninfected males becoming rare in the population.

Male Killing: In some cases, Wolbachia can cause the death of male hosts during embryonic development, resulting in a population with a high proportion of females.

For example, Wolbachia-infected Aedes aegypti mosquitoes have been released in some areas to reduce the transmission of dengue fever and other diseases, as Wolbachia can interfere with the ability of these mosquitoes to transmit viruses.

Overview of wMelPop Strain

- **Definition: A strain of *Wolbachia* bacteria**

- **Primary Hosts:** Mosquitoes, particularly *Aedes aegypti*
- **Significance:** Used for controlling mosquito-borne diseases like dengue and Zika

Mechanisms of Action

Cytoplasmic Incompatibility:

Affects reproduction between infected and uninfected mosquitoes

Virus Inhibition:

Reduces transmission rates of viruses (e.g., dengue, Zika)

Parasite Reduction:

Lowers parasite levels in mosquitoes

Applications

Disease Control:

Integrated pest management strategies

Release of wMelPop-infected mosquitoes to reduce disease transmission

- **ISRO's Small Satellite Launch Vehicle-03 (SSLV-D3)**

Overview

Objective: To successfully launch small satellites into orbit.

Significance: Enhances India's capabilities in satellite launches and boosts commercial prospects.

Key Features

Launch Date: August 16, 2024.

Mission Type: Earth Observation Satellite.

Developmental Flight: Final flight of the SSLV series.

Mission Details

Rocket Type: SSLV (Small Satellite Launch Vehicle)

Payload: EOS-08 Earth Observation Satellite.

Launch Site: Satish Dhawan Space Centre, Sriharikota.

Technical Specifications

Payload Capacity: Up to 500 kg to Sun-Synchronous Orbit (SSO).

Launch Duration: Shorter preparation and turnaround time compared to previous models.

Flexibility: Quick deployment for client satellites.

Market Impact

Commercial Launches: Opens new avenues for small satellite commercial launches.

Global Positioning: Establishes ISRO as a competitive player in the international launch market.

Future Prospects

Further Developments: Potential for enhanced SSLV variants.

International Collaborations: Opportunities for partnerships in satellite launches.

- **The Indian Space Research Organisation on Friday launched the EOS-08 Earth Observation Satellite on board the Small Satellite Launch**

Vehicle (SSLV-D3) from the Satish Dhawan Space Centre (SDSC) in Sriharikota.

- **EOS-08 is a first-of-its kind mission built on a standard ISRO's Microsat/ IMS-1 bus with a suite of advanced payloads for observation in the IR range, novel GNSS-R Payload and SiC UV dosimeter.**
- **The satellite boasts a host of new technological developments in satellite mainframe systems like an Integrated Avionics system Communication, Baseband, Storage and Positioning (CBSP) Package, Structural panel embedded with PCB, embedded battery, Micro-DGA (Dual Gimbal Antenna),**

Illegal Mining in Aravali

Overview of Illegal Mining

Definition: Unregulated extraction of minerals without permission.

Environmental Impact:

Erosion

Biodiversity Loss

Water Pollution

Legal Actions:

Supreme Court orders to halt illegal mining.

Directions to state governments for strict enforcement.

Causes of Illegal Mining

Economic Factors:

Poverty in surrounding areas

High demand for minerals

Weak Enforcement:

Corruption in regulatory bodies

Lack of resources for monitoring

Consequences of Illegal Mining

Social Issues:

Displacement of communities

Unsafe working conditions for miners

Ecological Damage:

Destruction of habitats

Altered water tables

Recent Developments

Court Rulings:

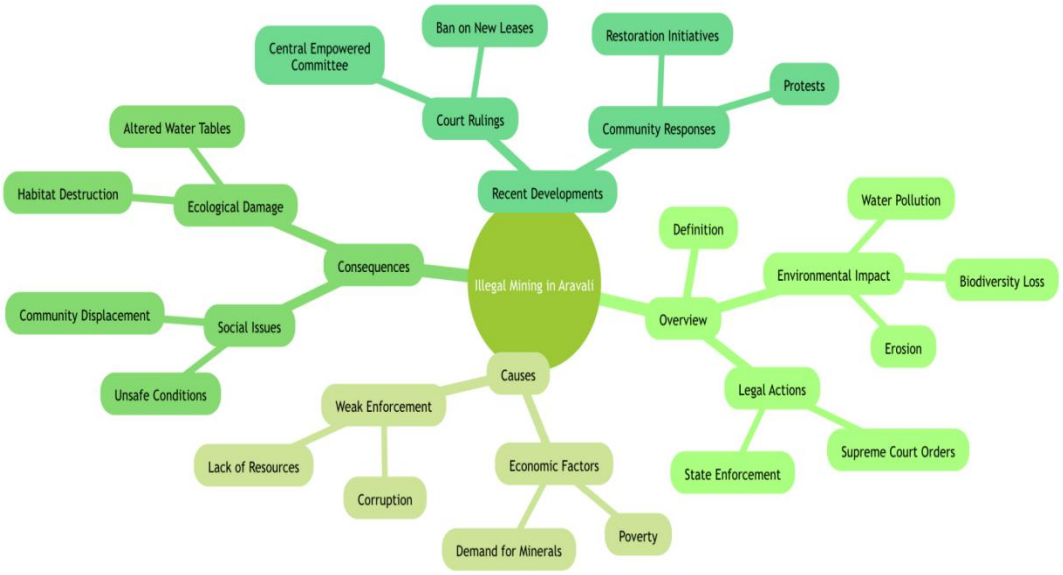
Ban on new mining leases in Aravali.

Examination of mining practices by Central Empowered Committee.

Community Responses:

Protests advocating for environmental protection.

Local initiatives to restore affected areas



Lidar Technology

Overview of Lidar Technology

Definition: Lidar (Light Detection and Ranging) technology uses laser light to measure distances and create high-resolution maps.

Applications: Widely used in autonomous vehicles, environmental monitoring, agriculture, and urban planning.

Applications of Lidar Technology

Autonomous Vehicles:

Navigation and obstacle detection

Accurate 3D mapping for route planning

Environmental Monitoring:

i. **Forest mapping**

ii. **Coastal and flood monitoring**

Urban Planning:

i. **Infrastructure development**

ii. **Smart city initiatives**

Challenges and Considerations

Cost: High production costs limit accessibility.

Regulatory Issues: Compliance with safety standards and regulations.

Technological Integration: Challenges in integrating lidar with existing systems.

Future of Lidar Technology

Innovations: Advancements in sensor technology and data processing.

Market Growth: Anticipated growth in adoption across multiple sectors.

Sustainability: Potential for environmental applications to support climate initiatives

Krishi-Decision Support System (DSS)The Union

Agriculture Ministry launched a digital geo-spatial platform, Krishi-Decision Support System (DSS), which will share realtime data-driven insights on weather patterns, soil conditions, crop health, crop acreage, and advisories with all stakeholders such as farmers, experts, and policymakers.

The Ministry said the system was "a significant milestone" in the country's agricultural innovation landscape. The platform provides seamless access to comprehensive data, including satellite images, weather information, reservoir storage, groundwater levels, and soil health information.

Overview of Phygital

Definition: Integration of physical and digital experiences

Importance: Enhances customer engagement and satisfaction

Trends: Growing adoption across various industries

Applications of Phygital

Retail:

Phygital Stores: Merging online and offline shopping experiences

Interactive Displays: Engaging customers with digital interfaces

Banking:

Phygital Branches: Combining in-person services with digital solutions

Events:

Hybrid Experiences: Blending physical events with online participation

Entertainment:

Gaming: Integration of real-world elements in digital platforms (e.g., Roblox)

Benefits of Phygital

Customer Engagement:

Personalized experiences

Increased interaction and satisfaction

Data Collection:

Insights from customer behavior analysis

Competitive Advantage:

Differentiation in the market

Challenges of Phygital

Technology Integration:

Ensuring seamless connectivity between platforms

Cost:

Investment in technology and infrastructure

User Adoption:

Encouraging customers to embrace new experiences

Future of Phygital

Potential Growth:

Expanding into new sectors (e.g., healthcare, education)

Innovation:

Continuous evolution of technology and customer expectation

Defence in news

Defence Minister Rajnath Singh inaugurated a new Maritime Rescue Coordination Centre (MRCC) of the Coast Guard in Chennai .At the event, he also inaugurated two new Coast Guard units the Regional Marine Pollution Response Centre (RMPRC) in Chennai and a Coast Guard Air Enclave in Puducherry

Like the heart, the brain has electrical activity, too.

A functional magnetic resonance imaging (fMRI) machine can capture this activity and the way it changes over time through electric signals.

In those with mental illness, the underlying brain circuits that connect different regions don't activate normally.

One region can have more intense electrical activity than it does in a healthy person.

Overview

Definition: A medical imaging technique used to visualize internal structures of the body.

Applications: Diagnosing diseases, planning treatments, and monitoring the effectiveness of therapies.

Advantages: No ionizing radiation, high-resolution images, and ability to view soft tissues.

Key Areas

Types of MRI

Functional MRI (fMRI): Measures brain activity by detecting changes associated with blood flow.

Cardiac MRI: Evaluates heart structures and functions.

Magnetic Resonance Angiography (MRA): Imaging of blood vessels using MRI techniques.

Clinical Uses

i. **Neurology: Diagnosing conditions like multiple sclerosis and brain tumors.**
ii.
iii. **Orthopedics: Assessing joint and soft tissue injuries.**
iv.
v. **Cardiology: Evaluating heart diseases and conditions.**

Technological Advances

Artificial Intelligence in MRI

Enhances image analysis and diagnosis accuracy.

Automates processes for efficiency.

Recent Research Innovations

AI-enabled cardiac MRI for cardiovascular disease screening:

Non-invasive mapping of brown adipose tissue

Challenges

Cost: High cost of MRI machines and procedures.

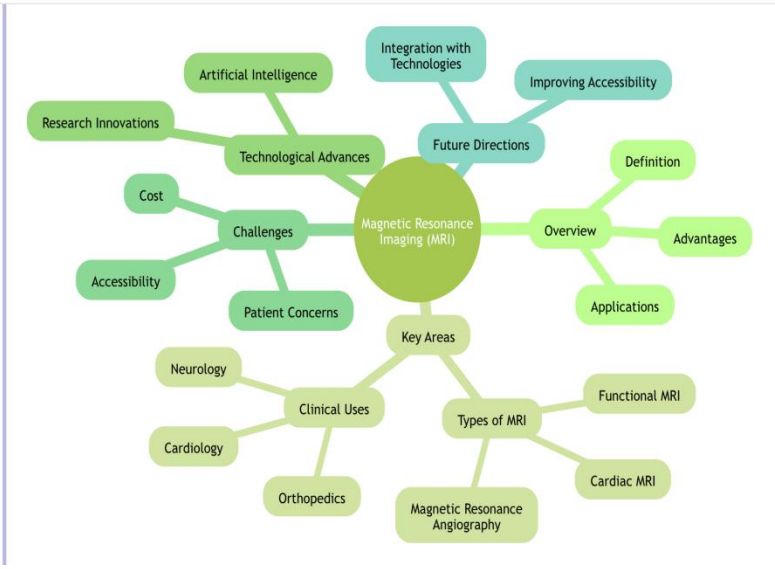
Accessibility: Limited availability in rural areas.

Patient Concerns: Claustrophobia and anxiety during scans.

Future Directions

Improving Accessibility: Developing portable MRI machines.

Integration with Other Technologies: Combining MRI with EEG and other imaging techniques for better diagnostics.



Blue Moon

on April 5, 1815, Mt. Tambora in contemporary Indonesia produced the most powerful volcanic eruption in recorded history.

The previous year, the Mayon volcano had erupted powerfully in the Philippines.

The effects of these volcanoes, combined with other climatic factors, lowered the temperature of the earth by 0.4–0.7 °C in 1816, producing what has since been called the "year without summer".

The dust and other small particles lingering in the air could have caused the moon to look blue,

Riptides

Overview of Riptides

Definition: Strong currents created by the movement of water.

Causes: Waves, tides, and underwater topography.

Locations: Commonly found at beaches and coastal areas.

Safety Concerns

Drowning Risks: Riptides can pull swimmers away from shore.

Increased Incidents: Recent news highlights the danger during storms.

Lifeguard Shortages: Many beaches face staffing issues affecting safety.

Dark Commercial Patterns

Overview of Dark Commercial Patterns

Definition: Dark patterns are user interface elements designed to trick

users into actions they might not want to take.

Examples: Misleading buttons, hidden opt-out options, and aggressive upselling.

Dark patterns manipulate user behavior to benefit businesses, often at the expense of consumer choice.

Types of Dark Patterns

Forced Continuity: Users are charged after a free trial without clear reminders.

Hidden Costs: Additional fees that appear late in the checkout process.

Bait and Switch: Advertising a product at a low price that isn't available, pushing users toward a more expensive option

Regulation of Dark Patterns

Current Laws: Review of existing regulations targeting deceptive practices.

Proposed Changes: Discussion of potential new regulations at national and international levels.

Tugboats play

Tugboats play a crucial and versatile role in marine transport, providing essential services that ensure the safety, efficiency, and environmental protection of maritime operations.

These powerful vessels are designed to tow, push, and maneuver larger ships,

barges, and other floating objects in various waterways, including harbors, rivers, and open seas.

Why the Recent Earthquake in Russia?

Location: Russia's Far East, specifically near the Kamchatka Peninsula.

Magnitude: Recent earthquake measured 7.0 on the Richter scale.

Aftermath: Triggered volcanic eruptions, notably of the Shiveluch volcano.

Causes of the Earthquake

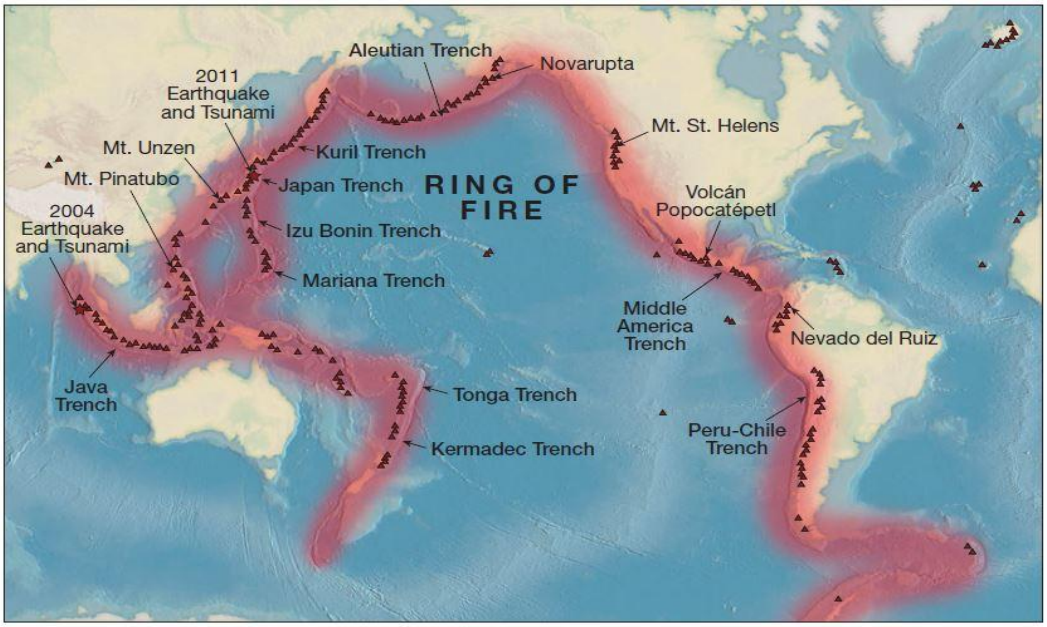
Tectonic Activity:

Movement of tectonic plates in the region.

Subduction zones contributing to seismic activity.

Historical Patterns:

Russia's Far East is known for its seismic history.



Impacts of the Earthquake

Volcanic Eruptions:

Eruption of Shiveluch volcano following the quake.

Ash clouds reported to rise 5 miles high.

Tsunami Warnings:

Initial warnings issued but later lifted.

The Shiveluch volcano

The Shiveluch volcano is an active stratovolcano located in the Kamchatka Peninsula in the far eastern part of Russia. It is one of the most active volcanoes in Kamchatka, which is a region known for its high concentration of volcanoes due to its location on the Pacific Ring of Fire. The volcano is situated in the central part of the peninsula and is part of the Kamchatka Volcanic Arc, which is a chain of volcanoes formed by the subduction of the Pacific Plate beneath the Okhotsk Plate.

Mapping

Seym River

Overview

Location: Eastern Europe, flows through Russia and Ukraine

Length: Approximately 840 km

Importance: Vital for local ecosystems, agriculture, and transportation

Recent Events

Military Actions: Ongoing conflicts affecting the region, including bridge destruction

Environmental Impact: Changes in water quality and ecosystem due to military activities. The Seym River is a river located in the western part of Russia, in the Yaroslavl Oblast. It is a right tributary of the Volga River, one of the major rivers in Europe. The Seym River is a part of the Volga-Baltic Waterway, which connects the Volga River to the Baltic Sea via the Neva River and Lake Ladoga.

This waterway is of historical significance as it was an important trade route in the past, and it continues to be used for navigation and recreational purposes. Seym River flows through several small villages and towns, including the town of Myshkin, which is situated on the Volga River near the confluence with the Seym

Mapping in news

Kursk is a city and the administrative center of Kursk Oblast, a region in

western Russia.

Snowball Earth Concept

The Snowball Earth hypothesis suggests that the Earth was once completely or nearly completely frozen.This event likely occurred during the Cryogenian period (approximately 720 to 635 million years ago).

Causes

Tectonic Activity

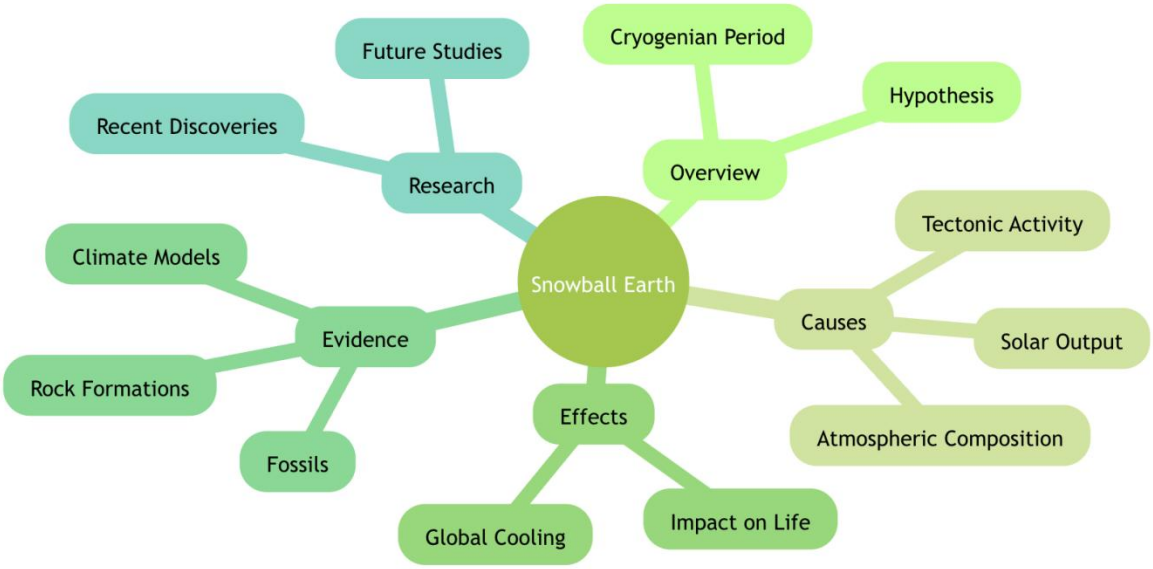
- **Movement of continents affecting ocean currents.**
- **Solar Output ☀**
- **Changes in the sun's energy output**
- **Atmospheric Composition**
- **Elevated levels of CO_2 leading to a cooling effect.**

Effects

- **Global Cooling**
  - **Drastic drop in temperatures affecting ecosystems.**
- **Impact on Life**
  - **Possible mass extinction events and evolution of multicellular organisms.**

Mapping

The Port Askaig Formation is a geological formation located in Scotland, primarily recognized for its significance in the study of the Snowball Earth hypothesis.



Zoopharmacognosy

'Zoopharmacognosy: the self-medication behaviour of animals, Dogs medicate themselves by chewing grass and vomiting it to get rid of infections in the stomach.

Pregnant lemurs nibble on tamarind leaves to aid milk production, and pregnant elephants in Kenya eat the leaves of some plants of the Boraginaceae family to induce delivery.

The medicinal plant Fibrourea tinctoria that the Sumatran orangutan used for wound healing contains the anti-inflammatory molecule berberine.

Called 'Akar Kunyi' locally, the plant is used in the traditional medical system there.

And in the southern subtropical regions, its equivalent is called Oleander and is used as a curative for jaundice. The shrub aloe vera, which is found in India (where it is called 'gwar patta' in Hindi and 'katrazhai' in Tamil) and many parts of Asia and Africa, has antimicrobial, anti-inflammatory, and wound

healing properties.

China has had the Zhongyi system for the past 5,000 years, Arabia for 4,000 years, and the Indian Ayurvedic system for 5,000 years. They all use various plants, fruits and roots such as Rauwolfina serpentina (sarpagandha in Hindi), holy basil (tulsi), aloe vera, wild garlic, onion, oregano, artichokes, camphor, coconut, and castor oil.

Demchok

Demchok is a border area between India and China, located in the Ladakh region of Jammu and Kashmir, which is administered by India. The area is part of the larger Sino-Indian border that has been a source of tension between the two countries for decades.

Demchok is significant not only because of its strategic location but also because it is one of the few places along the Line of Actual Control (LAC)—the de facto border between India and China—where both sides have civilian settlements in close proximity to each other.

The region is inhabited by nomadic herders from both countries, and the settlements are separated by the LAC.

The dispute over Demchok, as with other areas along the Sino-Indian border, stems from differing interpretations of historical treaties and agreements, as well as the lack of a clearly demarcated border in some areas.

Clean Ganga Mission

Overview

Objective: To rejuvenate the Ganges River and improve water quality

Stakeholders: Government, NGOs, local communities, and international bodies.

The Clean Ganga Mission aims to clean the Ganges River, addressing pollution and restoring its ecology for future generations.

Key Components

Project Management

- **Leadership and Coordination**
- **Funding and Budgeting**
- **Monitoring and Evaluation**

Pollution Control

- **Sewage Treatment Plants (STPs)**
- **Industrial Waste Management**
- **Riverbank Cleaning Initiatives**

Public Awareness

- **Community Engagement Programs**
- **Educational Campaigns in Schools**
- **Involvement of Local Residents**

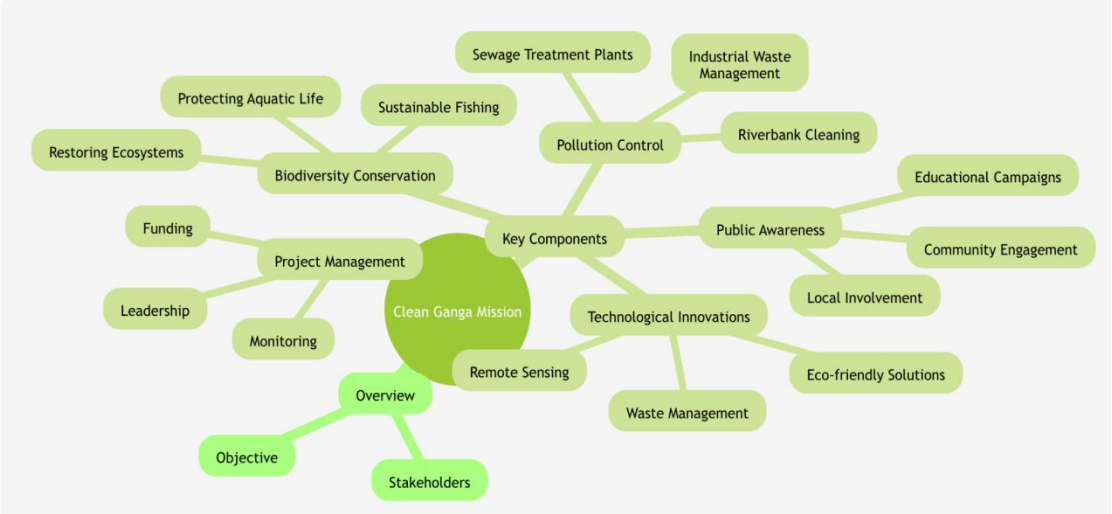
Biodiversity Conservation

- **Protecting Aquatic Life**
- **Restoring River Ecosystems**
- **Sustainable Fishing Practices**

Technological Innovations

- **Remote Sensing and Monitoring Technologies**
- **Waste Management Technologies**

Eco-friendly Practices and Solutions



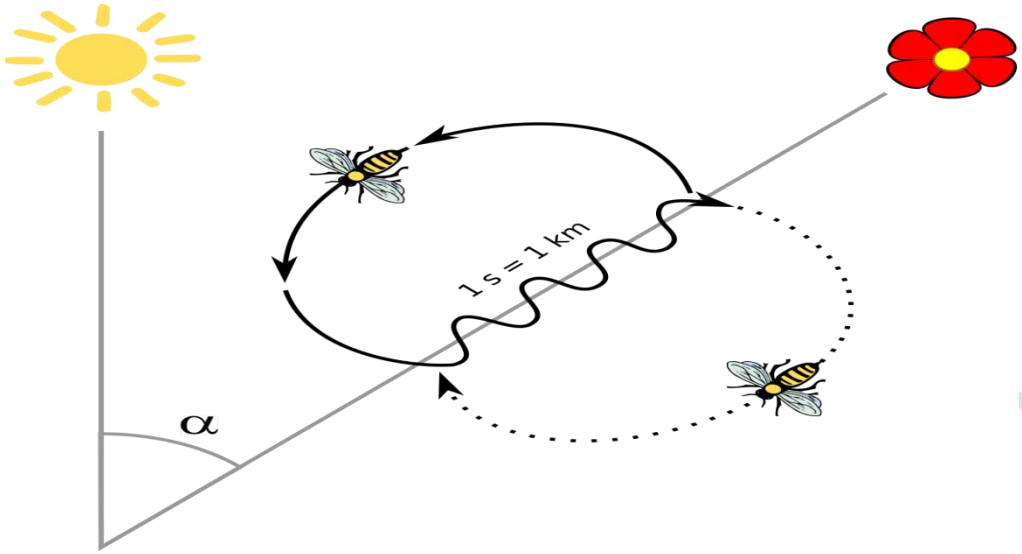
The waggle dance

The waggle dance Bees use two kinds of dances to communicate information: the waggle dance at the heart of the new controversy and the circle dance.

The purpose of either dance is for some honey bees to communicate to others the location of a flower patch with more nectar or pollen. One bee dances while the others watch it to figure out the directions.

During a waggle dance, the bees move in a figure of eight formation, roughly, while in a circle dance, the bees move in a circle.

The waggle dance indicates both the distance and the direction to the patch. In this the straight line in the roughly figure of eight formation is called the waggle run. The circle dance indicates only the distance to the hive.



What is the Godda project?

- **The Jharkhand-subsidiary of Adani Power supplies 1,496-megawatt net capacity power to Bangladesh from the ultra super-critical thermal power plant in Godda.**
- **This is facilitated under a Power Purchase Agreement (PPA) entered with the Bangladesh Power Development Board (BPDB) in November 2017 for a period of 25 years.**
- **The Godda plant is India's first transnational power project that supplies all the power generated to another nation.**

  In a statement on July 15 last year, Adani Power stated that the electricity supplied from Godda will have a positive impact on the neighbour's power situation by replacing costly power generated using liquid fuel.

  It elaborated that the transition would help reduce the average cost of power purchased.

Why was the project criticised?

- **The criticisms emanated from the use of coal imported from the Carmichael mine in Australia into India to produce power for Bangladesh.**
- **Thermal plants utilise coal as a primary fuel.**

  India's South Asian neighbour continues to experience fuel and gas supply constraints, thus, contributing to the underutilisation of its power plants.

Banni grassland

Unique Ecological Landscape: The Banni grasslands, spanning over 3,000 square kilometers, form one of the largest expanses of grassland in the Indian subcontinent. Situated in Gujarat's Kachchh district, this region is renowned for its rich biodiversity and unique ecological features, providing a valuable learning opportunity for students to understand diverse ecosystems.

Cultural Significance: The grasslands are not only a vital ecosystem but also hold cultural significance, being inhabited by pastoral communities that have a deep connection to the land and its resources, offering insights into the intersection of human societies and natural environments.

Legal Protection: The Banni grasslands are legally protected under the Banni Grassland Reserve, ensuring the preservation of this critical ecological area and providing a case study for the importance of conservation efforts.

Geographic and Environmental Characteristics

Location and Landscape: Situated along the northern border of Kachchh district, the Banni grasslands boast a diverse landscape, including scrub forests and wetlands, contributing to its ecological richness. Understanding the geographical features and environmental conditions of the grasslands is

essential for comprehending the factors influencing biodiversity.

Biodiversity Hotspot: The region's unique environmental conditions support a wide array of flora and fauna, making it a hotspot for biodiversity and wildlife conservation efforts, offering students an opportunity to explore the interconnectedness of species and their habitats.

Challenges and Threats: Despite its ecological significance, the Banni grasslands face threats from factors such as invasive species and land degradation, necessitating conservation measures, providing a real-world context for environmental challenges and solutions.

Human-Environment Interaction

- **Pastoral Communities: The grasslands are home to pastoral communities, such as the Jat, Mutwa, Hingora, and Hingorja tribes, whose traditional livelihoods are intricately linked to the sustainable use of the grassland resources, offering insights into the coexistence of human communities and natural landscapes.**
- **Livestock Grazing: The symbiotic relationship between the pastoralists and the grasslands is characterized by sustainable livestock grazing practices, which have shaped the ecological dynamics of the region for generations, providing a case study for sustainable land use practices.**
- **Cultural Heritage: The Banni grasslands are not only an ecological treasure but also a repository of cultural heritage, with the pastoral communities' traditions and knowledge contributing to the sustainable management of the landscape, highlighting the importance of indigenous knowledge in conservation.**

Sabina Shoal

Context of Sabina Shoal

Location: Disputed area in the South China Sea

Involved Parties:

China

Philippines

Recent Incidents: Collisions between ships from China and the Philippines

Key Events

Collision Incidents:

Chinese and Philippine ships collide near Sabina Shoal.

Accusations exchanged between China and the Philippines over the collisions.

Diplomatic Tensions:

Ongoing tensions over territorial claims in the South China Sea.

Military maneuvers and responses from both countries.

Implications

Regional Stability: Potential flashpoints for conflict in the South China Sea.

International Relations: Impact on US-Philippines alliances amidst

rising tensions with China.

Latest news highlights the ongoing maritime disputes in the South China Sea, particularly around Sabina Shoal.

Jupiter Icy Moon Explorer Mission

Overview

Objective: Explore Jupiter's icy moons, particularly Europa, Ganymede, and Callisto.

Mission: Investigate potential habitability and search for signs of life.

Launch: JUICE (Jupiter Icy Moons Explorer) launched in April 2023.

Key Missions

Europa:

Assess subsurface ocean.

Analyze surface composition.

Ganymede:

Study magnetic field and ice shell.

Investigate potential habitability.

Callisto:

Understand impact history and surface evolution.

Technologies Used

Spacecraft: JUICE equipped with advanced instruments.

Instruments:

Cameras for imaging.

Spectrometers for chemical analysis.

Radar for subsurface exploration.

Scientific Goals

Habitability: Determine conditions for life.

Ocean Worlds: Study the dynamics of icy moons' oceans.

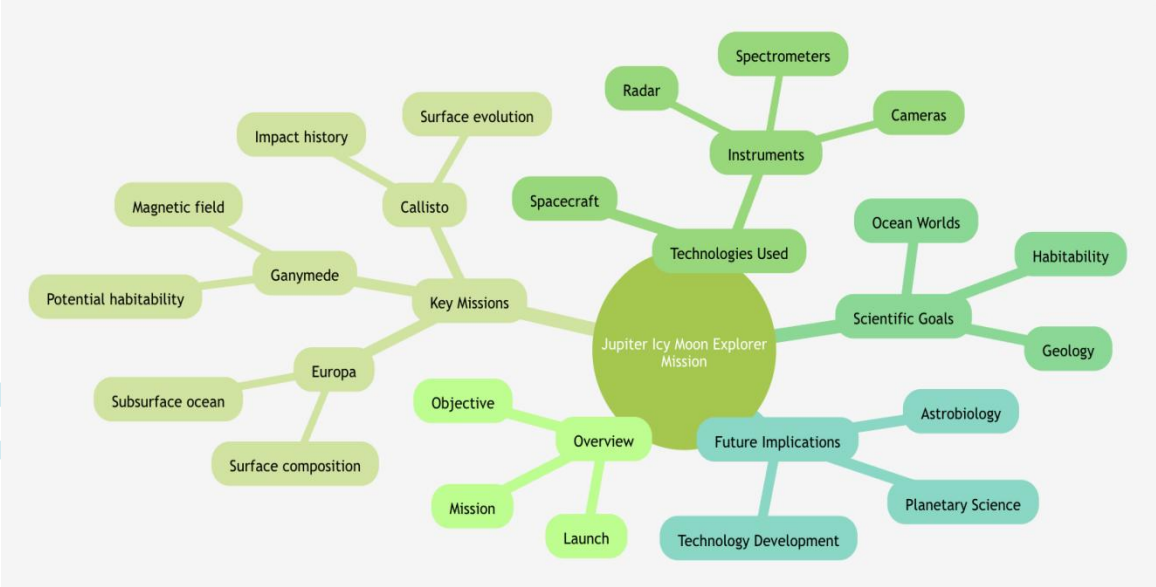
Geology: Investigate surface and subsurface processes.

Future Implications

Astrobiology: Insights into life's potential beyond Earth.

Planetary Science: Understanding the evolution of solar system bodies.

Technology Development: Advancements in space exploration technologies.



Sustainable mass employment

First, begin from below through decentralized community action, to identify skilling needs. Ownership by a community of State programmes only comes through direct community action.

The gram sabha or basti samitis in urban areas can play a critical role in taking government programmes to the people. The steps can be as follows: Create a register of all those wanting employment/self-employment.

Create a plan for every youth in partnership with professionals at the cluster level. Well-educated professionals are needed on fixed-term *appointment* at the local government level, to ensure evidence-based outcomes. Make it the basis for finding skill providers and employers.

Second, converge initiatives for education, health, skills, nutrition, livelihoods, and employment (at the local government level) with women's collectives.

This will ensure community accountability, with untied funds, functions and functionaries for effective quality outcomes.

Employment does not improve in isolation.

All human development indicators achieve better when they devolve and converge. Untied funds are transformational as communities make effective choices.

India's failures in public goods (education, health, nutrition, environment, and sanitation) can improve through such an approach. We need to put in more money in these sectors, through decentralized community action

Third, introduce need-based vocational courses/certificate programmes alongside undergraduate programmes (B.A., B.Sc., B. Com.) in every college.

Fourth, standardize nursing and allied health-care professional courses in all

States according to international benchmarks. Nurses, geriatric care-givers, and health paramedics are required on scale in and outside India

Fifth, create community cadres of care-givers to run crèches universally so that women can work without fear.

We have a four- to six-hour anganwadi service but the number of infants is more than what a crèche care-giver can manage.

Sixth, invest in Industrial Training Institutes (ITI), polytechnics as hubs in skill development for feeder schools.

The absence of quality and up-to-date infrastructure in many ITIs, polytechnics, and Rural Self Employment Training Institutes (RSETIs) is a very critical gap in an age of upskilling and re-skilling

Seventh, introduce enterprise and start-up skills through professionals in high schools. Schools need to introduce technology and enterprise as a subject at the upper primary/high school-level onwards.

Eighth, have a co-sharing model of apprenticeships with industry on scale. This is critical as far as manufacturing sector opportunities or even the services sector is concerned

Ninth, streamline working capital loans for women-led enterprises/rst-generation enterprises to enable them to go to scale.

Tenth, start a universal skill accreditation programme for skill providing institutions, and let the state and industry jointly sponsor candidates for courses. Skill providers can be accredited after a rigorous assessment process.

Eleventh, use 70% funds under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in 2,500 water-scarce blocks and blocks with high deprivation, with a thrust on the poorest 20 families.

Twelfth, apprenticeships on scale can facilitate the absorption of youth in a

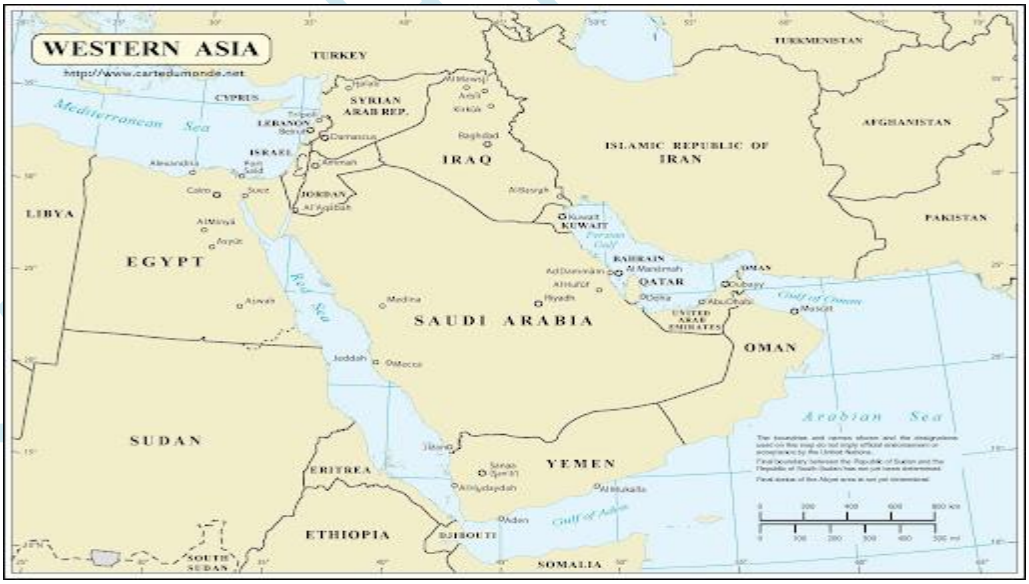
workplace. The scale must go up.

The focus must be on skill acquisition or else it can get routinised with a stipend being provided, merely as an incentive

US ,CHINA AND RUSSIA INTEREST IN WEST ASIA

U.S. Interests

- **Security and Stability: The United States seeks to maintain security and stability in West Asia to safeguard its interests, including the free flow of oil, counterterrorism efforts, and support for regional allies.**
- **Containment of Adversaries: U.S. policy aims to contain the influence of adversaries, particularly Iran, and counter the activities of non-state actors that pose a threat to regional and global security.**
- **Alliance Management: The U.S. maintains strategic alliances with countries such as Israel, Saudi Arabia, and the UAE, leveraging these partnerships to advance its geopolitical and security objectives**



Russian Interests

- **Military Presence: Russia has sought to expand its military presence in West Asia, particularly through its intervention in the Syrian civil war, which has bolstered its influence in the region.**
- **Energy and Arms Sales: The region's energy resources and arms market are of significant interest to Russia, which has pursued economic and strategic partnerships with countries such as Iran and Turkey.**
- **Geopolitical Balancing: Russia's engagement in West Asia serves as a means of countering U.S. influence and projecting power beyond its immediate sphere of influence in Eastern Europe.**

Chinese Interests

- **Belt and Road Initiative: China's ambitious Belt and Road Initiative (BRI) has led to increased economic engagement in West Asia, with a focus on infrastructure development, energy cooperation, and trade connectivity.**
- **Energy Security: West Asia's vast energy reserves are critical to China's energy security, prompting investments and partnerships with countries such as Saudi Arabia, Iran, and the UAE.**
- **Geopolitical Influence: China's growing influence in West Asia is part of its broader geopolitical strategy to expand its presence in regions of strategic importance and diversify its global partnerships.**

Regional Dynamics

- **Iran's Aspirations: Iran seeks to assert itself as a regional power, pursuing its interests through alliances, proxy groups, and its nuclear program, which has significant implications for regional stability and**

security.

- **Saudi-Iran Rivalry:** The rivalry between Saudi Arabia and Iran continues to shape the region's geopolitics, influencing conflicts in Yemen, Lebanon, and Iraq, and contributing to sectarian tensions.
- **Israeli-Palestinian Conflict:** The unresolved Israeli-Palestinian conflict remains a central issue in West Asia, impacting regional alliances, security dynamics, and international diplomacy.

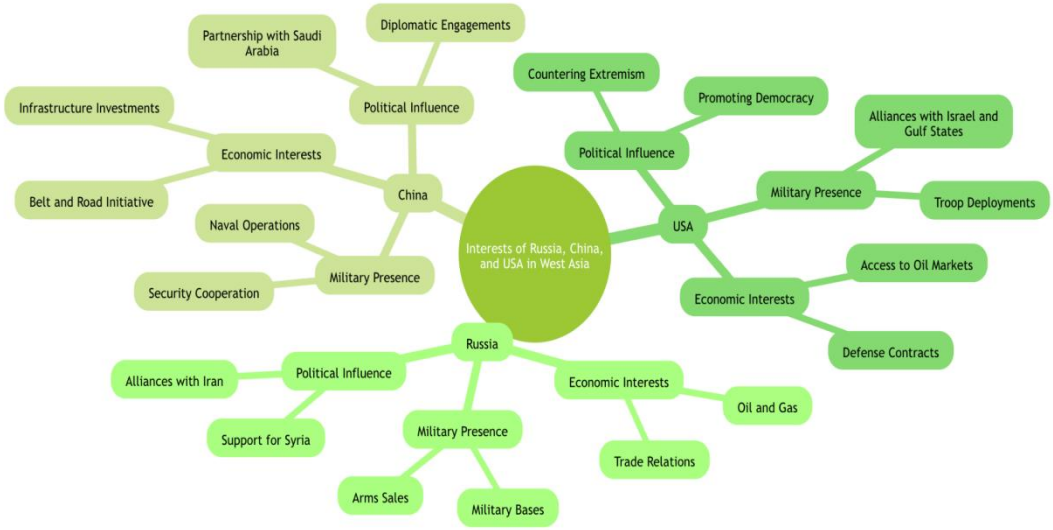


figure 1.2: table

Ethanol Blending Program of India

Overview

Ethanol Blending: Combining ethanol with petrol to reduce carbon emissions and improve energy security.

Goals: Achieve 20% blending by 2025.

Economic Impact: Significant foreign exchange savings and boost in local agriculture.

Key Aspects

Production Sources:

Sugarcane

Maize

Economic Benefits:

Saved ₹24,300 crore in 2022-23.

Aiming for increased local production.

Challenges

Feedstock Availability: Limitations on sugar feedstock usage.

Price Fluctuations: Possible price hikes for ethanol to encourage production.

Government Initiatives

Policy Support: Incentives to local farmers for raw material production.

International Collaboration: US offers assistance to enhance blending targets.

Future Outlook

Expanding Production: Plans to procure more maize for ethanol.

Sustainability Goals: Aligning with low-carbon future initiatives.

Analysis

India is on its way to achieve its target of blending 20% of petrol with ethanol by 2025-26, going by the milestones on blending percentages crossed so far and the increase in ethanol production capacity.

However, the food versus fuel equation continues to hang over the ethanol economy as recent events have shown. For example, maize import has increased from April to June of this year compared to last year at a time when maize has been used to produce more fuel ethanol to compensate for

restrictions on using sugarcane products

All the emphasis has been on first generation (1G) ethanol that is directly made from foodgrains and sugarcane. The government should diversify and move to 2G and 3G that are more benign in terms of impact on food security.

Sugarcane gives rise to three main related products sugarcane juice and syrup, B-heavy molasses and C-heavy molasses, in the order of decreasing sugar content.

The first two would typically go to making sugar while the third will be used for ethanol production. Expanding sugarcane production will have to be sustained by higher water use.

Expanding sugarcane cultivation would redirect irrigation water from essential food-grain crops, exacerbating concerns about agricultural sustainability, he says.Government policy is that maize as well as surplus rice and damaged grains will be used to feed grain-based distilleries.

India ranks as a major maize producer globally, but domestic consumption consistently outpaces production,

On fuel efficiency in automobiles

Ethanol will not only reduce greenhouse gas emissions, it will also prevent an estimated foreign exchange outgo of some $4 billion per year, as per Maruti Suzuki company estimates, and bolster the rural economy by promoting the cultivation of various crops through an assured market.

Many vehicle makers say the government deadline of E20 (20% ethanol and 80% gasoline) compliance is achievable, but questions remain over existing vehicles whose performance would be affected by higher ethanol content.

The NITI Aayog report notes that ethanol brought down fuel efficiency in vehicles not suited for ethanol by an average of 6%.

How different States view the policy

- **Meanwhile, the developing ethanol economy has impacted States differently.**
- **While the fuel ethanol pricing is the same across India, States determine the pricing of Extra Neutral Alcohol (ENA) that goes into making liquor for consumption and other uses.**
- **That pricing has been a decider for sugarcane-based distilleries in opting for highly pure fuel ethanol vis-a-vis ENA and other forms.**
- **An increase in sugarcane cultivation may not be possible because of water requirements.**
- **Maize is not water intensive. It degrades soil and cannot be the sole crop either. It can be used in rotation with sugarcane to ensure that soil fertility is not degraded," he says.**
- **Some half a dozen distilleries for fuel ethanol are on the drawing boards and at various stages of completion. Assuring feedstock supply can help to promote a non-sugarcane distillery base in the State.**

Extra Neutral Alcohol (ENA)

Overview of ENA

Definition: A highly purified form of alcohol used in the production of beverages and industrial applications.

Market Value: Expected to reach USD 18.1 Billion by 2034 due to rising demand for alcoholic beverages.

Extra Neutral Alcohol (ENA) is defined as a highly purified ethyl alcohol that is used primarily in the production of alcoholic beverages and as a

solvent in various industrial applications.

Key Factors Influencing ENA Market

Demand Drivers:

Increased consumption of alcoholic beverages

Growth in the beverage industry

Regulatory Factors:

Impact from GST laws and amendments

Exclusions from GST for ENA used in human consumption

The GST Council has ceded the right to tax extra neutral alcohol to states, indicating a significant shift in tax policy that may affect pricing and market dynamics.

Economic Impact

- **Budget 2024 Implications:**
  - Possible reduction in ENA prices due to exclusion from GST
  - Experts suggest lowering ENA costs will benefit the alcoholic beverage industry
- The lowering of costs for Extra Neutral Alcohol in the upcoming budget could potentially stimulate growth in the alco-beverage sector, making products more affordable for consumers

Challenges & Considerations

Taxation Issues: Ongoing discussions and potential changes in taxation could impact pricing and market stability

Supply Chain Constraints: Possible disruptions in raw material availability could affect production.

Recent discussions around alcohol tax and GST relief indicate a complex regulatory environment that businesses must navigate to remain competitive.

Future Trends

Market Growth: Anticipated growth driven by new product innovations and increased consumer preferences.

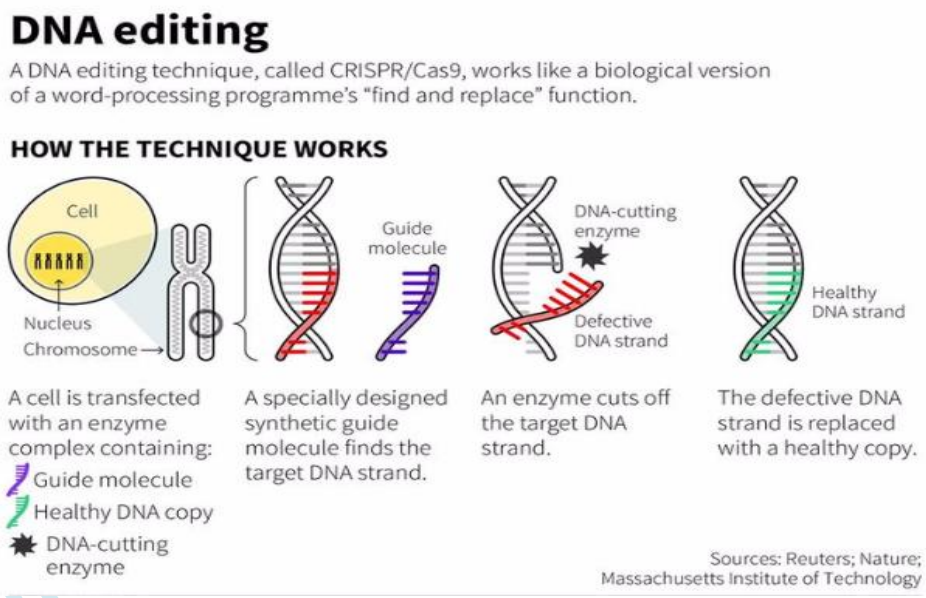
Sustainability: Focus on eco-friendly practices in production and sourcing of ENA ingredients

The Waorani people

- **The Waorani people, also known as the Huaorani or Waodani, are an indigenous group living in the Amazon rainforest, primarily in Ecuador. They are known for their traditional hunter-gatherer lifestyle and have historically lived in relative isolation from modern society.**
- **The Waorani have a unique culture and language, which is part of the Tucanoan language family.**
- **The Waorani's traditional territory spans across the Ecuadorian Amazon, an area rich in biodiversity and home to a variety of flora and fauna. Their lifestyle has been closely intertwined with the forest, relying on it for food, medicine, and shelter.**
- **The Waorani have a deep connection with and knowledge of their environment, which has been passed down through generations**

CRISPR AND AGRICULTURE

- **CRISPR holds the potential to revolutionise agriculture in particular by allowing agricultural scientists to increase crop yields and improve resistance to disease and anomalous weather through gene-editing.**
- **A commonly used form of the CRISPR system is too big for plant genomes.**
- **This system uses one of two proteins, Cas9 or Cas12, to target specific parts of the DNA. But they are too bulky for plant cells to accommodate.**
- **plant genome editor consisting of a protein called ISDra2TnpB, derived from bacteria called *Deinococcus radiodurans* (famous for being able to survive extreme environmental conditions).**
- **ISDra2TnpB is less than half the size of Cas9 and Cas12**

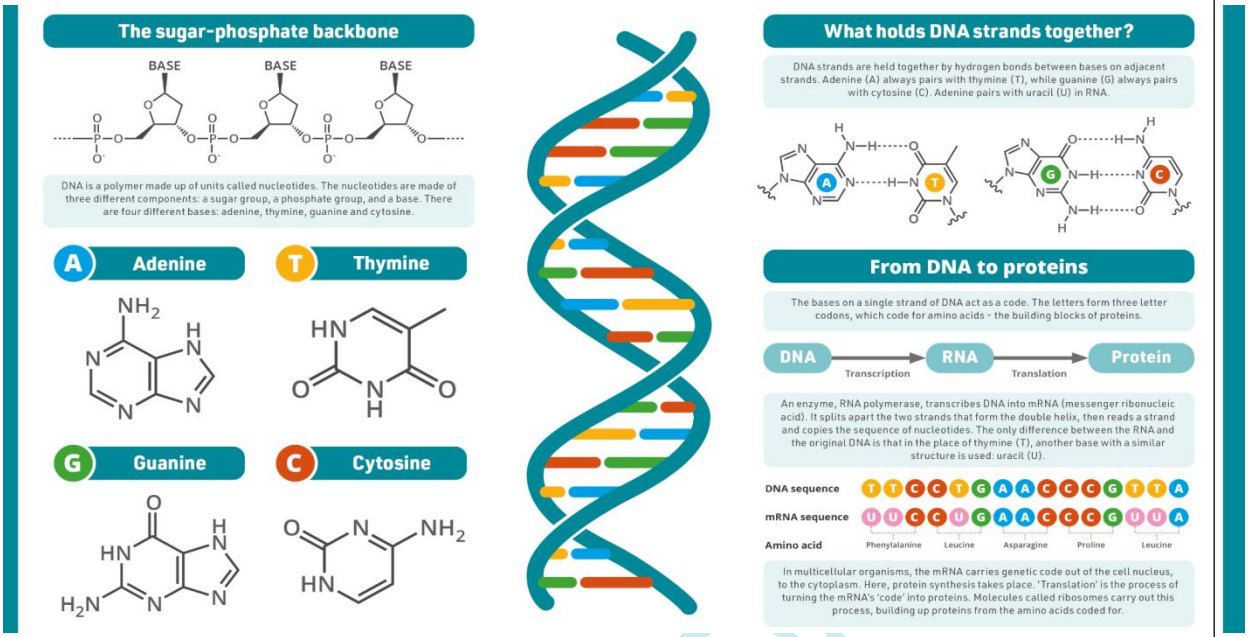


- **They reported developing a plant genome editor consisting of a protein called ISDra2TnpB, derived from bacteria called Deinococcus radiodurans (famous for being able to survive extreme environmental conditions). ISDra2TnpB is less than half the size of Cas9 and Cas12.**

- **"Currently, there are not many options available for plant genome editors, the improved TnpB certainly adds value.**
- **One should utilise the advantage of the size of TnpB in generating edited plants for various traits of interest,".**

TnpB's editing chops

- **TnpB is a protein made up of around 400 amino acid units (different combinations of the 20 amino acids make up all proteins). It belongs to a family of transposable elements, or transposons. Sometimes called "jumping genes", transposons are parts of a genome that can move from one location to another.**
- **The genome consists of two strands of DNA bonded to each other. Each strand is made up of building blocks called nucleotides.**
- **In turn, each nucleotide has three pieces; two are common to all of them whereas the identity of the third one can be one of four options: adenine (A), thymine (T), cytosine (C) or guanine (G).**
- **The DNA's 'sequence' refers to the order in which nucleotides containing these four compounds are arranged.**



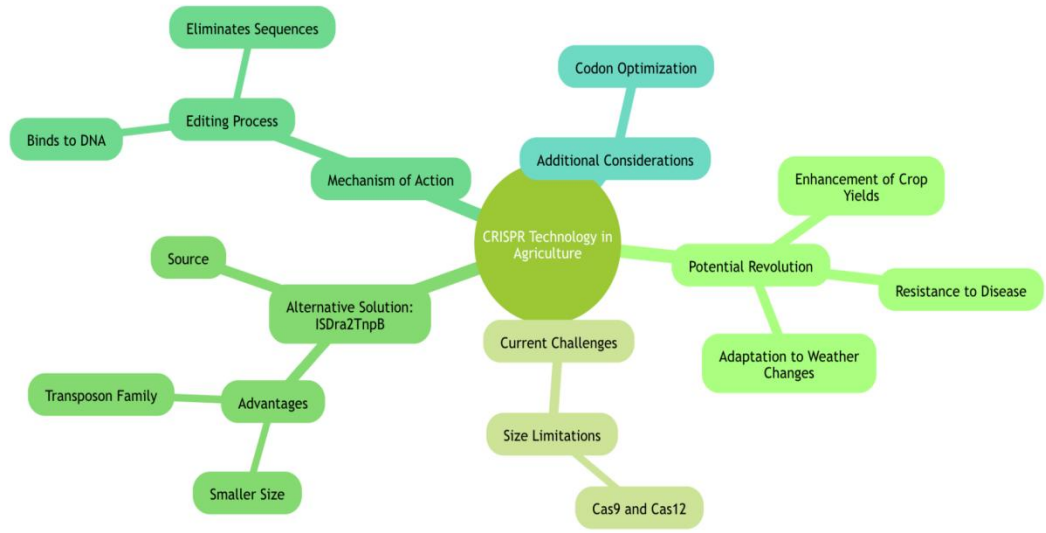
In the new system, TnpB hitches a ride on a piece of RNA that guides it to the target DNA sequence. Once there the TnpB binds with the sequence and eliminates it.

The cell that houses this DNA repairs the cut by restoring the "correct" sequence. Thus, the genome is modified to replace an undesirable sequence with a desirable one.

First, they used a process called codon optimisation.

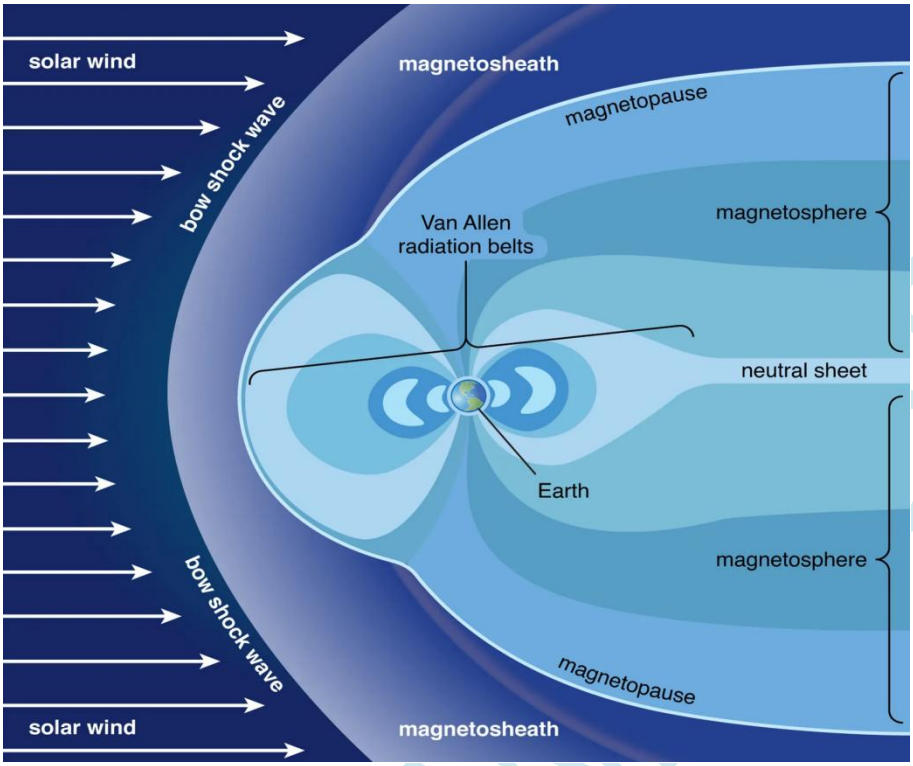
For example, cells in the body make the amino acid lysine by following an instruction in the genome represented by a sequence of three nucleotides. Such sequences of three are called codons.

The codon sequence that contains the recipe for lysine varies in different types of organisms. TnpB is a protein extracted from *D. radiodurans*, a prokaryotic bacteria, which has a different codon for lysine than do eukaryotes like plants



Van Allen radiation belts

- **The earth is surrounded by a bubble-shaped magnetic field that shields the planet from radiation from the Sun and other celestial objects. This field is called the earth's magnetosphere.**
- **During a solar storm, the Sun shoots out charged particles with more than usual energy through the space around it. Without the magnetosphere, these particles could have rendered life as we know it on earth impossible.**
- **But because the magnetosphere is there, these particles become trapped in it and zip around the earth rather than towards the ground in two large doughnut-shaped radiation belts in the upper atmosphere.**
- **These are called the Van Allen radiation belts.**
- **The American astrophysicist James Van Allen discovered these belts in 1958 and studied them in detail**

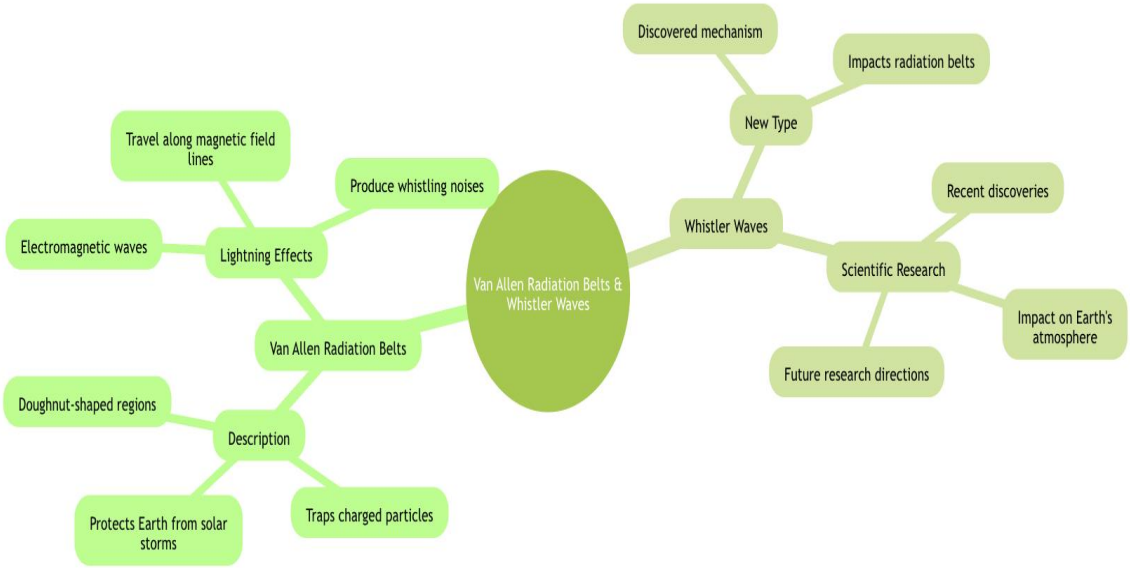


- **When lightning strikes, electrical energy flows in a path through the atmosphere that we see as a bolt.**
- **As it cuts through the air, the bolt releases its energy as electromagnetic waves with a range of frequencies.**
- **The earth's magnetic field can guide some of these waves up and into a layer of ionised gas above the atmosphere, where they travel along magnetic field lines like a train moving on tracks between the earth's northern and southern hemispheres.**
- **The higher the frequency of these waves, the faster they travel (even up to a tenth of the speed of light).**
- **The frequencies of these waves are often within the human hearing range (20–20,000 Hz) and can be heard as whistling noises through a receiver**

- **In a paper published in the journal *Science Advances* on August 16,**

scientists from the University of Alaska Fairbanks reported discovering a new type of whistler wave produced by a previously unknown wave generation mechanism.

- **They found lightning energy injected into the ionosphere at low latitudes could get reflected like a light from a mirror into the magnetosphere.**
- **This contradicted previous claims that energy insertion at low latitudes can't escape the ionosphere.**



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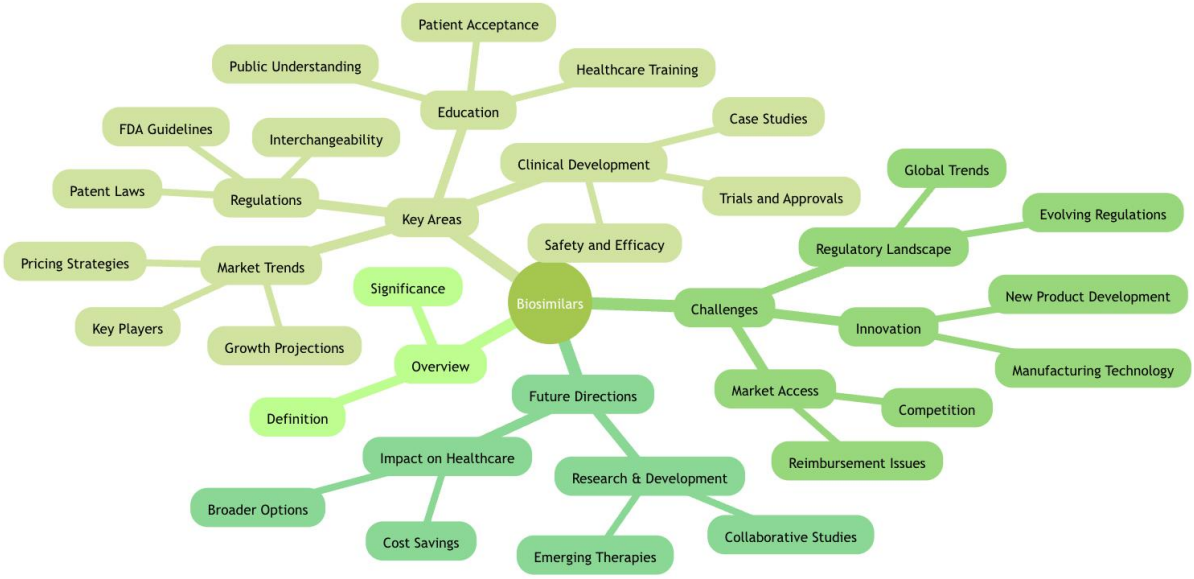
Biosimilar

- **Definition: (Biosimilars are biologic medical products highly similar to already approved reference products.)**

- **Significance: (Lower costs, increased access to treatment.)**

What are Biosimilars?

- **Definition and Characteristics**: Biosimilars are biological products that are highly similar to and have no clinically meaningful differences from an existing FDA-approved reference product. They are developed to be as safe and effective as the reference product, offering more affordable treatment options.
- **Regulatory Approval Process**: The approval of biosimilars involves rigorous testing to demonstrate similarity to the reference product in terms of structure, function, and clinical outcomes, ensuring patient safety and efficacy.
- **Patient Access and Affordability**: Biosimilars play a crucial role in expanding patient access to life-saving treatments by providing cost-effective alternatives to expensive biologic medication



Understanding Biologics

- **Biological Medicines**: Biologics are complex molecules derived from living

cells or organisms, offering targeted and often life-changing treatments for various diseases, including cancer, autoimmune disorders, and chronic inflammatory conditions.

Topic-Animation, Visual Effects, Gaming, and Comics Extended Reality (AVGC-XR) Policy

Overview

The AVGC-XR policy aims to boost the animation, visual effects, gaming, and comics industries in India.

It focuses on enhancing the extended reality (XR) sector, integrating cutting-edge technologies and creative processes.

Policy Implementation

Economic Growth

Technological Advancement

Industry Collaboration

Key Components

Policy Goals

Boost industry growth

Create job opportunities

Encourage innovation

- **Investment & Funding**
  - Government incentives
  - Support for startups
  - Funding for research and development

- **Infrastructure Development**
  - Establishing industry hubs
  - Improving technology access
  - Enhancing skill development programs
  - **Stakeholder Engagement**
    - Collaboration with industry leaders
    - Involvement of educational institutions
    - Partnerships with international organizations
  - **Market Expansion**
    - Increasing global competitiveness
    - Promoting Indian content abroad
    - Fostering local talent

Economic Impact

Projected market growth to $26 billion by 2030

Animation and VFX expected to reach $2.2 billion by 2026

Online gaming market forecasted at $4.6 billion

Mapping

Overview of Palermo

Location: Southern Italy, capital of Sicily

Culture: Rich history, art, and architecture

Cuisine: Renowned for street food and local delicacies

Tourism: Popular tourist destination with historical sites and beaches

Dumbur Dam

Overview

Location: Tripura, India

Purpose: Hydroelectric power generation, irrigation

Significance: A key infrastructure project impacting local communities and neighboring countries.

Recent Issues

Flooding Concerns: Reports of flooding in Bangladesh attributed to water release from the dam.

Government Responses: Indian authorities deny responsibility for flooding, blaming heavy rainfall in downstream areas.

Diplomatic Tensions: Strained relations between India and Bangladesh due to conflicting narratives about flood causes.

Impacts of Dumbur Dam

Environmental:

Changes in local ecosystems

Impact on wildlife habitats

Economic:

Agricultural benefits in Tripura

Energy production for regional needs

- **Location and Height:** The Dumbur Dam is situated approximately 120 km upstream of the Bangladesh border and stands at a height of about 30 meters.
- **Purpose of Construction:** It was built to harness the power of the Gumti River and generate electricity for the region.
- **Gumati River**: A significant river forming part of the India-Bangladesh border.

GLOF

The National Glacial Lake Outburst Floods Risk Mitigation Programme was approved by the Centre.

The programme aims at detailed technical hazard assessments, installing automated weather and water level monitoring stations, and early warning systems at the lakes and in downstream areas

Glacial Lake Outburst Floods

Overview

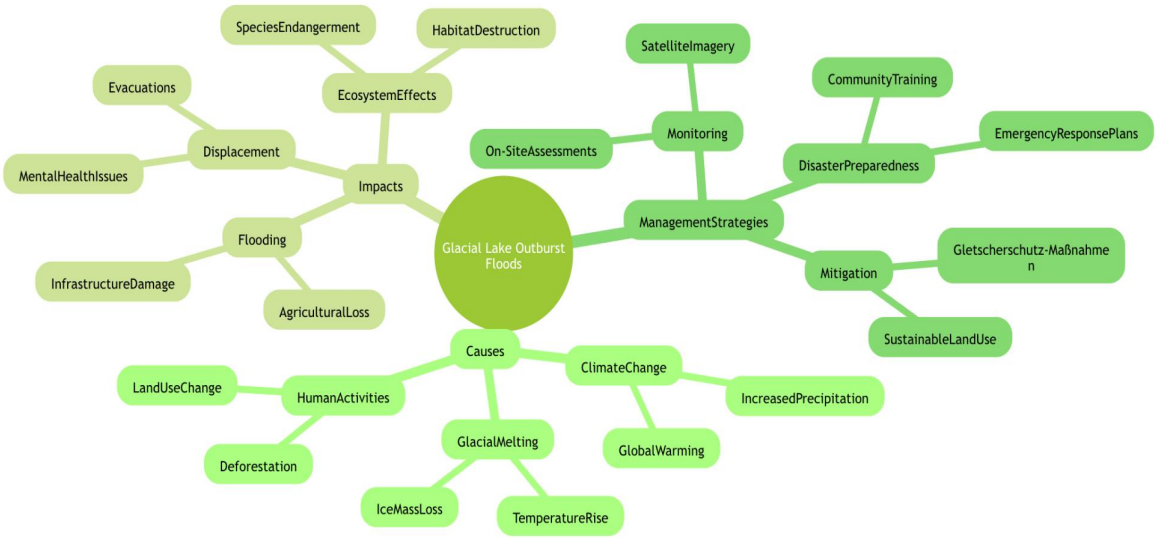
Definition: Sudden release of water from a glacial lake due to dam failure or glacier melting.

Causes:

- **Climate change**
- **Glacial melting**
- **Heavy rainfall**

Impacts:

- **Flooding of nearby areas**
- **Destruction of infrastructure**
- **Displacement of communities**



Lhonak Lake in Sikkim

Overview of Lhonak Lake

Location: Sikkim, India

Type: Glacial Lake

Importance: Ecological and cultural significance

Environmental Concerns

Climate Change: Impact on glacial lakes and surrounding ecosystems

Flood Risks: Recent reports on flooding due to glacial lake outburst floods (GLOFs)

Monitoring: Need for early warning systems for flood risks

Digital General Crop Estimation Survey (DGCES)

Digital General Crop Estimation Survey (DGCES), the Centre convened a national conference with the States to discuss the

improvement in crop production statistics .

The new initiative, according to the Centre, aims at enhancing accuracy, reliability, and transparency of agricultural statistics, which will help in policy formulation, trade decisions, and agricultural planning.DGCES has been initiated to calculate yield based on scientifically designed crop cutting experiments for all major crops across the country.

These initiatives are expected to provide near real-time and reliable data directly from the field.

"It will provide plot-level data with geotagged areas of crops and act as a single source of truth,

Vaccine derived Polio

Vaccine-derived

polio Vaccine-derived

- **polio is a rare condition that occurs when the weakened (also called attenuated) strain of poliovirus used in the oral polio vaccine (OPV) mutates and regains the ability to cause paralysis.**
- **OPV contains a live, attenuated virus that is used for immunisation against the disease. This weakened virus triggers an immune response when administered, thus protecting people from the disease.**
- **The attenuated virus replicates in the intestines for a limited period and is excreted in the stool.**

  In rare cases, the virus can mutate enough to cause the disease again and circulate in areas where either immunisation is low, where immunocompromised people reside, or where sanitation and hygiene

are poor.

According to the World Health Organization (WHO), the virus is classified as "circulating" (cVDPV2) if it is detected in at least two different sources, at least two months apart, that are genetically linked, showing evidence of transmission in the community.

Types of poliovirus Polioviruses are enteroviruses that are transmitted primarily by the faecal-oral route.

Three types wild poliovirus type 1 (WPV1), wild poliovirus type 2 (WPV2), and wild poliovirus type 3 (WPV3) have been known to exist. Symptomatically, all these strains are identical.

The first successful polio vaccine for poliovirus was made by Jonas Salk in the early 1950s.

Salk inactivated the virus using formaldehyde and injected it into the muscles of test subjects.

This inactivated polio vaccine (IPV) induced systemic immunity (relating to the blood, brain, and all other organ systems) in the subjects.

After Salk, Albert Sabin developed another vaccine that contained live polio strains weakened by growing them serially in macaque cells, making them unfit for human infection.

Since this vaccine contained the live virus, it had to be administered through its natural mode of infection in this case, oral.

This is what we today know as the OPV. OPV is usually preferred over IPV because of its ease of administration it does not require syringes or medical training and is inexpensive.

However, the weakened virus in OPV can occasionally revert, causing the disease it is meant to prevent.

IPV, on the other hand, is a less potent vaccine, but contains inactivated

virus particles and hence has no risk of causing vaccine-associated paralytic poliomyelitis (VAPP) a rare, adverse reaction to OPV.

IPV is comparatively tougher to manufacture, too, as it contains a chemically inactivated virus.

Mapping

Pokrovsk, formerly known as Krasnoarmiisk and Grishino, is a city and the administrative center of Pokrovsk Raion in Donetsk Oblast, Ukraine. It is located 56 kilometres northwest of Donetsk.

Space mission of india

Highlights in the last year

Aditya L1:

India followed its lunar success with the successful launch of its solar science mission Aditya-L1 on September 2, 2023. The launch was the easiest part of the mission, onboard ISRO's Polar Satellite Launch Vehicle (PSLV).

The spacecraft executed a series of manoeuvres to move into an orbit around the first earth-Sun Lagrange point (L1) on January 6, 2024.

It completed its first orbit around L1 on July 2, 2024. It studied a solar storm in May 2024 together with observatories on the ground and spacecraft in lunar orbit.

Gaganyaan TV-D1:

ISRO used a modified L-40 Vikas engine to build its Test Vehicle (TV) that it used to perform the first abort mission on October 21, 2023, as part of its

'Gaganyaan' human spaceflight mission.

The mission demonstrated the ability of the Crew Escape System (CES) to separate from the TV, take the crew module to safety, and the crew module's ability to decelerate before splashing down in the Bay of Bengal.

The crew module at the test's end was recovered by the Indian Navy vessel INS Shakthi

XPoSat:

ISRO celebrated the new year with the launch of its X-ray Polarimeter Satellite (XPoSat) on January 1, 2024.

The satellite will study how radiation from various celestial objects is polarised. It is the second such space-based observatory after NASA's Imaging X-ray Polarimetry Explorer (IPEX), launched in 2021.

The two instruments on board XPoSat, called XSPECT and POLIX, began operating on January 5 and 10

INSAT-3DS:

ISRO launched the meteorological satellite INSAT-3DS on February 17 onboard a Geosynchronous Satellite Launch Vehicle (GSLV).

This mission was important to prove the vehicle's credibility before the critical NASA-ISRO Synthetic Aperture Radar (NISAR) mission, now expected to launch in early 2025. This version of the GSLV had previously successfully launched the NVS-01 satellite in 2023.

RLV-TD:

ISRO used a downscale version of the Reusable Launch Vehicle, called Pushpak, to conduct two landing experiments LEX-02 and LEX-03 on March 22 and June 7 at its Aeronautical Testing Range in Challakere, Karnataka.

The tests simulated landing conditions from space by dropping the Pushpak vehicle from a Chinook helicopter, in LEX-02 along its landing path and in LEX-03 500 metres to one side. Successes in these tests gave ISRO the condence to move on to the 'Orbital Return Flight Experiment

SSLV

On August 16, ISRO launched the third and final development flight of the Small Satellite Launch Vehicle (SSLV), placing the EOS-08 and the SR-0 Demosat satellites in orbit. With two consecutively successful test flights, ISRO declared the SSLV's development complete and green-lit its transfer to industry.

EOS-08 carried three payloads: one for earth observation in the infrared range, one to demonstrate the use of reflections from a global satellite navigation system for earth observation, and one ultraviolet dosimeter and alarm to be tested ahead of their use in the Gaganyaan crew module.

ISRO roadmaps

After handing over operational responsibilities to NewSpace India, Ltd. (NSIL), ISRO has prioritised research. In December 2023, ISRO Chairman S. Somanath announced a 25-year roadmap until 2047 for Gaganyaan.

It intersects with the lunar exploration roadmap in the form of an Indian landing on the moon by 2040.

Mr. Somanath also shared a lunar exploration roadmap that includes apart from a crewed lunar mission a sample-return mission, a long-duration mission on the moon's surface, docking with NASA's Lunar Gateway (under the Artemis programme), and building moon habitats.

Gaganyaan - Human Spaceflight

India's First Manned Mission: **Gaganyaan represents India's maiden human spaceflight mission, aiming to send Indian astronauts to space, marking a historic milestone in the country's space exploration endeavors.**

Crew Training and Selection: **ISRO is rigorously training and selecting astronauts for the Gaganyaan mission, prioritizing safety and preparedness to ensure the success of the ambitious venture.**

International Collaboration: **The mission involves collaboration with other space agencies and organizations, fostering global partnerships and knowledge exchange in crewed space missions.**

Private space missions Agnikul Cosmos successfully launched its SoRTeD-01 vehicle from its launch pad at the Satish Dhawan Space Center in Sriharikota on March 21.

This was the first launch of a vehicle powered by a semi-cryogenic engine as its first stage from Indian soil. Skyroot Aerospace is progressing towards the launch of its Vikram 1 rocket.

Government of India amended its foreign direct investment (FDI) policy to allow 100% direct FDI in all space and spaceflight segments except for a 74% ceiling in satellite manufacturing and operations and 49% in launch infrastructure.

Prelims fact ----->>

Britain's drug regulator authorised the Alzheimer's drug Leqembi saying it's the first medicine to show some impact in slowing the progression of the disease

Transforming Indian Agriculture

Transforming Indian agriculture depends on adopting sustainable practices that ensure long-term productivity and environmental health.

Precision farming, genetically modified crops, and advanced irrigation techniques such as drip and sprinkler systems are leading this transformation.

For instance, the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has covered 78 lakh hectares, promoting water-use efficiency through micro-irrigation

India's agricultural sector faces challenges, including climate change, land degradation, and market access issues.

The Pradhan Mantri Fasal Bima Yojana (PMFBY), introduced in 2016, provides financial assistance for crop losses.

The Electronic National Agriculture Market (eNAM), launched in 2016, integrates existing markets through an electronic platform

Despite agriculture engaging nearly 46% of the workforce, agriculture's contribution to GDP is about 18%, highlighting a stark imbalance.

according to United Nations projections, India's population is expected to reach 1.5 billion by 2030 and 1.59 billion by 2040.

Following the agricultural challenges, meeting the food requirements of this burgeoning population will be imperative.

rationalising food and fertilizer subsidies and redirecting savings towards agricultural research and development innovation and extension services are crucial.

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), launched in 2019, disburses ₹6,000 annually to farmers in three instalments.

This scheme has already benefited over 11.8 crore farmers, offering much-needed financial support.

Another critical initiative, the Soil Health Card (SHC) scheme, aims to optimise soil nutrient use, thereby enhancing agricultural productivity.

Over 23 crore SHCs have been distributed, providing farmers with crucial insights into soil health and nutrient management

The government also championed the International Year of Millets in 2023, promoting nutritious coarse grains, both domestically and internationally .

The Agriculture Infrastructure Fund, with a ₹1 lakh crore financing facility, supports the development and modernisation of post-harvest management infrastructure.

the Survey of Villages and Mapping with Improvised Technology in Village Areas (SVAMITVA) initiative aims to ensure transparent property ownership in rural areas.

The government's strategic planning for agriculture, leading up to 2047, focuses on several key areas: anticipated future demand for agricultural products, insights from past growth catalysts, existing challenges, and potential opportunities in the agricultural landscape.

Projections indicate that the total demand for food grains in 2047-48 will range from 402 million tonnes to 437 million tonnes, with production anticipated to exceed demand by 10%-13% under the Business-As-Usual (BAU) scenario.

However, to meet this demand sustainably, significant investments in agricultural research, infrastructure, and policy support are required.

The Budget for 2024-25, with an allocation of ₹20 lakh crore for

targeted agricultural credit and the launch of the Agriculture Accelerator Fund, highlights the government's proactive approach to fostering agricultural innovation and growth.

Why Flooding in Bangladesh Due to Himalayan Rivers?

Understanding the Causes

Geographical Location: Bangladesh is situated at the delta of major Himalayan rivers (Ganges, Brahmaputra, Meghna).

Monsoon Seasons: Heavy rainfall during monsoon leads to overflow.

Himalayan Glacial Melting: Climate change increases glacial melt, feeding rivers.

Soil Erosion: Deforestation in the Himalayas results in increased sediment in rivers.

Flooding in Bangladesh is primarily influenced by the geography and climatic patterns associated with the Himalayan river systems.

Impact of Flooding

Displacement: Millions of people are displaced during floods.

Agricultural Damage: Floods destroy crops, affecting food supply.

Health Risks: Waterborne diseases increase post-flooding.

Infrastructure Damage: Roads, bridges, and homes are frequently damaged.

Each flooding event has devastating effects on the lives and livelihoods of Bangladeshi citizens.

Mitigation Strategies

Early Warning Systems: Implementing advanced flood forecasting.

Reforestation: Restoring forests in the Himalayas to reduce erosion.

Flood Resilient Infrastructure: **Building structures that can withstand flooding.**

Community Awareness Programs: **Educating communities about flood risks and preparedness.Preventive measures can significantly reduce the impact of flooding on vulnerable communities.**

TOPIC- Drina River

Overview

Location: **Serbia and Bosnia-Herzegovina**

Significance: **Natural border, important for ecosystems and local communities**

Recent Events: **Tragic incidents involving migrant boats**

Recent News Highlights:

Migrant boat capsizes -> multiple casualties

Search and rescue operations ongoing

Community impact and response

TOPIC- Balkan Region

Overview of the Balkan Region

Geography

Countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Kosovo, Montenegro, North Macedonia, Romania, Serbia, Slovenia

Capital Cities: Tirana, Sarajevo, Sofia, Zagreb, Pristina, Podgorica, Skopje, Bucharest, Belgrade, Ljubljana

Culture

Languages: Diverse languages spoken across the region

Traditions: Rich cultural heritage with festivals, music, and cuisine

Economics

Tourism: Nature, history, and adventure tourism (Cycling the Western Balkans)

Mining: EU supports green transition and mining initiative

Politics

Geopolitical Tensions: Historical conflicts and current diplomacy efforts

NATO Involvement: Addressing regional stability

Environment

Climate Challenges: Impact of heatwaves and natural disasters

Conservation: Efforts focused on biodiversity and river preservation

Starlink is a satellite internet constellation developed by SpaceX, with the goal of providing high-speed, low-latency internet access globally, particularly in remote and underserved areas. Here's how Starlink satellites work:

Key Features of Starlink:

1. **Constellation of Satellites: Starlink consists of thousands of small satellites (weighing about 260 kg each) in low Earth orbit (LEO),**

typically at altitudes of 550 km. These satellites work together to form a network that beams internet signals back to Earth.

2. Low Latency: The low altitude of Starlink satellites reduces the time it takes for data to travel between Earth and space compared to traditional satellite internet systems that operate at higher altitudes (geostationary orbits). This results in faster data transmission, or low latency, ideal for online activities like video calls or gaming.
3. Global Coverage: Starlink's dense network of satellites aims to cover most areas of the world, including rural and remote regions where fiber-optic or cable internet is unavailable or unreliable.
4. User Terminals: Customers use a small satellite dish, often called a "Starlink Dish," that connects to the satellites overhead, enabling internet access at speeds of 50 Mbps to 250 Mbps depending on the location.
5. Commercial and Government Applications: Beyond consumer use, Starlink is also valuable for military, government, and scientific purposes, especially in areas where traditional infrastructure is unavailable.

SpaceX's Progress and Future Plans:

- As of 2024, SpaceX has launched over 5,000 Starlink satellites, with plans for even more launches to further expand the network.
- SpaceX aims to launch tens of thousands of satellites to ensure continuous global coverage.

Starlink has been particularly impactful in providing internet services during natural disasters and in conflict zones, where terrestrial internet

infrastructure is often compromised.

Diamond mining in africa

A massive 2,492-carat diamond the second largest in the world has been discovered in Botswana, the Canadian mining company that found the stone.

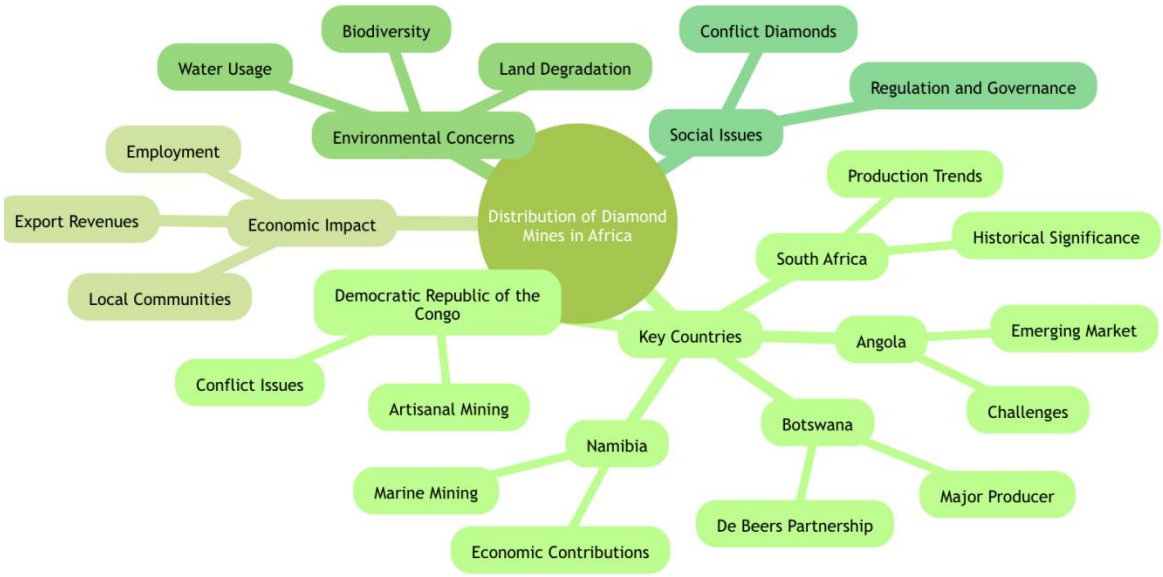
The diamond was discovered in the Karowe Diamond Mine in northeastern Botswana using Xray detection technology

In terms of carats, the stone is second only to the 3,016-carat Cullinan Diamond discovered in South Africa in 1905.

Distribution of Diamond Mines in Africa

Overview

- **Africa is a major player in global diamond mining.**
- **Countries like Botswana, South Africa, and Namibia are leading producers.**
- **The diamond industry has significant economic and social impacts on mining communities**



Mass wasting

Overview

Definition: The movement of rock or soil down slopes under the force of gravity.

Types: Rock falls, slumps, debris flows, etc.

Causes: Triggered by factors like rapid snow melt, intense rainfall, earthquakes, and slope oversteepening.

Types:

- **Landslides**
- **Mudslides**
- **Rockfalls**
- **Earthflows**

Causes of Mass Wasting

Natural Factors:

- Heavy rainfall
- Earthquakes
- Weathering and erosion

Human Activities:

- Deforestation
- Construction and excavation
- Mining operations

Effects of Mass Wasting

Geological Impacts:

- Landscape alteration
- Changes in drainage patterns

Human Impacts:

- Damage to infrastructure
- Loss of life and property
- Displacement of communities

California Mudslides: Analyzes causes and impacts of recent mudslides in California.

Prevention and Mitigation

Engineering Solutions:

- Retaining walls
- Drainage systems
- Slope stabilization techniques

Community Awareness:

Education on risks

Emergency preparedness plans

Case Studies

Cascadia Subduction Zone: Examines mass wasting events in seismic zones.

Recent study in the sedongpu gully

A new study on the high frequency of mass wasting events in the Sedongpu Gully of the Tibetan Plateau since 2017 and the rapid warming of the area, which rarely experienced temperatures beyond 0o C before 2012, could be bad signs for India, specifically the country's northeast.

A geological event, mass wasting is the gravity-influenced movement of rock and soil down a slope.

A gully is a landform created by erosion from running water, mass movement or both. The Sedongpu Gully, in the catchment of the Sedongpu glacier and its valley, is 11 km long and covers 66.8 sq. km.

It drains into the Yarlung Zangbo, or the Tsangpo River, near where it takes a sharp turn called the Great Bend while flowing around Mt. Namcha Barwa (altitude 7,782 metres) and Mt. Gyala Peri (7,294 metres) to create a gorge 505 km long and 6,009 metres deep.

This is one of the deepest gorges on the earth. The Great Bend is close to Tibet's border with Arunachal Pradesh, where the Tsangpo flows as the Siang river.

In Assam further downstream, the Siang meets the Dibang and Lohit to form the Brahmaputra, which flows as the Jamuna in Bangladesh.The combination

of long-term warming and intense local shaking due to earthquakes has greatly enhanced landslide activity in the area. The impact on humans has been low because it is so remote. However, environment scientists in Assam said the study underlining landslides was ominous for areas hundreds of kilometres downstream. The threat has been accentuated by big dams such as the 510-MW Zangmu on the Tsangpo and India's planned projects on the Siang.

"China plans to set up a 60-gigawatt project on the Tsangpo, which will [have] thrice the capacity of the Three Gorges project on the Yangtze, the world's largest hydropower plant,

"This region is characterised by enormous geophysical instability and experienced the 8.6-magnitude Assam-Tibet or Medog earthquake in 1950, one of the biggest of the 20th century

"The Sedongpu study has serious implications for the Tsangpo-Siang-Brahmaputra-Jamuna, especially in India and Bangladesh.

The most direct consequence could be the addition of major amounts of sediments to the course of the river, already one of the most sediment-laden rivers of the world,

The Brahmaputra carries more than 800 tonnes of sediment at Pandu in Guwahati, becoming more than a billion tonnes at Bahadurabad in Bangladesh.

"The sedimentation can elevate the river beds more, accentuating flood hazards.

Further, the channels of the river in Assam and Bangladesh may get choked with sand and silt in the lean season making navigation difficult and affecting livelihoods related to fishing,"

Sonoluminescence

When two German engineers were studying sonar the use of sound to navigate, like bats in 1934, they stumbled upon a strange phenomenon: when a small bubble trapped in a liquid is hit by powerful sound waves, it seems to produce a flash of light.

The cause turned out to be straightforward, if also fascinating: the alternating high- and low-pressure phases of sound waves caused the bubble to expand and collapse rapidly.

During the collapse, the bubble compressed so intensely that the temperature inside soared to several thousand kelvin. The extreme temperature caused gases within the bubble to ionise and release light energy in about a trillionth of a second.

Sonoluminescence is not restricted to labs. Pistol shrimp (family Alpheidae) possess a specialised claw that it can snap shut with incredible speed. The result is a jet of water moving so fast that it creates a low-pressure bubble in the water

Why Volcanic Eruption in Iceland?

Key Reasons for Eruptions

Tectonic Activity

- **Divergent plates**
- **Mid-Atlantic Ridge**

Geothermal Activity

- **Magma chambers**
- **Hot spots**

Climate Factors

- Melting glaciers
- Seasonal changes

Recent Eruptions

- Eruptions occurred multiple times in 2024
- Spectacular lava fountains and ash clouds

Effects of Eruptions

Environmental Impact

- Air quality
- Lava flows affecting vegetation

Human Impact

- Evacuations
- Damage to infrastructure

Monitoring & Research

- Continuous monitoring by scientists
- Use of technology to predict eruptions

figure 1.2: table

Topic- Hema Committee Report

Key Points

Background: The Hema Committee was formed to investigate allegations of *sexual abuse* within the Malayalam film industry.

Findings: The report highlighted systemic issues, including *patriarchy* and *abuse of power*.

Reactions: Significant backlash from industry participants, with some resignations following the report's release.

Impact: Initiated discussions on *women's safety* and *reforms* within the film industry.

Government Response: Kerala government formed a special team to address the issues raised.

Report Highlights

- **Major Resignations: Notable figures resigned in response to the report.**
- **Cultural Reflection: The report serves as a wake-up call for the entire nation regarding women's rights and safety.**
- **Future Actions: Calls for reforms and increased accountability in the industry**

It was released last week, several paragraphs redacted, and contains unsurprising and yet disturbing revelations about the state of affairs in the film industry discrimination, exploitation and sexual harassment of women.

Justice Hema points out that making the exchange of sexual favours the passkey for entry into the field itself, and normalising it and conflating it with consensual sexual activity, makes the industry inherently exploitative.

The report deals also with other inequities that disadvantage women in the industry, including the lack of essential facilities such as toilets, changing rooms, safe transportation, and accommodation at the shooting spot which are violative of the right to privacy; and discrimination in remuneration, and a lack of binding contractual agreements.

These affect the range of women across the industry — actors, technicians, make-up artists, dancers, support staff, and particularly so, women lower in the pecking order.

Mount GAMALAMA

Location: Indonesia

Type: Stratovolcano

Height: Approximately 2,315 meters

Significance: One of the active volcanoes in Indonesia

Recent Volcanic Activity

Increased eruptions and seismic activities

Affected areas and communities

Monitoring efforts by local authorities

Researchers have now found that humpback whales do not just create the 'bubble-nets' but they manipulate this unique tool in a variety of ways to maximise their food intake in Alaskan feeding grounds.

The humpback whales skillfully blow bubbles in patterns that form nets with internal rings, actively controlling details like the number of rings, the size and depth of the net, and the spacing between bubbles.

This method lets them capture up to seven times more prey in a single feeding dive without using extra energy

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feeding dive without using extra energy

Arabidopsis thaliana

Scientists have found that developmental change from the vegetative to reproductive transition happens over a few days.

During the transition, plants slow down the leaf growth and instead develop reproductive organs.

This transition starts the process of nutrients in the leaves being diverted into the reproductive organs of the plant and their fruits and grains

Arabidopsis thaliana is a small flowering plant related to cabbage and mustard

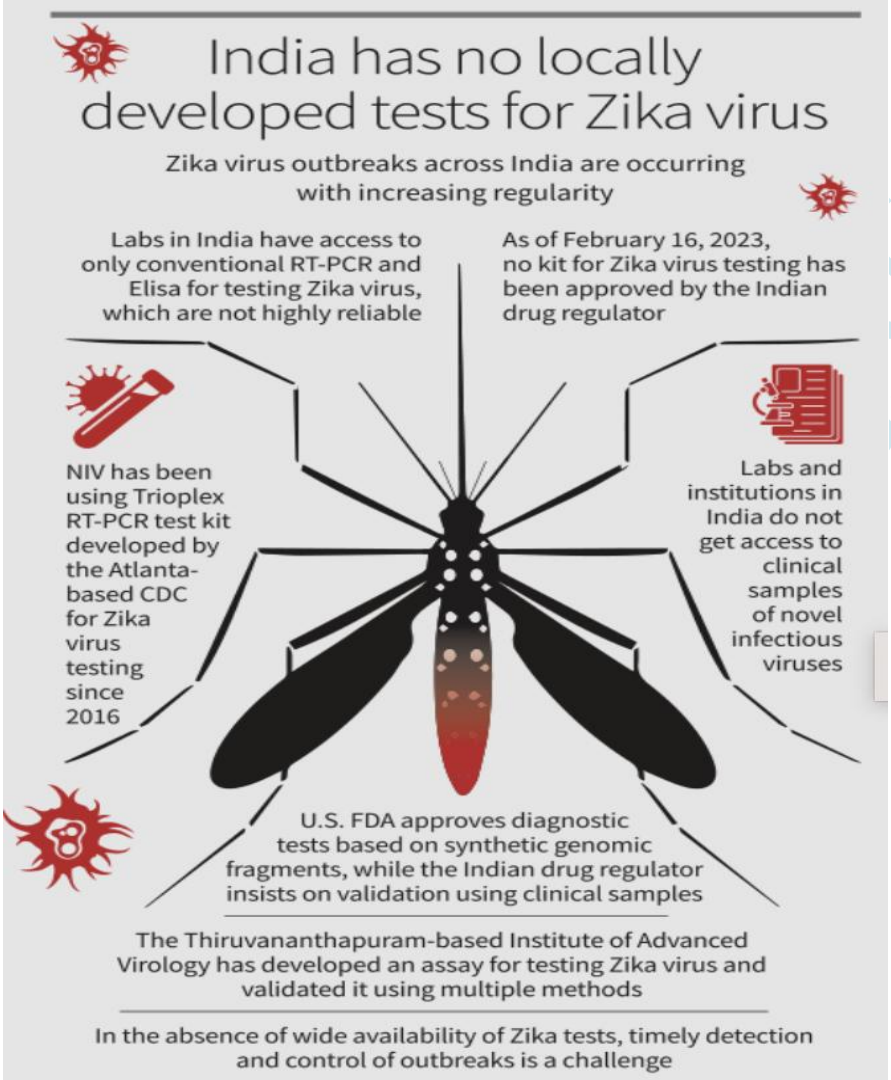
Anosmia

Anosmia is the partial or full loss of smell.

Anosmia can be a temporary or permanent condition.

You can partially or completely lose your sense of smell when the mucus membranes in your nose are irritated or obstructed such as

when you have a severe cold or a sinus infection



Topic - Overview of RTPCR

Definition: Reverse Transcription Polymerase Chain Reaction

Purpose: Detects RNA viruses like SARS-CoV-2

Importance: Key in COVID-19 diagnostics

[RNA] [Enzyme] [Primers] [ThermalCycling]

Key Aspects:

RNA Extraction: Isolate RNA from samples.

Reverse Transcription: Convert RNA to complementary DNA (cDNA).

Amplification: Use PCR to amplify cDNA for detection.

Applications of RTPCR

COVID-19 Testing: Main method for diagnosing SARS-CoV-2.

Research: Used in genetic research and pathogen detection.

Public Health: Monitor virus spread and variant identification.

Polaris Dawn

Overview of Polaris Dawn

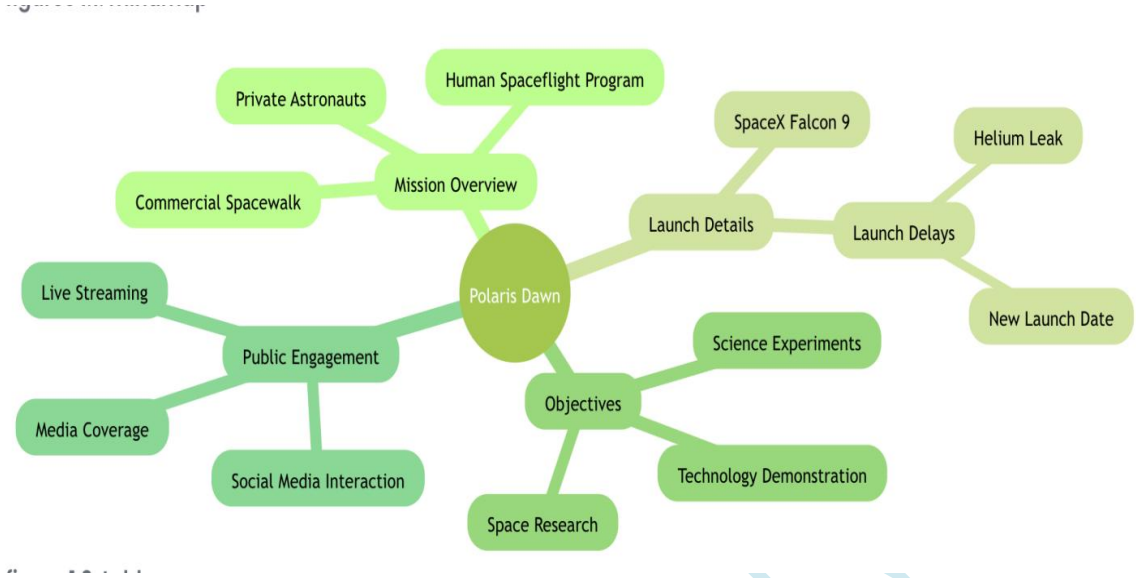
Description: An ambitious mission by SpaceX aiming to push the boundaries of space exploration.

Key Features:

First commercial spacewalk

Involves private astronauts

Aimed at expanding human presence in space



Ferroan Anorthosite

Overview

Definition: Ferroan anorthosite is a type of rock primarily found on the Moon's surface, consisting mainly of plagioclase feldspar with significant iron content.

Significance: It provides insights into the Moon's geological history and the conditions during its formation.

Recent Research Highlights

Magma Ocean Theory:

Evidence from Chandrayaan-3: **Recent data suggests the Moon once had a molten rock ocean, supporting the magma ocean hypothesis.**

Discovery of Apatite:

i. **Detection of apatite in ferroan anorthosite indicates a volatile-rich early lunar crust.**

Geological Implications

Lunar Crust Composition:

Provides data on the Moon's early crust and its evolution.

Planetary Formation:

Insights into the processes that led to the formation of terrestrial bodies in the solar system.

Future Research Directions

Sample Returns:

Importance of lunar sample return missions to further study ferroan anorthosite.

Comparative Planetology:

Studying ferroan anorthosite in relation to similar rocks on other celestial bodies to understand planetary formation.

figures 1.1: mindmap

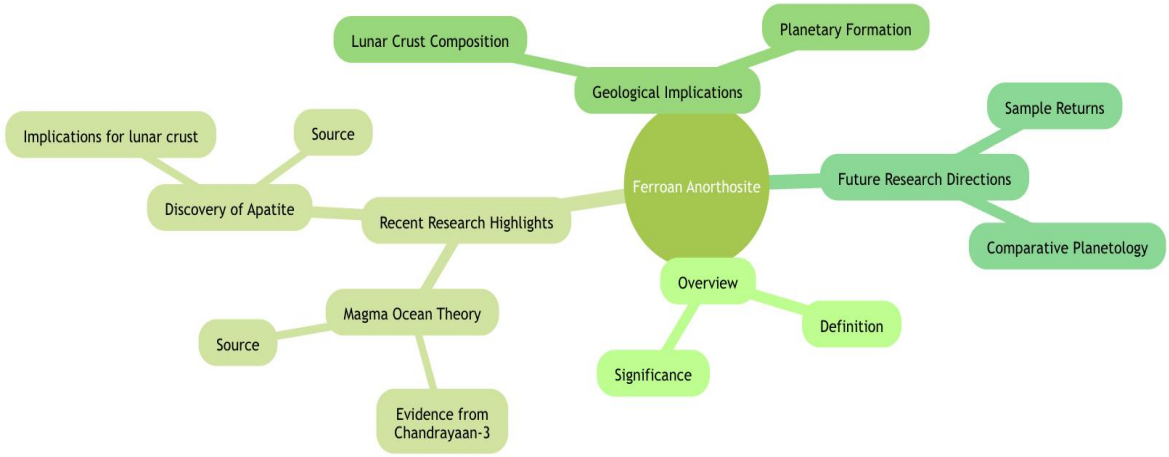


figure 1.2: table

Pragyan Rover

Overview

Pragyan Rover: Part of India's Chandrayaan-3 mission.

Objective: Explore lunar surface and gather scientific data.

Key Contributions: Evidence of ancient magma ocean on the Moon.

Key Findings

Magma Ocean: The rover provided insights into a vast magma ocean that once covered the Moon.

Materials Analyzed: Discovered minerals like ferroan anorthosite.

Support for Theories: Data supports long-standing theories about lunar formation.

Arbaat Dam

Background

Location: Eastern Sudan

Significance: Major infrastructure for water management

Recent Events

Collapse Incident: Heavy rainfall led to the dam's collapse.

Casualties: Reports of at least 132 fatalities and significant property damage.

Displacement: Approximately 50,000 homes destroyed, leading to mass displacement.

Impacts

Humanitarian Crisis: Increased need for emergency response and support.

Economic Effects: Dam collapse affects agriculture and local economies.

Environmental Concerns: Flooding leads to ecological damage and water contamination.

Key Stakeholders

Government: Sudan's military and local authorities involved in response.

NGOs: Humanitarian organizations mobilizing aid.

Community: Local residents affected by the disaster.

Future Actions

Reconstruction Plans: Discussions on rebuilding and improved infrastructure.

Preventative Measures: Evaluating and updating dam safety protocols.

Community Support: Initiatives to support displaced individuals and families.

FlaSh FloOd

Overview of Flash Floods

Definition: Rapid flooding in a short period, often due to heavy rain.

Causes:

- Intense rainfall ☔
- Rapid snowmelt
- Dam failure

Effects:

- Property damage
- Loss of life
- Erosion

Recent Events

Location: Grand Canyon National Park

Incidents: Multiple fatalities and rescues

Indonesia's Ternate Island

Incident: Buildings swept away; 13 dead

Preparedness and Response

Emergency Plans:

Evacuation routes

Flood alerts

Community Awareness:

Education on flash floods

Community drills

Mitigation Strategies

Infrastructure Improvements:

Drainage systems

Dams and levees

Monitoring and Warning Systems:

Weather forecasting

Real-time alerts

Hormones Role

(i) The brain: The hypothalamus, a small part of the brain, produces two kinds of hormones: orexigenic hormones increase appetite and anorexigenic hormones lower appetite and increase satiety. Hormones are molecules produced in one part of the body that exert their effects on a different and often distant part.

The orexigenic and anorexigenic hormones are produced in the hypothalamus and show their effects on other parts of the brain and in the gut.

(ii) The bowels: The gut produces hormones that can directly communicate with the brain to regulate appetite; it also regulates the rate at which food flows through the gut, which aects body weight.

(iii) The brawn: "The brawn refers to the physical build of the body,". It has two kinds of hormones that he called "burners" and "builders". Burners, including hormones produced by the thyroid, increase metabolism and lead to weight loss. Builders, like insulin, help incorporate glucose from the bloodstream into liver and fat cells and skeletal muscles, leading to weight

gain

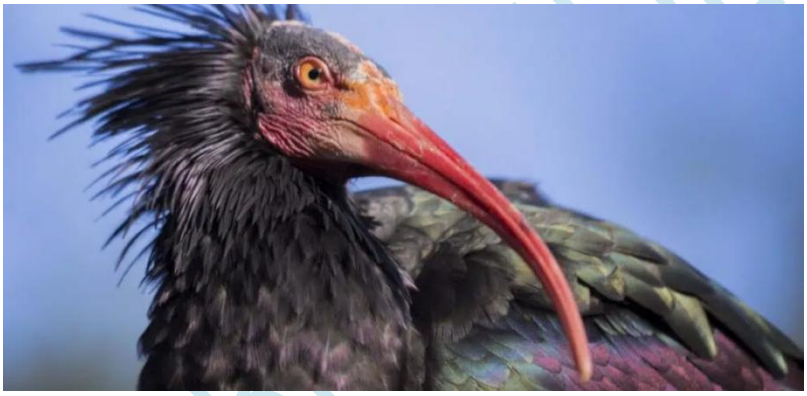
Topic- Northern Bald Ibis

Overview

Species: Northern bald ibis (Geronticus eremita)

Habitat: Open areas like grasslands and rocky mountains

Status: Critically endangered with fewer than 1,000 left in the wil



Characteristics

Appearance:

Blackish feathers, bare red face, and throat

Unique raggedy mane

Behavior:

Monogamous, lifelong mates

Communicate using croop calls

Conservation Efforts

Reintroduction Programs:

Initiatives in Europe to reintroduce the species

Threats:

Hunting pressure historically led to extinction in Central Europe

Climate change and habitat loss

Public Health Emergency of Continental Security (PHECS)

Defining PHECS

- **Definition and Significance: PHECS refers to a public health emergency that poses a significant threat to the health and security of an entire continent. It requires a coordinated and rapid response to mitigate its impact and prevent further spread.**
- **Triggers and Criteria: PHECS is declared based on specific criteria, such as the severity of the health threat, its potential to cross borders, and the need for a unified continental response, ensuring that resources and expertise are mobilized effectively.**
- **Historical Context: Understanding the historical context of PHECS declarations, including previous instances and their outcomes, provides valuable insights into the current challenges and response strategies.**

Key Characteristics of PHECS

- **Scope and Complexity: PHECS encompasses a wide range of health threats, including infectious diseases, environmental disasters, and other crises that require a continent-wide response due to their scale and complexity.**
- **Interconnectedness and Vulnerabilities: Exploring how interconnectedness and vulnerabilities contribute to the emergence and**

spread of PHECS helps students understand the broader context of global health security.

- **Role of Continental Organizations: Highlighting the roles of continental health organizations in addressing PHECS, such as the Africa CDC, demonstrates the importance of collaborative efforts in managing such emergencies.**

Preparedness and Mitigation Strategies

- **Risk Assessment and Early Warning Systems: Highlighting the importance of risk assessment and early warning systems in identifying and responding to potential PHECS events emphasizes the proactive approach to public health.**
- **Capacity Building and Resource Allocation: Understanding the need for capacity building and resource allocation in preparation for PHECS enables students to appreciate the logistical and organizational challenges involved.**
- **Community Engagement and Communication: Emphasizing the role of community engagement and effective communication in PHECS preparedness fosters an understanding of the importance of public participation in emergency response.**

Overview

Definition: A coordinated response to health threats affecting multiple countries in Africa.

Focus: Addressing the outbreak of Mpox and other infectious diseases.

Purpose: Mobilizing resources and strengthening health systems across the continent.

This comes on the heels of the Africa Centres for Disease Control and Prevention's (AfricaCDC) declaration of a Public Health Emergency of Continental Security (PHECS), marking the first instance where both regional and global health emergencies have been declared concurrently for the same disease

Key Components

Detection & Surveillance:

Early identification of outbreaks.

Continuous monitoring of disease spread.

Response Strategies:

Rapid deployment of health resources.

Coordination among countries and health organizations.

Awareness & Education:

Public health campaigns to inform communities.

Training healthcare professionals on emerging threats.

Collaboration:

Partnerships with WHO and other international organizations.

Engagement with local governments and NGOs.

Challenges

Resource Allocation:

Ensuring equitable distribution of medical supplies.

Funding for health initiatives.

Public Compliance:

Overcoming vaccine hesitancy and misinformation.

Encouraging adherence to health guidelines.

Infrastructure:

Improving healthcare access in remote areas.

Strengthening laboratory and diagnostic capabilities.

Future Directions

Innovation in Health Technologies:

Utilizing AI and data analytics for outbreak prediction.

Developing new vaccines and treatments.

Strengthening Health Systems:

Investing in healthcare infrastructure.

Enhancing training for health professionals.

Global Partnerships:

Collaborating on research and development.

Sharing best practices and resources among nations.

YOLO GENERATION

A s South Korea scrambles to halt the sharp decline in its birth rate, policymakers are having a hard time convincing many in their 20s and 30s that parenthood is a better investment than stylish clothes or fancy restaurants.

Asia's fourth-largest economy plans to launch a new government ministry dedicated to demographic challenges after years of incentives failed to ease the baby crisis.

"I'm all about YOLO (you only live once),"

"They are status hunting. Their high spending habits show young people are working on their own emblems of success online rather

than focusing on the impossible goals of settling down and have children,

Overview of the YOLO Generation

- **The term "YOLO" stands for "You Only Live Once"**
- **Represents a lifestyle of spontaneity and enjoyment**
- **Associated with the younger demographics, primarily Millennials and Gen Z**

Key Characteristics

- **Emphasis on experiences over possessions**
- **Willingness to take risks**
- **Preference for luxury and unique products**
- **Resistance to traditional norms such as marriage and homeownership**

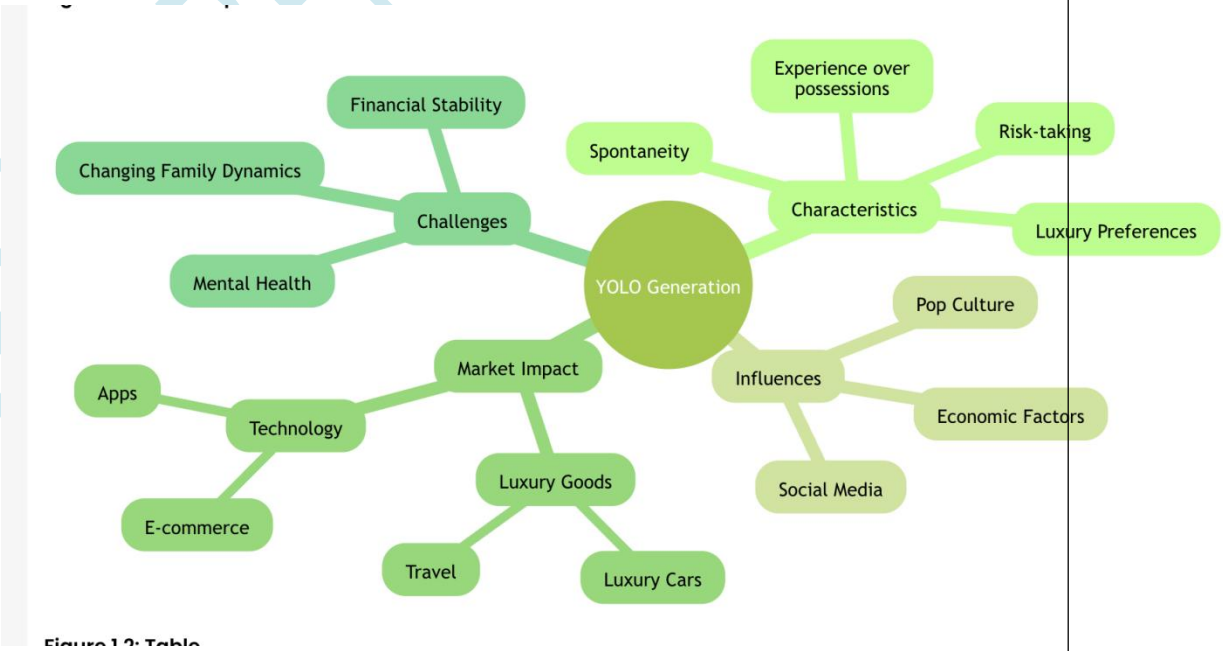


Figure 1.2: Table

Pacific Islands Summit Overview

Pacific islands summit in Tonga

Key Themes

Climate Change

Geopolitical Rivalry

Economic Development

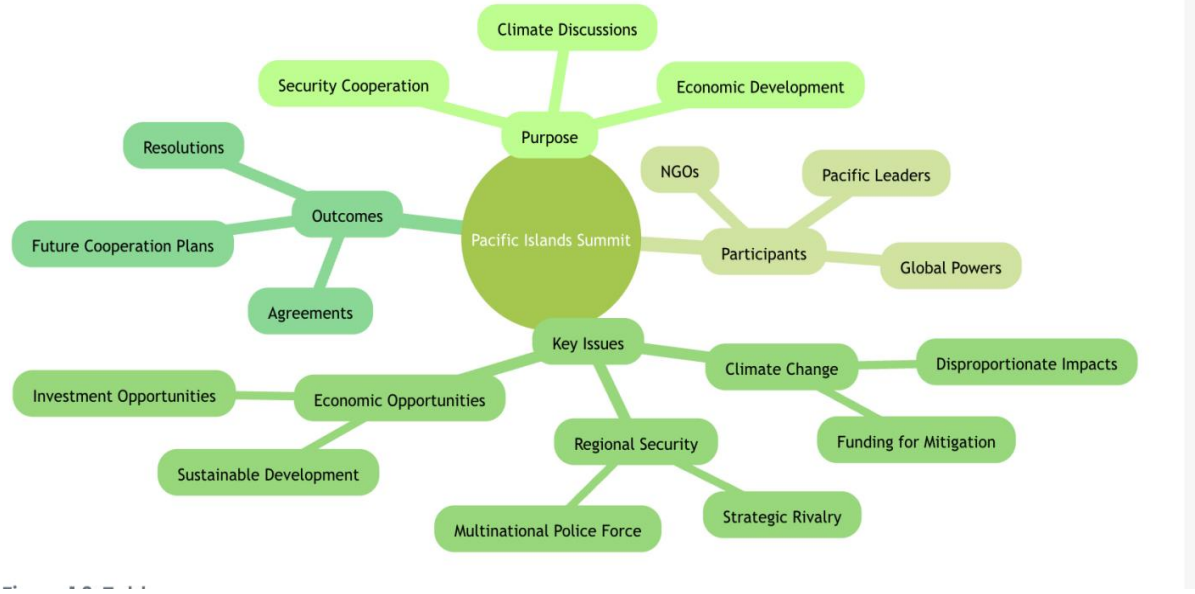
Regional Security

Climate Change

Disproportionate impacts on Pacific islands.

Urging big polluters to take responsibility.

Focus on sustainable practices and renewable energy.



Geopolitical Rivalry

- **Strategic interests of world powers in the Pacific.**

- **Influence from China, U.S., and other nations.**
- **Concerns over sovereignty and local governance.**

Economic Development

Opportunities for trade and investment.

Sustainable tourism as a growth sector.

Support from international organizations.

Regional Security

Discussion on multinational Pacific police force.

Collaboration on maritime security.

Response strategies for natural disasters

What is the Chandipura virus

According to an article, 'Chandipura virus: an emerging human pathogen?'published in *The Lancet* in 2004, the virus is a member of the Vesiculovirus genus of the family Rhabdoviridae. Incidentally this family also includes the rabies virus.

The Chandipura virus, the paper states, was first isolated in 1965, from the blood of two adults with a febrile illness in a village in Nagpur, Maharashtra. The virus is reportedly named after the village it was isolated from. The other instance when the virus was isolated in human beings was in 1980, in Madhya Pradesh from a patient with acute encephalitis, the article says.

How is it transmitted?

- **The virus is vector-borne, with the likely vector believed to be the**

female *Phlebotomine* sandfly, insects that are prevalent in the early monsoon period.

- **A 2016 paper, 'Changing clinical scenario in Chandipura virus infection', published in *The Indian Journal of Medical Research*, also pointed to the role of *Sergentomyia* sandflies.**
- **It said several species of mosquitoes replicated and transmitted the virus experimentally, and among the different mosquito species studied, *Aedes aegypti*, (which also transmits dengue), was found to be highly susceptible and could transmit the virus more efficiently than others, under laboratory conditions.**
- **However it said no isolation of the virus from the mosquito had been reported as of then.**

Microplastic in PCP

Personal care products (PCP) like face wash and shower gels in India contain a significant amount of harmful microplastics.

Polyethylene (PE) is the dominant polymer in microplastic emissions from PCPs. Microplastics are plastic particles are under 5 mm in size; microbeads have a diameter under 5 mm in diameter

According to the researchers, white microbeads are more easily concealed in PCP.

These orb-like particles are used as exfoliating agents and to enhance the delivery of active ingredients in the PCP.

Microbeads are small, solid, manufactured plastic particles that are less than 5mm in diameter and do not degrade or dissolve in water

They are made of PE, polypropylene or and polyester.

PE was present in the highest concentration in more than half the microbeads.

Microplastics have also been found in the human brain, blood, lungs, colon, placenta, testicles, and stool.

The study paper advocated for better policies to control microplastic pollution in India and suggested coffee, apricots, walnut, kiwi seeds, and soluble cellulose beads could replace microbeads in PCPs.

Chips Act

Overview of the Chips Act

Objective: Promote semiconductor manufacturing in the U.S.

Funding: Billions allocated to support chip manufacturing and research

Impact: Strengthening supply chains and reducing dependence on foreign semiconductors

Key Aspects of the Chips Act

Federal Support

Funding for new facilities

Grants and incentives for companies to invest in U.S. manufacturing

Industry Response

Major players like Intel and HP involved

Expansion plans and new projects announced

International Context

Comparison with initiatives in Europe and China

Global competition for semiconductor dominance

Challenges and Opportunities

Challenges

- Technical hurdles in chip production
- Competition from established foreign manufacturers

Opportunities

- Job creation in the tech sector
- Innovation in semiconductor technology

Future Directions

Long-Term Goals

- Achieving semiconductor independence
- Developing next-generation chip technologies

Investment Strategies

- Fostering collaboration between government and industry
- Encouraging research and development in semiconductor fields

Olive Farming in Greece

Overview

(Cultural Significance)

(Economic Importance)

(Climate Challenges)

Key Points:

Greece is known for its high-quality olive oil.

Olive farming is a significant part of Greek culture and economy.

Recent climate changes are affecting yields and quality.

Challenges in Olive Farming

(Climate Change)

(Dismal Harvests)

(Economic Strain)

Key Points:

Changes in weather patterns affect crop production.

Farmers are facing lower yields and increased costs.

The rising prices of olive oil can negatively impact the industry.

Technological Innovations

(GPS Tracking)

(Sustainable Practices)

Key Points:

- **Farmers are using technology to prevent theft and monitor crops.**

- **There is a shift towards more sustainable farming practices.**
- **Innovations are necessary to cope with environmental changes.**

Future Prospects

(Market Trends)

(Consumer Preferences)

(Policy Support)

Key Points:

- **The olive oil market is expected to face fluctuations due to climate impact.**
- **Consumers are leaning towards organic and sustainably sourced products.**
- **Government policies could play a crucial role in supporting farmers.**

SHe-Box

The Union Ministry of Women and Child Development has launched SHe-Box, a centralised portal for registering and monitoring complaints of sexual harassment of women at the workplace.

It serves as a centralised repository of information related to Internal Committees (ICs) and Local Committees (LCs) formed, encompassing both the government and private sectors.

It offers a common platform to file complaints, track their status, and ensure a time-bound processing of complaint by ICs.It also provides assured redressal of complaints and a streamlined process.

Topic- Submarine Arighaat

Overview

INS Arighaat: India's second nuclear-powered submarine.

Purpose: Strengthens India's nuclear triad.

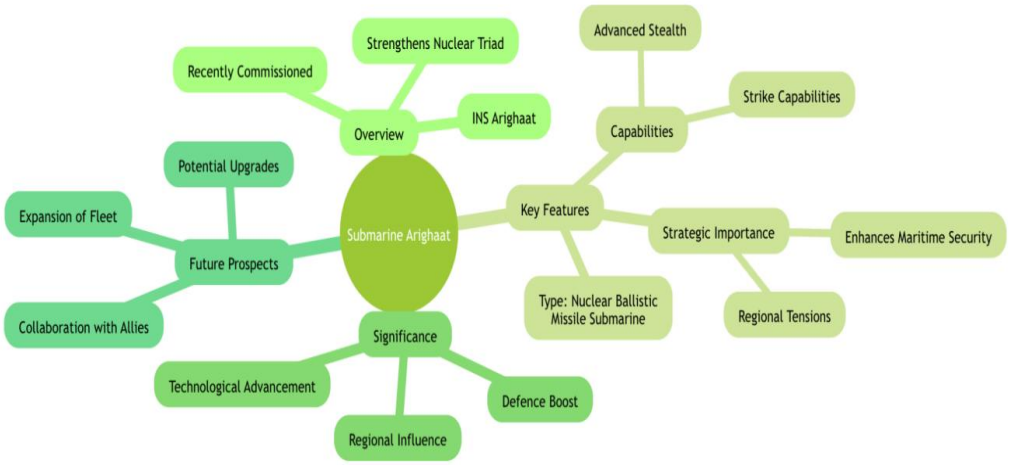
Commissioning: Recently entered service.

Key Features

Type: Nuclear ballistic missile submarine.

Capabilities: Advanced stealth and strike capabilities.

Strategic Importance: Enhances maritime security amid regional tensions.



LaseR Surgery & Chirped Pulse Amplification (CPA)

The word 'laser' is actually an acronym for 'Light Amplification by Stimulated Emission of Radiation', a phrase that encapsulates the physics underlying this transformative technology.

The fundamental concept of stimulated emission was first introduced by Albert Einstein in 1917.

He theorised that when an electron in an excited state drops to a lower

energy level, it can release energy as a photon.

If this photon interacts with another excited electron, it can stimulate the release of a second photon of identical energy, phase, and direction — a process that amplifies light.

It wasn't until 1960, however, this theory was practically realised.

Theodore Maiman, a physicist at Hughes Research Laboratories, built the first working laser using a ruby crystal as the gain medium.

The ruby laser emitted light at a specific wavelength (694 nm) in the red part of the spectrum and was the first of its kind to produce a concentrated beam of light with unique properties coherence, monochromaticity, and the ability to be focused to a very small spot.

Chirped Pulse Amplification (CPA)

This technique revolutionised the field of laser physics. Working at the University of Rochester, Gérard Mourou and his student Donna Strickland (the third woman to win a Nobel prize in physics) introduced CPA to amplify ultrashort laser pulses without damaging the amplifying material. Their innovation later earned them the Nobel Prize in Physics in 2018.

CPA allowed for the amplification of laser pulses in a previously-impossible way, opening the door to medical applications requiring extreme precision, such as in eye surgery.

Femtosecond Lasers

Definition: Lasers that emit pulses of light on the order of femtoseconds (10^-15 seconds).

Applications: Used in various fields like medicine, manufacturing, and

scientific research.

Advantages

Precision: High accuracy in cutting and shaping materials.

Minimal Heat Affected Zone: Reduces thermal damage to surrounding areas.

Versatility: Applicable across multiple fields and industries.

Challenges

Cost: High initial investment for equipment.

Complexity: Requires skilled operators for effective use.

Material Limitations: Not all materials are suitable for femtosecond laser processing

Fixed Dose Combinations

Overview

Definition: A fixed-dose combination (FDC) is a formulation that combines two or more active pharmaceutical ingredients in a single dosage form.

Purpose: Enhance efficacy, simplify treatment regimens, and improve patient adherence.

Key Considerations

Regulatory Challenges: Various countries have different regulations regarding FDCs.

Safety and Efficacy: Importance of clinical trials to ensure safety and

therapeutic effectiveness.

Market Trends: Growing demand for combination therapies in chronic diseases.

Applications

Cardiovascular Diseases: Preventing atherosclerotic cardiovascular disease.

Infectious Diseases: Treating conditions like tuberculosis and HIV.

Chronic Conditions: Management of diabetes and hypertension.

Recent Developments

Bans and Regulations: Recent bans on certain irrational FDCs due to safety concerns.

Challenges

Adverse Effects: Potential for increased side effects due to multiple active ingredients.

Public Awareness: Educating patients and healthcare providers on the benefits and risks.

BioE3 or Biotechnology for Economy,

Cabinet cleared a proposal, though without specifying a budget, called BioE3 or Biotechnology for Economy, Environment and Employment. Its thrust is to boost manufacturing in the biotechnology sector. Since 1986, India has had a dedicated department for biotechnology, and which deserves substantial credit.

For instance, the progress in vaccine development, diagnostics and biologicals,

that has bolstered India's reputation as a 'vaccine factory', is due to the initiatives of this department.

However, biotechnology did not quite spawn the equivalent of the IT revolution. There is much more to an industrialised biotechnology sector beyond vaccines.

There are billiondollar conglomerates today that rest on high-value microbes, gene-modification technologies, bio-plastics, bio-materials, and high-precision medical devices.

However, despite the know-how and human resource capital, only a few Indian biotechs have global resonance, as there are few local manufacturers who can supply Indian laboratories/startups with the ingredients and devices to make products.

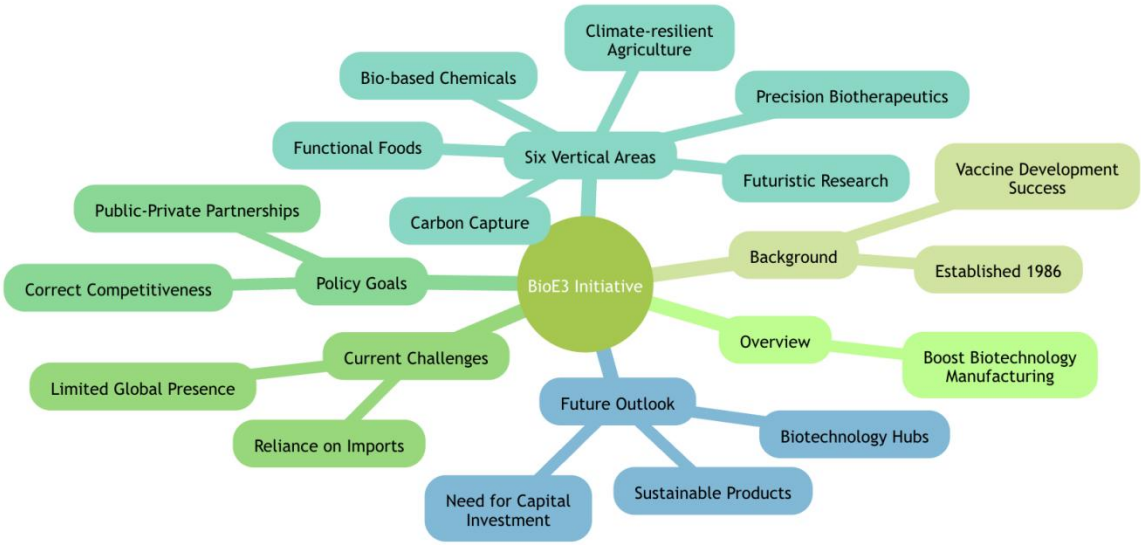
The reliance on imports means that India loses its international competitiveness. The BioE3 policy aims to correct this. In the last four decades, India has funded biotech research institutions but now sees that it needs to be going beyond and setting up companies, in public private partnership mode, to bolster biotechnology manufacturing.

There are six verticals that this initiative envisages: bio-based chemicals and enzymes; functional foods and smart proteins; precision biotherapeutics; climate-resilient agriculture; carbon capture, and futuristic marine and space research.

Futurists have been saying that the era of fossil-fuel industrialisation is over and humanity will have to rely on the natural world for food and for making consumer products. This is to solve the global problem of non-biodegradable waste and carbon emissions. Future industries must be grounded in environmentally benign products, and this is impossible without sophisticated biotechnology.

By setting up bio-foundries and bio-articial intelligence hubs, the policy hopes there will be avenues for a variety of biotechnologists to congregate.

Well intentioned this may be, but India's woes with manufacturing have chronic causes. Without establishing enabling grounds for longterm capital investment and these have little to do with biotechnology per se top-down initiatives will have limited impact



Why Fishes Died in Port of Volos, Greece

Overview

- **Recent event: Mass fish die-off at Port of Volos.**
- **Cause: Primarily attributed to extreme climate conditions.**
- **Recent reports indicate over 100 tons of dead fish collected around the port, significantly impacting the local ecosystem and tourism.**
- **The situation has raised concerns about environmental health and climate change effects.**

Impact

Environmental:

Disruption of local marine ecosystems.

Potential loss of biodiversity.

Economic:

Negative effects on local fishing industry.

Decrease in tourism due to unpleasant conditions.

Social:

Community concerns regarding health and safety.

Public outcry for better environmental management.

Response Measures

Clean-Up Operations:

Local authorities mobilizing resources for cleanup.

Ongoing investigations into causes and remedies.

Research Initiatives:

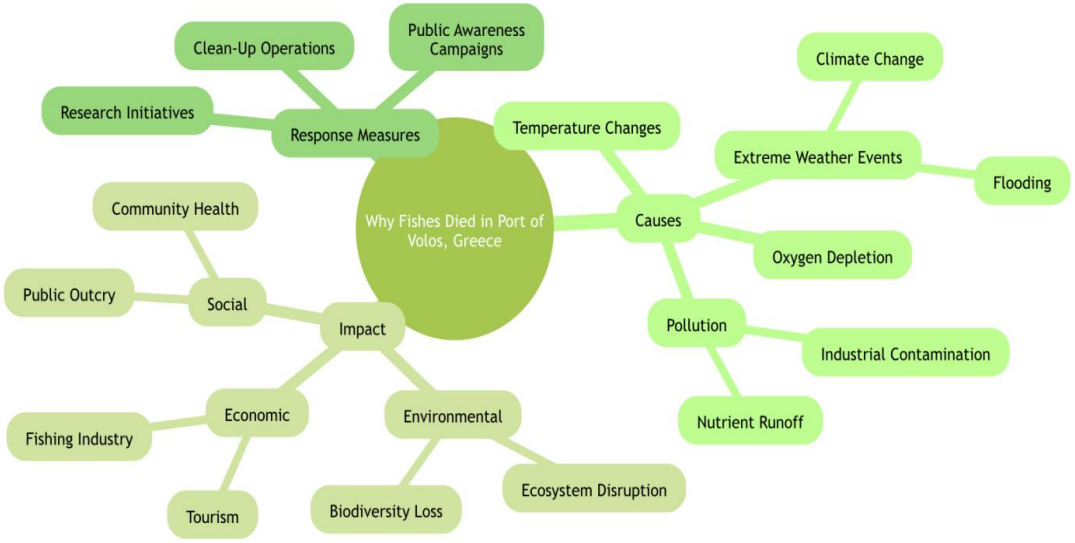
Studies on long-term impacts of climate change on marine life.

Monitoring water quality and fish populations.

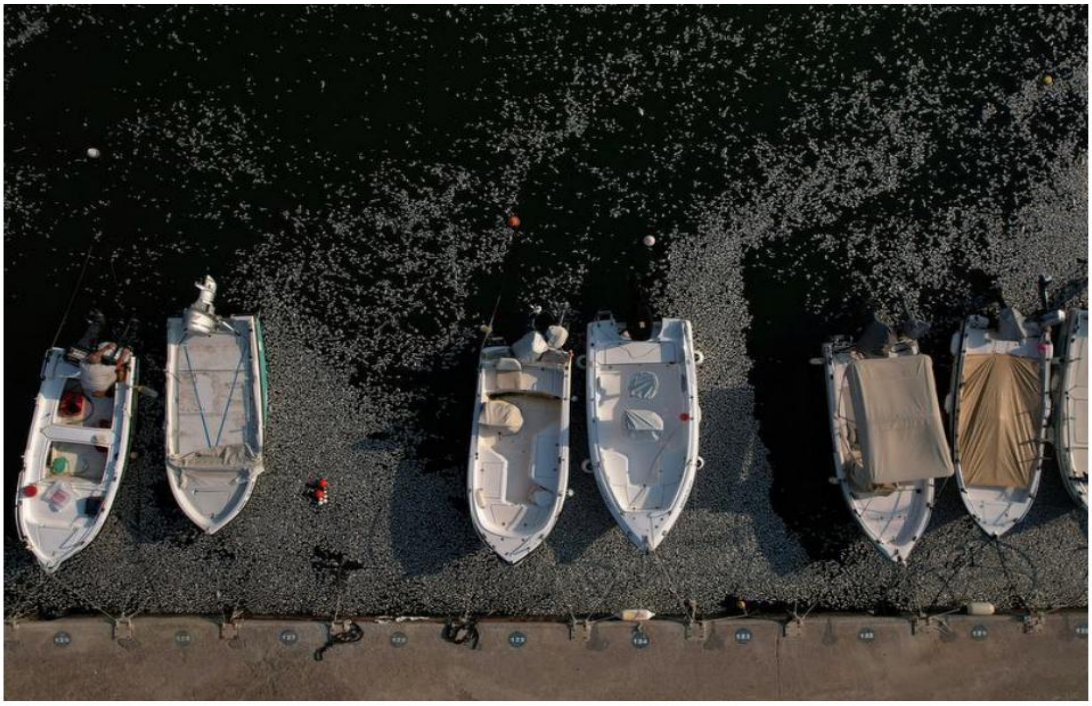
Public Awareness Campaigns:

Educating the community on environmental protection.

Promoting sustainable fishing practices.



Climate catastrophe



Grim sight: Dead fish surround boats after washing up in tonnes in the port of Volos, Greece, on Wednesday following a mass die-off linked to extreme climate fluctuations. REUTERS