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Seed copter

- A city-based technology start-up has come up with the innovative idea of an aerial seeding campaign as a solution for the reforestation challenge.
- Marut Drones, is now using them for greening large swathes of denuded forest lands through its “Hara Bhara” initiative.
- ‘Seed copter’ a drone with seed balls on Friday, kicking off the.
- The first payload of 1.5 lakh seed balls was delivered in the KBR National Park in the city.
- “Loss of vegetation occurs in vast tracts of forest areas every year due to fire and other causes.
- The seed balls contain a variety of seeds rolled within a ball of clay, together with organic manure and fertilizer.
- The balls, after being dispersed in a barren area, are expected to dissolve when it rains, and result in germination of the seeds.
- Tiny plants to digest plastic
- Researchers from University of Madras and Presidency College, Chennai, have isolated an alga species that shows promise as an agent of biodegradation of plastic sheets.
- It is a preliminary study that has been published in Scientific Reports.
- According to the Central Pollution Control Board’s annual report for the year 2011- 12, the plastic waste generated in a year amounted to 5.6 million metric tonnes. Only 60% of the plastic used in India was collected and recycled.
- The usual means of disposal of plastic waste involves incineration, land-filling and recycling.
- These methods have limitations and also sometimes produce side-effects that are hazardous to the environment.

- In earlier studies, species of bacteria that degrade plastic have been studied. In the present study, this role is played by the microalga *Uronema africanum* Borge.
- This is a species of microalgae that is commonly found in Africa, Asia and Europe.
- In Rangoon, Burma, it was noted to be an epiphyte, attaching itself to other algae and plant
- “The microalgae produce different kinds of extra cellular polysaccharides, enzymes, toxins such as cyan toxins, hormones which react with the polymer sheets (polymer bonds) and break them up into the simpler monomers which will not have harmful effect in the atmosphere.



Coral microbiome

- Bacteria, fungi and viruses that comprise the microbiome of corals may play a role in the ability of corals to resist global warming and avoid bleaching, according to a new study by Penn State researchers.

- This study, published in Nature Communications, observed three species of corals: the shallow water starlet coral, shown in the picture, the knobby brain coral and the mountainous star coral.
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Food system

- The first and historic United Nations Food Systems Summit (UNFSS) 2021 which was held in September this year, concluded after an intense ‘bottom up’ process conceived in 2019 by UN Secretary-General Antonio Guterres to find solutions and ‘catalyse momentum’ to transform the way the world produces, consumes, and thinks about food and help address rising hunger.
- In terms of larger goals, the food system transformation is considered essential in achieving the sustainable development agenda 2030.
- This makes strong sense as 11 Sustainable Development Goals (SDGs) out of 17 are directly related to the food system
- Global food systems the networks that are needed to produce and transform food, and ensure it reaches consumers, or the paths that food travels from production to plate are in a state of crisis in many countries affecting the poor and the vulnerable.
- The flaws in food systems affect us all, but most of all they are affecting 811 million people in the world who go to bed hungry each night
- One of India's greatest contributions to equity in food is its National Food Security Act 2013 that anchors the Targeted Public Distribution System (TPDS), the Mid-Day meals (MDM), and the Integrated Child Development Services (ICDS).
- Today, India’s food safety nets collectively reach over a billion people.

- Food safety nets and inclusion are linked with public procurement and buffer stock policy
- Climate change and unsustainable use of land and water resources are the most formidable challenges food systems face today.
- The latest Intergovernmental Panel on Climate Change (IPCC) report has set the alarm bells ringing, highlighting the urgency to act now.
- Dietary diversity, nutrition, and related health outcomes are another area of concern as a focus on rice and wheat has created nutritional challenges of its own.
- India has taken a bold decision to fortify rice supplied through the Public Distribution System with iron.
- Agricultural research institutes are about to release varieties of many crops having much higher nutrition as a long-term solution for undernutrition and malnutrition
- It is ironic that despite being a net exporter and food surplus country at the aggregate level, India has a 50% higher prevalence of undernutrition compared to the world average.
- But the proportion of the undernourished population declined from 21.6% during 2004-06 to 15.4% during 2018-20.
- The high prevalence of undernutrition in the country does not seem to be due to food shortage or the low availability of food
- Reducing food wastage or loss of food is a mammoth challenge and is linked to the efficiency of the food supply chain. Food wastage in India exceeds ₹1-lakh crore.
- An alarming escalation in global hunger is unfolding, with the 'dramatic worsening' of world hunger in 2020, much of it likely related to the fallout of COVID-19

- It is important to reiterate that hunger and food insecurity are key drivers of conflict and instability across the world.
 - ‘Food is peace’, is a catchphrase often used to highlight how hunger and conflict feed on each other.
 - The Nobel Peace Prize 2020 conferred on the United Nations WFP highlighted the importance of addressing hunger to prevent conflicts and create stability.
 - We must collaborate to invest, innovate, and create lasting solutions in sustainable agriculture contribution to equitable livelihood, food security, and nutrition.
 - India has so much to offer from its successes, and learning also, to prepare itself for the next 20 to 30 years.
 - This surely requires reimagining the food system towards the goal of balancing growth and sustainability, mitigating climate change, ensuring healthy, safe, quality, and affordable food, maintaining biodiversity, improving resilience, and offering an attractive income and work environment to smallholders and youth.
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Amendment in forest conservation act

- The Union Government has proposed absolving agencies involved in national security projects and border infrastructure projects from obtaining prior forest clearance from the Centre as part of amendments to the existing Forest Conservation Act (FCA).
- The FCA, which first came in 1980 and was amended in 1988, requires such permission.
- The proposed amendment is part of a larger rationalising of existing forest laws, the government

- There is also a plan in the document that is now available on the Environment Ministry's website, to exempt land acquired before 1980 before the FCA came into effect by public sector bodies such as the Railways.
- Currently, the document notes, there was "strong resentment" among several Ministries on how the Act was being interpreted over the right of way of railways, highways.
- As of today, a landholding agency (Rail, NHAI, PWD, etc.) is required to take approval under the Act and pay stipulated compensatory levies such as Net Present Value (NPV), Compensatory Afforestation (CA), etc. for use of such land which was originally been acquired for non-forest purposes.
- Bonn challenge and restoration of green cover
- Covering nearly 30% land surface of the earth, forests around the globe provide a wide variety of ecosystem services and support countless and diverse species.
- They also stabilise the climate, sequester carbon and regulate the water regime.
- The State of the World's Forests report 2020, says that since 1990, around 420 million hectares of forest have been lost through deforestation, conversion and land degradation.
- Nearly 178 million hectares have decreased globally due to deforestation (1990-2020).
- India lost 4.69 MHA of its forests for various land uses between 1951 to 1995.
- Despite various international conventions and national policies in place to improve green cover, there is a decline in global forest cover
- India's varied edaphic, climatic and topographic conditions are spread over 10 biogeographical regions and four biodiversity hotspots, sheltering 8% of the world's known flora and fauna.

- However, dependence on forests by nearly 18% of the global human population has put immense pressure on ecosystems; in India, this has resulted in the degradation of 41% of its forests.
- To combat this, India joined the Bonn Challenge with a pledge to restore 21 MHA of degraded and deforested land which was later revised to 26 MHA to be restored by 2030.
- The first-ever country progress report under the Bonn Challenge submitted by India by bringing 9.8 million hectares since 2011 under restoration is an achievement
- Local ecology with a research base: forest restoration and tree planting are leading strategies to fight global warming by way of carbon sequestration.
- Restoration, being a scientific activity, needs research support for its success
- Nearly 5.03% of Indian forests are under protection area (PA) management needing specific restoration strategies.
- The remaining areas witness a range of disturbances including grazing, encroachment, fire, and climate change impacts that need area specific considerations.
- Further, much of the research done so far on restoration is not fully compatible with India's diverse ecological habitats hence warranting due consideration of local factors.
- Further, encroachment of nearly 1.48 MHA of forest and grazing in nearly 75% of forest area is also linked to the livelihood of local communities.
- Linked with the degradation of forests, this dependency, along with various social political and economic factors, complicates the issue manifold.
- Adequate financing is one of the major concerns for the success of any interventions including restoration.

- Active engagement of stakeholders including non-governmental organisations, awareness and capacity building of stakeholders with enabling policy interventions and finance can help a lot to achieve the remaining 16 MHA restoration objectives for India
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Cities and climate action

- Most cities report targeted projects to deal with heat waves and water scarcity, followed by inland flooding, extreme rainfall, and growing disease incidence.
- Coastal flooding, sea-level rise, and cyclones are discussed less often despite India's long coastline and highly vulnerable coastal cities and infrastructure.
- This focus tends to overlook how multiple risks converge and reinforce each other for example, seasonal cycles of flooding and water scarcity in Chennai.
- Importantly, solutions exist and many of them can simultaneously meet climate action and sustainable development goals.
- Front-runners in this space have been cities such as Ahmedabad, which has had a Heat Action Plan (HAP) since 2010, its success evident from reduced heat mortality
- Combining infrastructural interventions (for example, painting roofs white) and behavioural aspects (building public awareness on managing heat), the model has now been scaled up to 17 cities across the country.
- Nature-based solutions such as mangrove restoration in coastal Tamil Nadu and urban wetland management in Bengaluru have demonstrated how restoring ecosystem health can sustain human systems as well.
- For example, urban parks provide cooling benefits and wetlands regulate urban floods.

- Undertaking long-term planning needs resilience planners in every line department as well as communication channels across departments to enable vertical and horizontal knowledge sharing.
- Another key aspect inherent in transforming cities is focusing on changing behaviours and lifestyles.
- This is tougher and less understood because the norms we adhere to, the values we cherish, and the systems we are familiar with tend to stymie change.
- One emerging example of slow but steady behavioural change is bottom-up sustainable practices such as urban farming where citizens are interpreting sustainability at a local and personal scale.
- This can mean growing one's own food on terraces and simultaneously enhancing local biodiversity; composting organic waste and reducing landfill pressure; sharing farm produce with a neighbour, bringing communities closer and creating awareness about food growing.
- India is becoming increasingly urban. Its cities or city-like villages are sites where the twin challenges of climate change and inclusive development will be won or lost.

Smog Tower

- 'Smog tower', a technological aid to help combat air pollution
- The structure is 24 m high, about as much as an 8-storey building an 18-metre concrete tower, topped by a 6-metre-high canopy. At its base are 40 fans, 10 on each side.

- Each fan can discharge 25 cubic metres per second of air, adding up to 1,000 cubic metres per second for the tower as a whole. Inside the tower in two layers are 5,000 filters
- Polluted air is sucked in at a height of 24 m, and filtered air is released at the bottom of the tower, at a height of about 10 m from the ground.
- When the fans at the bottom of the tower operate, the negative pressure created sucks in air from the top.
- The 'macro' layer in the filter traps particles of 10 microns and larger, while the 'micro' layer filters smaller particles of around 0.3 microns.

Further steps

- First, policymakers should expand air pollution monitoring in areas with limited or no air quality monitoring and strengthen forecasting capacity across cities
- Second, city-level emission inventories must be updated periodically
- Third, targeted efforts must be made to improve air quality for urban slum dwellers who have no access to clean cooking energy.
- Finally, and most importantly, cities should strengthen their enforcement capacity by investing in people and systems that can keep a round the-clock watch on both egregious and episodic polluters.



Monsoon

- The southwest monsoon has officially ended in India with 87.4 cm of rainfall between June and September, or just 0.7% short of the historical average of 88 cm. In many ways this was an exceptional year.
- By August end, India was staring at an all India monsoon rainfall deficit of nearly 9%.
- This was primarily due to monsoon rain in August, usually the second rainiest month, being short by 24%.
- Early in the monsoon, the India Meteorological Department (IMD) had forecast “normal” rains with “a tendency towards the positive side” and the August failure had it backtrack a little.
- It forecast correctly in hindsight strong rains in September but maintained that the overall monsoon rainfall while still “normal” would be towards the lower end.
- However, September rainfall 35% more than the monthly normal was so munificent that it completely closed the deficit and was well beyond the IMD’s expectations
- Three years of good rains have boosted storage in India’s key reservoirs. The monsoon, however, proved erratic for agriculture.
- The two key months for kharif crop sowing, July and August, were the ones when the monsoon failed and the excess September rains meant there are real fears of crop damage due to excessive moisture.
- The Government is expecting record crop output with kharif crops expected to yield 150.5 million tonnes until June 2022, which is slightly higher than the 149.56 million tonnes harvested last year.
- There are record surpluses expected for rice, pulses and oilseeds.

- While this could advantage exports it might also mean demands by farmers for more remunerative prices.
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Report of CEEW

- Uttar Pradesh is the largest emitter of PM2.5, the class of particulate matter considered most harmful to health, according to an analysis by the Council on Energy, Environment and Water (CEEW).
- The council, a research body, looked at five of the most reliable data sources international and national that have tracked and measured the quantum and sources of air pollution in India.
- The high emissions from U.P. were largely due to a significant share of PM2.5 emissions from solid-fuel use in households and, by virtue of being India's most populous State, it had a higher proportion of households relying on this form of fuel.
- Maharashtra, Gujarat, Odisha, West Bengal, Madhya Pradesh, Bihar, Tamil Nadu, and Rajasthan too feature in the list of top polluters but are differently ranked by the five sources.
- Only Uttar Pradesh is at the top of the lists from all sources
- 'Digne resolution' and geodiversity
- Like social diversity, India's geodiversity, or variety of the geological and physical elements of nature, is unique.
- India has tall mountains, deep valleys, sculpted landforms, long winding coastlines, hot mineral springs, active volcanoes, diverse soil types, mineralised areas, and globally important fossil-bearing sites.
- It is long known as the world's 'natural laboratory' for geo-scientific learning

- Broken loose from a supercontinent 150 million years ago, the Indian landmass, with all its strange-looking plants and animals, drifted northwards all by itself for 100 million years until it settled under the southern margin of the Asian continent.
- It got entwined with the world's youngest plate boundary.
- The geological features and landscapes that evolved over billions of years through numerous cycles of tectonic and climate upheavals are recorded in India's rock formations and terrains, and are part of the country's heritage.
- For example, the Kutch region in Gujarat has dinosaur fossils and is our version of a Jurassic Park. The Tiruchirappalli region of Tamil Nadu, originally a Mesozoic Ocean, is a store house of Cretaceous (60 million years ago) marine fossils.
- To know how physical geography gets transformed into a cultural entity, we need to study the environmental history of the Indus River Valley, one of the cradles of human civilisation.

India offers plenty of such example

- Lack of interest in the government and our academic circles towards geological literacy is unfortunate at a time when we face a crisis like global warming.
- As the climate of the future is uncertain, decision-making is difficult.
- Learning from the geological past, like the warmer intervals during the Miocene Epoch (23 to 5 million years ago), whose climate can be reconstructed using proxies and simulations, may serve as an analogue for future climate
- The importance of the shared geological heritage of our planet was first recognised in 1991 at an UNESCO-sponsored event, 'First International Symposium on the Conservation of our Geological Heritage'.

- The delegates assembled in Digne, France, and endorsed the concept of a shared legacy: “Man and the Earth share a common heritage, of which we and our governments are but the custodians.”
- This declaration foresaw the establishment of geo-parks as sites that commemorate unique geological features and landscapes within their assigned territories; and as spaces that educate the public on geological importance.
- These sites thus promote geo-tourism that generates revenue and employment
- In the late 1990s, in what may be considered as a continuation of the Digne resolution, UNESCO facilitated efforts to create a formal programme promoting a global network of geoheritage sites.
- These were intended to complement the World Heritage Convention and the UNESCO Man and the Biosphere programme. UNESCO provided guidelines for developing national geo-parks so that they become part of the Global Geoparks Network.
- Today, there are 169 Global Geoparks across 44 countries.
- Countries like Vietnam and Thailand have also implemented laws to conserve their geological and natural heritage. Unfortunately, India does not have any such legislation and policy for conservation.
- Though the Geological Survey of India (GSI) has identified 32 sites as National Geological Monuments, there is not a single geo-park in India which is recognised by the UNESCO.
- This is despite the fact that India is a signatory to the establishment of UNESCO Global Geoparks
- Despite international progress in this field, the concept of geo-conservation has not found much traction in India.
- Many fossil-bearing sites have been destroyed in the name of development

- For example, the high concentration of iridium in the geological section at Anjar, Kutch district, provides evidence for a massive meteoritic impact that caused the extinction of dinosaurs about 65 million years ago. This site was destroyed due to the laying of a new rail track in the area.
 - Similarly, a national geological monument exhibiting a unique rock called Nepheline Syenite in Ajmer district of Rajasthan was destroyed in a road-widening project.
 - The Lonar impact crater in Buldhana district of Maharashtra is an important geo-heritage site of international significance.
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EU and GM Rice from India

- When candy giant Mars Wrigley carried out a mass recall of several batches of its Crispy M&Ms across Europe this August, it was due to the use of one ingredient: rice flour with genetically modified (GM) contamination that allegedly originated in India, according to notifications on the European Commission's rapid alert system.
- However, the Commerce Ministry pointed out that GM rice is not grown commercially in India, let alone exported, and promised a thorough enquiry by its agricultural exports authority.
- The Ministry alleged that the case was a "futile conspiracy to malign the image of India as a reliable food security provider".
- Worried farmers' groups and environmental activists, however, noted that multiple GM rice varieties had been approved for confined field trials, and warned that any cross-contamination could dampen the country's agricultural export ambitions.

- India's annual rice exports amount to 18 million tonnes worth ₹65,000 crore, and reach more than 75 countries
- Transgenic plants have genes inserted into them that are derived from another species.
- **BENEFITS-** Improved shelf life, improved nutrition (golden rice- rich in vitamin A-Gene is derived from the bacterium *Erwinia uredovora*); stress resistance, insect resistance etc.
- PRODUCTION OF BIOFUEL
- USEFUL PRODUCTS
- Bioplastic- use of potato
- Oilseed can be modified to produce detergent

POTENTIAL RISK

- Allergen city
- May impact human health
- Loss of indigenous crops
- Some have toxic properties
- ADVANTAGE GM
- Increasing population and food security
- Drought resistant
- Salinity tolerance
- Nutrition

DISADVANTAGES

- More safety testing
- More use of pesticide and pesticide resistance
- Impact on consumer behaviour
- REGULATION

- CODEX alimentations
- Sanitary and phytosanitary measures
- GEAC
- GM in India
- Bt cotton is the only genetically modified (GM) crop that has been approved for commercial cultivation in 2002 by the Government of India. Long term studies were conducted by ICAR on the impact of Bt cotton which did not show any adverse effect on soil, microflora and animal health.
- However, the Parliamentary Standing Committee on Science and Technology, Environment and Forests, in its report on 'Genetically modified crops and its impact on environment', submitted to parliament on August 25, 2017, recommended that GM crops should be introduced in the country only after critical scientific evaluation of its benefit and safety, and also recommended restructuring of regulatory framework for unbiased assessment of GM crops.
- In 2002 approval for the commercial release of Bt cotton hybrids/ varieties resistant to cotton bollworm was given.
- Bt Brinjal resistant to brinjal shoot fly developed by M/S Mahyco in collaboration with University of Agricultural Sciences, Dharwad; Tamil Nadu Agricultural University, Coimbatore and ICAR-Indian Institute of Vegetable Research, Varanasi was approved by GEAC in 2009 but due to 10 years moratorium imposed on GM crops by the Technical Expert Committee (TEC) appointed by the Hon'ble Supreme Court of India, no further action on commercialization has been taken.
- GM mustard Dhara Mustard Hybrid 11 (DMH 11) developed by Delhi University is pending for commercial release as GEAC has advised to generate complete safety assessment data on environmental bio-safety, especially effects on beneficial insect species. No such request is pending in the matter.

- ICAR always promotes the science based innovative technology including research on GM crops. 'Network Project on Transgenic in Crops' (presently Network Project on Functional Genomics and Genetic Modification in Crops) was launched by ICAR in 2005 for development of GM crops in case of pigeonpea, chickpea, sorghum, potato, brinjal, tomato and banana for different traits and the material is in different stages of development.
 - The Government of India has very strict guidelines to test and evaluate the agronomic value of the GM crops so as to protect the interests of the farmers.
 - These guidelines address all concerns with regard to the safety of GM seeds.
 - The regulatory system for GM crops as operative in the Department of Biotechnology, Ministry of Science and Technology (Review Committee on Genetic Manipulation; RCGM) and Ministry of Environment and Forests (Genetic Engineering Appraisal Committee; GEAC) has guidelines to consider the GM crops on case-by-case basis towards testing.
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Carbon market

- Article 6 of the Paris Agreement introduces provisions for using international carbon markets to facilitate fulfilment of Nationally Determined Contributions (NDCs) by countries.
- The success of COP26 at Glasgow hinges, to a great extent, on the conclusion of carbon markets discussions
- Developing countries, particularly India, China and Brazil, gained significantly from the carbon market under the Clean Development Mechanism (CDM) of the Kyoto Protocol.
- India registered 1,703 projects under the CDM which is the second highest in the world.

- Total carbon credits known as Certified Emission Reductions (CERs) issued for these projects are around 255 million which corresponds to an overall anticipated inflow of approximately U.S.\$2.55 billion in the country at a conservative price of U.S.\$10 per CER
 - Unlike the Kyoto Protocol, now even developing countries are required to have mitigation targets.
 - Developing countries are faced with a dilemma of either selling their carbon credits in return for lucrative foreign investment flows or use these credits to achieve their own mitigation targets.
 - Accounting rules: Article 6.4 mechanism is meant to incentivise the private sector and public entities to undertake mitigation activities for sustainable development.
 - Under this mechanism, a country can purchase emission reductions from public and private entities of the host country and use it to meet its NDC targets.
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Way ahead for CDM

- For developing countries, the new market mechanism is much more than a tool for achieving mitigation targets under the NDCs.
- Much like its predecessor, it should help promote sustainable development and assist climate change adaptation in the developing countries.
- It should encourage private sector participation and attract foreign investments to support low carbon development
- If the decision regarding transition of CDM is not favourable, it could lead to a loss of billions of dollars' worth of potential revenue to India alone

- Share of Proceeds (SOP) to the Adaptation Fund: For developing countries, adaptation is a necessity. However, it remains severely underfunded compared to financing for mitigation activities.
 - While developing countries emphasise that the SOP must be uniformly applied to Articles 6.2 and 6.4 to fund adaptation, developed countries want to restrict its application to Article 6.4.
 - This would disincentive the Article 6.4 mechanism and limit voluntary cooperation to the cooperative approaches under Article 6.2 favoured by developed countries.
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Is genetically modified rice grown in India?

- GM foods are derived from plants whose genes are artificially modified, usually by inserting genetic material from another organism, in order to give it a new property, such as increased yield, tolerance to a herbicide, resistance to disease or drought, or to improve its nutritional value.
- Probably the best known variety of GM rice is golden rice, which involves the insertion of genes from a plant both daffodils and maize have been used and a soil bacterium to create a grain that is enriched with Vitamin A.
- India has approved commercial cultivation of only one GM crop, BT cotton.
- No GM food crop has ever been approved for commercial cultivation.
- However, confined field trials have been allowed for at least 20 GM crops.
- That includes varieties of GM rice which would have improved resistance to insects and diseases, as well as hybrid seed production and nutritional enhancements such as golden rice.

- Trials have been carried out by public universities and research institutions such as the Indian Agricultural Research Institute (IARI) and Tamil Nadu Agricultural University, as well as private firms such as Bayer Bioscience and Mahyco.
 - India is the world's top rice exporter, earning ₹65,000 crore last year by selling 18 million tonnes of grain, about a quarter of which is premium basmati.
 - Among the 75 countries which buy Indian rice, West Asian nations, the U.S. and the U.K. are the biggest importers of basmati, while the majority of non-basmati rice goes to African countries and Nepal and Bangladesh.
 - For Indian farmers, the nightmare scenario could be what happened in the U.S. in 2006, when trace amounts of a GM rice variety being tested by Bayer were found in shipments ready for exports.
 - Trading partners such as Japan, Russia and the EU suspended rice imports from the U.S., hitting farmers hard and forcing Bayer to pay \$750 million in damages. Under pressure from the rice export lobby at the time, India drafted policies to ban GM rice trials in the basmati belt.
 - In the face of new advances in rice research, scientists and farmers say the regulatory regime needs to be strengthened for the sake of domestic and export consumers.
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Coal crisis

- The demand of coal is nearly a billion million tonnes (MT), the supply is well below 800 MT within the country.
- When this shortage becomes acute, in terms of the availability of coal at power plants, it is sometimes called a crisis.

- The acute shortage can be on the account of production, an increased demand or a failure of supply chain management when the stocks are sufficient at the pit head but requisite supply is not made to the power plants.
 - Coal crises keep recurring in the country primarily due to the shortage in coal production.
 - Ironically, India sits on 300 billion MT of coal and, as mentioned earlier, our annual requirement is around a billion MT per annum.
 - The immediate coal crisis is attributed to an increase in the demand for power on account of the post-pandemic economic recovery, an increase in international prices of coal, unseasonal rainfall and a mismanagement of the supply chain within the country
 - CIL has a fabulous team. It needs to be supported and not “monitored”.
 - The Union Government has an important role to play. CIL should focus on mining.
 - Government officers should interact with the States, but before that, this ongoing “war” between the Union Government and the States will have to stop
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NLM and livestock breeding

- Livestock breeding in India has been largely unorganised because of which there have been gaps in forward and backward integration across the value chain.
- Such a scenario impacts the quality of livestock that is produced and in turn negatively impacts the return on investment for livestock farmers. Approximately 200 million Indians are involved in livestock farming, including around 100 million dairy farmers.
- Roughly 80% bovines in the country are low on productivity and are reared by small and marginal farmers.

- To enhance the productivity of cattle, the Rashtriya Gokul Mission was initiated in 2014 with a focus on the genetic upgradation of the bovine population through widespread initiatives on artificial insemination, sex-sorted semen, and in vitro fertilization
- The revised version of the Rashtriya Gokul Mission and National Livestock Mission (NLM) proposes to bring focus on entrepreneurship development and breed improvement in cattle, buffalo, poultry, sheep, goat, and piggery by providing incentives to individual entrepreneurs, farmer producer organisations, farmer cooperatives, joint liability groups, self-help groups, Section 8 companies for entrepreneurship development and State governments for breed improvement infrastructure.
- The breed multiplication farm component of the Rashtriya Gokul Mission is going to provide for capital subsidy up to ₹200 lakh for setting up breeding farm with at least 200 milch cows/ buffalo using latest breeding technology.
- The grassroots initiatives in this sphere will be further amplified by web applications like e-Gopala that provide real-time information to livestock farmers on the availability of disease-free germplasm in relevant centres, veterinary care, etc.
- The poultry entrepreneurship programme of the NLM will provide for capital subsidy up to ₹25 lakh for setting up of a parent farm with a capacity to rear 1,000 chicks
- In the context of sheep and goat entrepreneurship, there is a provision of capital subsidy of 50% up to 50 lakh
- For piggery, the NLM will provide 50% capital subsidy of up to ₹30 lakh. Each entrepreneur will be aided with establishment of breeder farms with 100 sows and 10 boars, expected to produce 2,400 piglets in a year

- The revised scheme of NLM coupled with the Rashtriya Gokul Mission and the Animal Husbandry Infrastructure Development Fund has the potential to dramatically enhance the productivity and traceability standards of our livestock.
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Adaptation strategies and climate crisis

- The recently published Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report from Working Group I makes a clarion call for climate action.
- According to the report, the past decade (2011-2020) was warmer by 1.09°C than the period from 1850 to 1900, and the 1.5°C global warming threshold is likely to be breached soon.
- The IPCC report warns India against more intense heat waves, heavy monsoons and rise in weather extremes in the future.
- The Global Climate Risk Index (2021) ranked India the seventh-most affected country by weather extremes

Adaptation strategy

- India is targeting 450 gigawatts of renewable energy capacity by 2030 and it has launched mega solar and green hydrogen missions.
- The Shoonya programme by NITI Aayog, which aims to accelerate adoption of electric vehicles, is yet another effort towards adoption of clean technologies.
- With escalating climatic risks, there is an urgency to adopt adaptation strategies.
- India has some dedicated initiatives towards adaptation, such as the National Action Plan on Climate Change and the National Adaptation Fund.
- However, a breakthrough on adaptation and resilience actions is needed to save hard earned developmental gains and adjust to new climate conditions

- To strengthen adaptation and resilience, India can do the following. First, it can be more prepared for climate change with high-quality meteorological data.
 - With improved early warning systems and forecasting, we can tackle the crisis better. Premier research institutes can be roped in to develop regional climate projections for robust risk assessments.
 - Second, for sustainable production systems, it is necessary to develop well-functioning markets for environmentally friendly products and disseminate them for the desired behavioural change.
 - Third, it is important to encourage private sector participation for investment in adaptation technologies and for designing and implementing innovative climate services and solutions in areas such as agriculture, health, infrastructure, insurance and risk management.
 - Fourth, we need to protect mangroves and forests to address climate related risks by blending traditional knowledge with scientific evidence and encourage local and non-state actors to actively participate.
 - Fifth, major social protection schemes must be climate-proofed. We have an opportunity to create resilient infrastructural assets, diversify the economy and enhance the adaptive capacity of rural households.
 - Sixth, for continuous monitoring and evaluation, effective feedback mechanisms must be developed for mid-course correction.
 - Periodic fine-tuning of State Action Plans on Climate Change is crucial to systematically understand micro-level sensitivities, plan resource allocation, and design responses to serve at different levels of intensities of climate hazards
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Plastic waste recycling rules

- The Environment Ministry has issued draft rules that mandate producers of plastic packaging material to collect all of their produce by 2024 and ensure that a minimum percentage of it be recycled as well as used in subsequent supply.
- It has also specified a system whereby makers and users of plastic packaging could collect certificates called Extended Producer Responsibility (EPR) certificates and trade in them.
- The notification was expected to come into force by December 6 and, as of now, was open to public feedback.
- Only a fraction of plastic that cannot be recycled such as multi-layered multi material plastics would be eligible to be sent for end-of life disposal such as road construction, waste to energy, and waste to oil and cement kilns.
- Only methods prescribed by the Central Pollution Control Board (CPCB) would be permitted for their disposal. Plastic packaging, as per the rules made public on October 6, fall into three categories.
- The first is “rigid” plastic, category 2 is “flexible plastic packaging of single layer or multilayer (more than one layer with different types of plastic), plastic sheets and covers made of plastic sheet, carry bags (including carry bags made of compostable plastics), plastic sachet or pouches; and the third category is called multi-layered plastic packaging, which has at least one layer of plastic and at least one layer of material other than plastic.
- Producers of plastic would be obliged to declare to the government, via a centralised website, how much plastic they produce annually.
- Companies would have to collect at least 35% of the target in 2021-22, 70% by 2022- 23 and 100% by 2024. In 2024, a minimum 50% of their rigid plastic

(category 1) would have to be recycled as would 30% of their category 2 and 3 plastic.

- Every year would see progressively higher targets and after 2026-27, 80% of their category 1 and 60% of the other two categories would need to be recycled.
 - If entities cannot fulfil their obligations, they would on a “case by case basis” be permitted to buy certificates making up for their shortfall from organisations that have used recycled content in excess of their obligation.
 - The CPCB would develop a “mechanism” for such exchanges on an online portal. Noncompliance would not invite a traditional fine.
 - Instead an “environmental compensation” would be levied, though the rules do not specify how much this compensation would be
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Agrofood system

- The health of a country’s agri-food systems determines the health of its people.
- The findings from the first round of the Fifth National Family Health Survey suggest that nutrition related indicators have worsened in most States.
- For Indians to eat better, India must sow better.
- A structural shift in dietary pattern and nutrition requires a shift in production.
- Pathways for nutritional security consist of improving dietary diversity, kitchen gardens, reducing post-harvest losses, making safety net programmes more nutrition sensitive, women’s empowerment, enforcement of standards and regulations, improving Water, Sanitation and Hygiene, nutrition education, and effective use of digital technology
- Addressing the complex problem of malnutrition is a colossal task for which we need to look at agri-food systems as a whole and adopt a multipronged approach.

- While COVID-19 has exacerbated the nutrition issue, climate change has challenged agricultural production itself.
- However, the country's agri-food systems are facing new and unprecedented challenges, especially related to economic and ecological sustainability, nutrition and the adoption of new agricultural technologies.
- The edifice of India's biosecurity remains vulnerable to disasters and extreme events.
- The agri-food systems are the most important part of the Indian economy.
- India produces sufficient food, feed and fibre to sustain about 18% of the world's population (as of 2020). Agriculture contributes about 16.5% to India's GDP and employs 42.3% of the workforce (2019-20)
- There is an urgent need for reorientation of the long-term direction of agri-food systems to not only enhance farm incomes but also ensure better access to safe and nutritious foods.
- Additionally, the agri-food systems need to be reoriented to minimise cost on the environment and the climate.
- This need is recognised by the theme of World Food Day 2021: 'Our actions are our future. Better production, better nutrition, a better environment and a better life'.
- The four betters represent the Food and Agriculture Organization (FAO)'s contribution to the Sustainable Development Goals and other high -level aspirational goals.
- World Food Day marks the foundation day of the FAO. FAO has enjoyed valuable partnership with India since it began operations in 1948.
- More recently, FAO has been engaged with the Indian government for mainstreaming agrobiodiversity, greening agriculture, promoting nutrition sensitive agriculture and strengthening national food security.

- FAO's support for the transformation of agri-food systems is rooted in agro-ecology.
- The more diverse an agricultural system, the greater its ability to adapt to shocks.
- Different combinations of integrated crop -livestock -forestry- fishery systems can help farmers produce a variety of products in the same area, at the same time or in rotation.
- A sustainable agri-food system is one in which a variety of sufficient, nutritious and safe foods are made available at an affordable price to everyone, and nobody goes hungry or suffers from any form of malnutrition.
- Less food is wasted, and the food supply chain is more resilient to shocks.
- Food systems can help combat environmental degradation or climate change.
- Sustainable agri-food systems can deliver food security and nutrition for all, without compromising the economic, social and environmental bases
- Duplicate tea from Nepal
- After years of countering cheaper teas imported from Kenya and Sri Lanka, the beverage industry in India has a new worry duplicate Darjeeling tea brought in from Nepal.
- The Tea Association of India (TAI) has raised the red flag on Nepal origin teas reportedly sold in the domestic market as the premium Darjeeling teas, thereby "diluting the brand image of Darjeeling tea and adversely impacting prices".
- A concerted effort by the Tea Board along with the Customs, the Ministry of Commerce and Industry and the Food Safety and Standards Authority of India (FSSAI) was needed to check the damage to the Darjeeling brand,
- The paper said a revised treaty on trade signed in 2009 allowed the free and unhampered flow of goods between India and Nepal.
- But that should not be the reason for overlooking certain regulations,

- “The current trade between India and Nepal allows mandatory sanitary and phytosanitary certificates before products are allowed in the country. This should be strictly enforced and a notification may accordingly be issued,”
 - Allowing duty- free import of poor quality teas, primarily from Kenya and Sri Lanka, had been undermining the ‘self -reliant India’ and ‘vocal for local’ vision
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Mudumalai Tiger reserve

- Mudumalai National Park is a national park in the Nilgiri Mountains in Tamil Nadu, south India, covering 321 km² (124 sq mi).
- It is located in the Nilgiri District and shares boundaries with the states of Karnataka and Kerala.
- It is part of the Nilgiri Biosphere Reserve and was declared a tiger reserve in 2007. It harbours several endangered and vulnerable species including Bengal tiger, Indian leopard, Indian elephant and gaur.
- Mudumalai National Park harbours 266 bird species, including Indian white-rumped vulture and long-billed vulture

Basic Geography

- Mudumalai National Park is located in the eastern hills of the Western Ghats at an elevation range of 850–1,250 m (2,790–4,100 ft). It is bordered in the north by Bandipur National Park, in the east by Sigur Reserve Forest and in the west by Wayanad Wildlife Sanctuary.
- In the south, it is bordered by Singara Reserve Forest. The Moyar River and its tributaries drain this area, and several artificial waterholes provide drinking water for wildlife during dry seasons.

- The elevation range of 250–1,200 m (820–3,940 ft) in the Western Ghats is characterised by evergreen forest with dipterocarp species prevailing.
- Its undulating hills consist mostly of hornblendite and biotite gneiss with black sandy loam; red heavy loam prevails in the southern part
- A Clean energy transition plan
- India faces the twin challenges of meeting the aspirations of its 1.3 billion population even as it safeguards its energy security and contributes to global efforts to mitigate climate change.
- However, India has a long way to go in providing electricity security to its people since its per capita electricity consumption is still only a third of the global average
- Coal is the only fuel that India has in abundance and the geopolitics of India's neighbourhood do not permit ready access to piped natural gas.
- TPPs contributed 71% of the 1,382 billion units (BU) of electricity generated by utilities in India during FY 2020-21 though they accounted for only 55% of the total installed generation capacity of 382 GW (as of March 2021).
- Coal, therefore, plays a vital role in India's ongoing efforts to achieve Sustainable Development Goal 7, which is "to ensure access to affordable, reliable, sustainable and modern energy for all"
- While variable renewable energy (VRE) sources (primarily, wind and solar) account for 24.7% of the total installed generation capacity, as of March 2021, they contributed 10.7% of the electricity generated by utilities during FY 2020-21.
- However, the ramp -up of VRE generation capacity without commensurate growth in electricity demand has resulted in lower utilisation of TPPs whose fixed costs must be paid by the distribution companies (DISCOMs) and passed through to the final consumer.

- The rapid growth of VRE sources in India has been largely aided by policy measures as well as financial incentives whose cost is borne by the consumer
- We have developed a time bound transition plan for India's power sector involving the progressive retirement of 36 GW of installed generation capacity in 211 TPPs (unit size 210 MW and below) based on key performance parameters such as efficiency, specific coal consumption, technological obsolescence, and age.
- shortfall in baseload electricity generation can be made up by increasing the utilisation of existing High Efficiency Low Emission (HELE) TPPs that are currently under-utilised to accommodate VRE and commissioning the 47 government owned TPPs (total capacity of 31.6 GW) that are at an advanced stage of construction in which ₹ 1,77,742 crore have already been invested by government utilities.
- These TPPs have already signed power purchase agreements with the respective DISCOMs
- With the implementation of our transition plan, the total installed capacity of TPPs operated by utilities will increase from the current level of 209 GW (as of September 2021) to 220 GW by FY 2029-30 even after retiring 211 inefficient and obsolete TPPs that are more than 25 years old and need major sustenance capital expenditures (Capex) for life extension, modernisation, and retrofit of flue gas desulphurisation plants (FGDs).
- As per our transition plan, India's power generation from TPPs is expected to reduce from the FY 2020-21 level of 71% to 57% of the total electrical energy (2,172 BU) projected to be generated by utilities during FY 2029-30.
- HELE TPPs minimise emissions of particulate matter (PM), SO₂, and NO₂, our transition plan offers operational, economic, and environmental benefits including avoidance of FGD costs in the 211 obsolete TPPs to be retired besides

savings in specific coal consumption and water requirement leading to reductions in electricity tariffs and PM pollution

WMO report

- A report from the World Meteorological Organisation (WMO) on Monday said the increase in CO₂ from 2019 to 2020 was slightly lower than that observed from 2018 to 2019 but higher than the average annual growth rate over the past decade.
- This is despite the approximately 5.6% drop in fossil fuel CO₂ emissions in 2020 due to restrictions related to the pandemic.
- For methane, the increase from 2019 to 2020 was higher than that observed from 2018 to 2019 and also higher than the average annual growth rate over the past decade.
- For nitrous oxides also, the increase was higher and also than the average annual growth rate over the past 10 years.
- The National Oceanic and Atmospheric Administration (NOAA) Annual Greenhouse Gas Index (AGGI) shows that from 1990 to 2020, radiative forcing by long-lived greenhouse gases (LLGHGs) increased by 47%, with CO₂ accounting for about 80% of this increase.
- Concentration of carbon dioxide (CO₂), the most significant greenhouse gas, reached 413.2 parts per million in 2020 and is 149% of the pre-industrial level.
- Methane (CH₄) is 262% and nitrous oxide (N₂O) is 123% of the levels in 1,750 when human activities started disrupting earth's natural equilibrium. Roughly half of the CO₂ emitted by human activities today remains in the atmosphere.
- The other half is taken up by oceans and land ecosystems

- The Bulletin shows that from 1990 to 2020, radiative forcing the warming effect on our climate by long lived greenhouse gases increased by 47%, with CO₂ accounting for about 80% of this increase.
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IAO HANLE

- The Indian Astronomical Observatory (IAO) located at Hanle near Leh in Ladakh is becoming one of the globally promising observatory sites, according to a recent study.
- This is due to its advantages of more clear nights, minimal light pollution, background aerosol concentration, extremely dry atmospheric condition and uninterrupted monsoon.



Nobel Prize in chemistry

- Germany's Benjamin List and U.S.-based David MacMillan on Wednesday won the Nobel Chemistry Prize for developing a tool to build molecules which has helped make chemistry more environmentally friendly.

- Their tool, which they developed independently of each other in 2000, can be used to control and accelerate chemical reactions, exerting a big impact on drugs research.
 - Prior to their work, scientists believed there were only two types of catalysts metals and enzymes.
 - The new technique, which relies on small organic molecules and which is called “asymmetric organ catalysis” is widely used in pharmaceuticals, allowing drug makers to streamline the production of medicines for depression and respiratory infections, among others.
 - Organ catalysts allow several steps in a production process to be performed in an unbroken sequence, considerably reducing waste in chemical manufacturing, the Nobel committee at the Royal Swedish Academy of Sciences.
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Rocket system along LAC

- India’s military posture in the Tawang sector of Arunachal Pradesh has added an offensive punch with the Army deploying Pinaka and Smerch long -range, multi barrel rocket launch systems as well as BrahMos supersonic cruise missiles in the region.
- In a rare demonstration, the Army showcased its Pinaka and Smerch units deployed on the Arunachal Pradesh- Assam
- In addition to the rocket systems, deployment of BrahMos missiles, which have a range of over 290 km, gives the Army the ability to hit targets deep inside China in case of any Chinese misadventure in this sector.
- Smerch, procured from Russia, is the longest range conventional rocket system in the Army’s inventory with a maximum range of 90 km

- Pinaka, indigenously designed and developed by the Defence Research and Development Organisation, has a range of 38 km.
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S400

- Striking a discordant note on the impending delivery of the Russian S-400 missile systems to India, however, US described the deal as “dangerous”, expressed the hope that the two sides could “solve” the issue arising from possible U.S. sanctions over the defence purchase.
- US been quite public about any country that decides to use the S-400.

About

- The S-400 Triumph, previously known as the S-300PMU-3, is an anti-aircraft weapon system developed in the 1990s by Russia's Almaz Central Design Bureau as an upgrade of the S-300 family.
 - It has been in service with the Russian Armed Forces since 2007.
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Nobel Prize in medicine

- This year's Nobel Prize for Physiology or Medicine awarded to the researchers, David Julius and Ardem Patapoutian from the University of California, San Francisco and Scripps Research in La Jolla, California, respectively recognises their seminal work in identifying the gene and understanding the mechanism through which our body perceives temperature and pressure.
- Our ability to sense touch and temperature particularly noxious temperature is essential for our survival and determines how we interact with our internal and external environment; chronic pain results when the pain response goes awry.

- Dr. Julius utilised capsaicin, a key ingredient in hot chilli peppers that induces a burning sensation, to identify a sensor in the nerve endings of the skin and the cellular mechanism that responds to uncomfortably hot temperatures.
 - The receptor for heat gets activated only above 40° C, which is close to the psychophysical threshold for thermal pain, thus allowing us to react to external heat.
 - In 2002, five years after the heat sensor was discovered, the two laureates, and independently, used menthol to discover the receptor that senses cold temperatures.
 - Recent studies have found that discrimination between warm and cool temperatures is possible only through simultaneous activation of warmth-sensing nerve fibres and inhibition of cold-sensing nerve fibres
 - The discovery of pain receptors and the cellular mechanism have attracted pharmaceutical companies as these could be targets for novel medicines.
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Malaria vaccine

- Malaria remains a primary cause of childhood illness and death in sub-Saharan Africa, according to the WHO.
- “For centuries, malaria has stalked sub-Saharan Africa, causing immense personal suffering,”
- now for the first time ever, we have such a vaccine recommended for widespread use
- The WHO’s recommendation was based on the results from an ongoing pilot programme in Ghana, Kenya and Malawi.

- The development comes at a time when the WHO and its partners have reported a stagnation in the progress against the disease that kills more than 2,60, 000 African children under the age of five annually.
 - On October 6, the World Health Organization made a historic announcement, endorsing the first-ever malaria vaccine, RTS,S, among children in sub-Saharan Africa, and in other regions with moderate-to-high Plasmodium falciparum malaria transmission.
 - It made its recommendations based on the results from a pilot programme administering the vaccine to children in Ghana, Kenya and Malawi.
 - Malaria is a life-threatening disease caused by micro-organisms that belong to the genus Plasmodium, and is transmitted by infected female Anopheles mosquitoes.
 - RTS,S/AS01 is a recombinant protein-based vaccine that acts against P. falciparum, believed to be the deadliest malaria parasite globally and the most prevalent in Africa.
 - Malaria is a major public health problem in India, endemic to many States, and involves multiple Plasmodium species, including P. falciparum.
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Enriched uranium

- Enriched uranium is a type of uranium in which the percent composition of uranium-235 has been increased through the process of isotope separation.
- Naturally occurring uranium is composed of three major isotopes: uranium-238 (238U with 99.2739–99.2752% natural abundance), uranium-235 (235U, 0.7198–0.7202%), and uranium-234 (234U, 0.0050–0.0059%).
- 235U is the only nuclide existing in nature (in any appreciable amount) that is fissile with thermal neutrons.

- Enriched uranium is a critical component for both civil nuclear power generation and military nuclear weapons.
 - The International Atomic Energy Agency attempts to monitor and control enriched uranium supplies and processes in its efforts to ensure nuclear power generation safety and curb nuclear weapons proliferation.
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Pegasus

- Pegasus is a highly invasive malware that once installed on an individual's phone, can collect and transmit data, track activities such as browsing history, and control functionalities such as the phone camera.
 - In the aftermath of the Pegasus revelations, certain countries such as France and Morocco ordered immediate investigations
 - If a person whose mobile phone has been hijacked by a military-grade spyware that is only sold to governments, and
 - Person has the right to know why this has been done to him, and at whose behest.
 - And with the inability of Parliament to hold the executive to account the only place where the individual can seek answers is the court.
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Silicosis

- Silicosis is part of the pneumoconiosis family of diseases, described by the policy as “occupational diseases due to dust exposure... are incurable, cause permanent disability and are ‘totally preventable by available control measures and technology’ (emphasis added)”

- Silicosis is a long-term lung disease caused by inhaling large amounts of crystalline silica dust, usually over many years. Silica is a substance naturally found in certain types of stone, rock, sand and clay. Working with these materials can create a very fine dust that can be easily inhaled.
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TB

- The COVID-19 pandemic has reversed years of global progress in tackling tuberculosis and for the first time in over a decade, TB deaths have increased, according to the 2021 Global TB report released recently by the World Health Organization (WHO).
- Worse, India (41%) was on the list of countries that topped those which contributed most to the global reduction in TB notifications between 2019 and 2020.
- India, along with Indonesia (14%), the Philippines (12%), China (8%) and 12 other countries, accounted for 93% of the total global drop in notifications.
- The WHO estimated that some 4.1 million people currently suffer from TB but had not been diagnosed with it or had not officially reported to the national authorities.
- This figure is up from 2.9 million in 2019.

About TB

- A person may develop TB after inhaling Mycobacterium tuberculosis (M. tuberculosis) bacteria.
- When TB affects the lungs, the disease is the most contagious, but a person will usually only become sick after close contact with someone who has this type of TB.

- TB infection (latent TB)--A person can have TB bacteria in their body and never develop symptoms. In most people, the immune system can contain the bacteria so that they do not replicate and cause disease. In this case, a person will have TB infection but not active disease.
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Endemic Transmission

- In epidemiology, an infection is said to be endemic in a population when that infection is constantly maintained at a baseline level in a geographic area without external inputs.
 - For example, chickenpox is endemic (steady state) in the United Kingdom, but malaria is not.
 - Every year, there are a few cases of malaria reported in the UK, but these do not lead to sustained transmission in the population due to the lack of a suitable vector (mosquitoes of the genus Anopheles).
 - For an infection that relies on person-to-person transmission, to be endemic, each person who becomes infected with the disease must pass it on to one other person on average.
 - Assuming a completely susceptible population, that means that the basic reproduction number (R_0) of the infection must equal one.
 - In epidemiology, the basic reproduction number, or basic reproductive number (sometimes called basic reproduction ratio or basic reproductive rate), denoted of an infection is the expected number of cases directly generated by one case in a population where all individuals are susceptible to infection
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Childhood infection

- Childhood infection with the coronavirus is mostly mild and self-limiting as children have lower density of the ACE2 receptor (the portal of cell-entry of virus) in their respiratory passages. Multi-system-inflammatory syndrome, a severe complication encountered in children, is fortunately very rare and treatable.
 - Under these circumstances, children are best protected by fully immunising all school personnel (teachers, non-teaching staff, and transport) and all eligible subjects at home, thereby creating a protective mantle.
-

Pro drug and Molnupiravir

- Antiviral drug molnupiravir
- Molnupiravir has significant promise.
- But there are some concerns about how early and how mild the disease has to be for molnupiravir to work
- Molnupiravir is a pro-drug, which means that it needs to undergo processing in the body to become active.
- It is metabolised to a ribonucleotide analog, which is essentially a sugar molecule linked to a molecule that resembles a nucleic acid.
- Nucleic acids are needed to make RNA, and if molnupiravir is used, the viral enzyme instead of using real cytidine or uridine uses a molecule that is generated by metabolism of molnupiravir called NHC-TP.
- The virus has a proof-reading mechanism but the viral exnuclease which is responsible for removing mistakes does not recognize NHC-TP as an error, so

that when the viral RNA polymerase is making copies of RNA that contains molnupiravir, then it randomly replaces cytidine or uridine.

- This causes more mutations that can be survived by the virus or it becomes unable to replicate this is called lethal mutagenesis or error catastrophe

DLX1

- Researchers at the Indian Institute of Technology (IIT), Kanpur, have discovered that a particular gene (DLX1) which plays an important role in the development of jaws, skeleton, and interneurons in the brain has an important role to play in the growth and development of prostate cancer.
 - The DLX1 protein is found at elevated levels in prostate cancer patients, the reason why the DLX1 protein has been used as a urine-based biomarker.
 - IIT Kanpur has found that the DLX1 protein, which is expressed at higher levels in the prostate cancer cells, has a huge role in the growth and development of the tumour and the spread of the cancer to other organs in the body (metastasis)
-

Tobacco use

- Archaeologists have uncovered evidence that hunter-gatherers in North America were using tobacco around 12,300 years ago 9,000 years earlier than was previously documented.
 - There is much debate on how and when tobacco plants were first domesticated.
 - Researchers have discovered the oldest direct evidence of tobacco use at a hunter-gatherer camp in Utah's West Desert.
-

Seagrass

- Advantage seagrass Research by Dalhousie University and reported in Science found that seagrass meadows are much more genetically diverse and thus resilient in areas where otters are present.
- Otters leave their trademark pits and craters on ground while digging for clams.
- The rough treatment of lush seagrass meadows appears to be producing a reproductive favour.

About Seagrasses

- Seagrasses are underwater plants that evolved from land plants.
 - They are like terrestrial plants in that they have leaves, flowers, seeds, roots, and connective tissues, and they make their food through photosynthesis. ...
 - Seagrasses can reproduce sexually or asexually. They are flowering plants that produce seeds.
 - Radio Waves
 - New class of object
 - University of Sydney astronomers have discovered unusual signals coming from the direction of the Milky Way's centre.
 - The radio waves fit no currently understood pattern of variable radio source and could suggest a new class of stellar object.
 - The light from the new signal oscillates in only one direction and that direction rotates with time.
 - The brightness also varies dramatically.
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About Radio waves

- Radio waves are a type of electromagnetic radiation with wavelengths in the electromagnetic spectrum longer than infrared light. Radio waves have frequencies as high as 300 gigahertz to as low as 30 hertz.
 - At 300 GHz, the corresponding wavelength is 1 mm; at 30 Hz the corresponding wavelength is 10,000 km
 - Radio waves are a type of electromagnetic radiation best-known for their use in communication technologies, such as television, mobile phones and radios.
-

SDN technology

Why in News?

- Even as the Centre investigates allegations that unauthorised genetically modified (GM) rice was exported to Europe, it is yet to decide on a research proposal from its own scientists which would allow plants to be genetically modified without the need for conventional transgenic technology.
- Scientists at the Indian Agricultural Research Institute are in the process of developing resilient and high yield rice varieties using such gene editing techniques, which have already been approved by many countries, and they hope to have such rice varieties in the hands of the Indian farmers by 2024.
- However, the proposal for Indian regulators to consider this technique as equivalent to conventional breeding methods, since it does not involve inserting any foreign DNA, has been pending with the Genetic Engineering Appraisal Committee for almost two years.

- The IARI has previously worked on golden rice, a traditional GM variety which inserted genes from other organisms into the rice plant, but ended trials over five years ago due to agronomic issues
- The Institute has now moved to newer technologies such as Site Directed Nuclease (SDN) 1 and 2.
- They aim to bring precision and efficiency into the breeding process using gene editing tools such as CRISPR.
- “In this case, you are just tweaking a gene that is already there in the plant, without bringing in any gene from outside.
- When a protein comes from an outside organism, then you need to test for safety.
- But in this case, this protein is right there in the plant, and is being changed a little bit, just as nature does through mutation

What is SDN Technology?

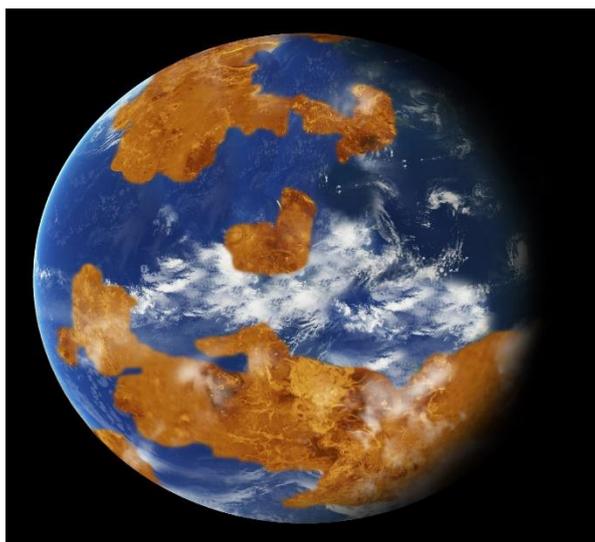
- Several New Breeding Techniques (NBTs) have already been developed, including Site-Directed Nuclease (SDN) technology. Obtaining desired characteristics through targeted adaptations
- Three main SDN technologies currently in use include: Mega nucleases, Zinc-Finger Nucleases (ZFNs) and Transcription Activator like Effector Nucleases (TALENs).
- These technologies rely on biological molecules that have both a DNA-binding domain that recognizes a specific DNA sequence (the site direction) and a DNA cleavage activity (the nuclease), which, when added to a plant cell, result in a specific, predetermined break in the plant’s DNA.
- The plant’s natural DNA repair mechanism recognises this break and repairs the break using enzymes naturally present in the cell.

- The goal of SDN technology is to take advantage of the targeted DNA break and the host's natural repair mechanisms to introduce specific small changes at the site of the DNA break.
- The change can either be a small deletion, a substitution or the addition of a number of nucleotides.
- Such targeted edits result in a new and desired characteristic, such as enhanced nutrient uptake or decreased production of allergens
- SDN-1 produces a double-stranded break in the genome of a plant without the addition of foreign DNA. The spontaneous repair of this break can lead to a mutation or deletion, causing gene silencing, gene knock-out or a change in the activity of a gene.
- SDN-2 produces a double-stranded break, and while the break is repaired by the cell, a small nucleotide template is supplied that is complementary to the area of the break, which in turn, is used by the cell to repair the break. The template contains one or several small sequence changes in the genomic code, which the repair mechanism copies into the plant's genetic material resulting in a mutation of the target gene.
- SDN-3 also induces a double-stranded break in the DNA, but is accompanied by a template containing a gene or other sequence of genetic material. The cell's natural repair process then utilizes this template to repair the break; resulting in the introduction of the genetic material.
- SDN technologies can create specific and targeted mutations in the genome of a plant, in order to obtain plants with improved characteristics.
- India faces the twin challenges of meeting the aspirations of its 1.3 billion population even as it safeguards its energy security and contributes to global efforts to mitigate climate change.

- However, India has a long way to go in providing electricity security to its people since its per capita electricity consumption is still only a third of the global average.
-

Oceans in Venus

- While previous studies have suggested that Venus may have been a much more hospitable place in the past, with its own liquid water oceans, a recent study by astrophysicists led by the University of Geneva found that Venus is unlikely to have harboured any ocean anytime in the past.
- The researchers simulated the climate of the Earth and Venus at the very beginning of their evolution, when the surface of the planets was still molten.
- The high temperatures seen in Venus meant that any water would have been present in the form of steam.
- This means the temperatures never got low enough for the water in its atmosphere to form raindrops that could fall on its surface.
- Instead, water remained as a gas in the atmosphere, and oceans never formed.
- “One of the main reasons for this is the clouds that form preferentially on the night side of the planet.
- These clouds cause a very powerful greenhouse effect that prevented Venus from cooling as quickly as previously thought.



Frameworks

- A few networked sheets, when stacked one over another, form a functional 2-D entity.
- Because words like polymer do not do justice to this complex arrangement of atoms, such molecular networks are called frameworks.
- Uses for these Covalent Organic Frameworks (COFs) take advantage of their stability, large surface area, controlled pore sizes, and tunable chemical environments.
- Metal Organic frameworks (MOFs) are structured like COFs but have metals in complexes with organic entities.
- The choice of metals is wide, from Beryllium to Zinc, though relatively abundant metals are preferred for economic and environmental reasons.
- They offer great advantages: for gas storage, as in the case of hydrogen storage in fuel cells; in catalysis, where they replace very expensive metals; in sensors; and in drug-delivery – anticancer and other drugs with severe side effects can be trapped in the porous confines of MOFs, to be released in small and steady doses

- Zeolites are highly porous, 3-D meshes of silica and alumina.
 - In nature, they occur where volcanic outflows have met water. Synthetic zeolites have proven to be a big and low-cost boon.
 - One biomedical device that has entered our lexicon during the pandemic is the oxygen concentrator.
 - This device has brought down the scale of oxygen purification from industrial-size plants to the volumes needed for a single person
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China's hypersonic missile

- China's military has carried out its first-ever test of a "nuclear capable hypersonic missile".
 - Hypersonic missiles, like traditional ballistic missiles which can deliver nuclear weapons, can fly at more than five times the speed of sound
 - But ballistic missiles fly high into space in an arc to reach their target, while a hypersonic flies on a trajectory low in the atmosphere, potentially reaching a target more quickly.
 - Only the U.S., Russia and China were developing hypersonic glide vehicles, which are launched on rockets and then orbit the earth on their own speed.
 - They are difficult to track because unlike ballistic missiles, they "do not follow the fixed parabolic trajectory".
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System science

- The 2021 Nobel Prize for Physics has been shared by three physicists (with one half jointly to Syukuro Manabe and Klaus Hasselmann) “for the physical modelling of Earth’s climate, quantifying variability and reliably predicting global warming” and (and the other half to Giorgio Parisi) “for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales”
- Physicists had realised the limitations of human minds to understand how the world really works a century ago.
- Systems’ sciences have advanced since the seminal meeting at the Santa Fe Institute in 1987.
- Engineers design machines, applying the laws of mechanics, to produce greater outputs with lesser inputs
- Systems Science, also referred to as Systems Research, or, simply, Systems, is an interdisciplinary field concerned with understanding systems from simple to complex in nature, society, cognition, engineering, technology and science itself.
- The field is diverse, spanning the formal, natural, social, and applied sciences
- To systems scientists, the world can be understood as a system of systems.
- The field aims to develop interdisciplinary foundations that are applicable in a variety of areas, such as psychology, biology, medicine, communication, business management, technology, computer science, engineering, and social sciences.
- Themes commonly stressed in system science are
 - (a) Holistic view
 - (b) Interaction between a system and its embedding environment

- (c) Complex (often subtle) trajectories of dynamic behaviour that sometimes are stable (and thus reinforcing), while at various 'boundary conditions' can become wildly unstable (and thus destructive).
 - Concerns about Earth-scale biosphere/geosphere dynamics is an example of the nature of problems to which systems science seeks to contribute meaningful insights.
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Monsoon and disaster

- The Indian monsoon is an invaluable resource that sustains hundreds of millions of people, but variations in its patterns and intensity pose a rising challenge.
- Kerala, which hosts a vast stretch of the Western Ghats, is having to contend with these changes with almost no respite between severe spells.
- The recurrent bursts show that anomalies in precipitation over the State, spectacularly demonstrated by the inundation of idyllic towns in 2018 and by mudslides that killed many a year later, require a comprehensive adaptation plan.
- This year's torrential rain in the State, which has killed at least 35 people so far, is causing alarm as large reservoirs in mountainous reaches start filling up fast, while the Northeast monsoon lies ahead.
- The Government has responded by issuing alerts for several dams, including Idukki, and put in place plans to release water to avoid a repeat of the flooding witnessed three years ago
- Nurturing the health of rivers and keeping them free of encroachments, protecting the integrity of mountain slopes by ending mining, deforestation and incompatible construction hold the key.

- The ecological imperative should be clear to Kerala with successive years of devastation, echoing the warnings in the Madhav Gadgil committee report on the Western Ghats.
 - Land may be an extremely scarce resource, but expanding extractive economic activity to montane forests is certain to cause incalculable losses.
 - One estimate by researchers in 2017 put quarrying area in Kerala at over 7,157 hectares, much of it in central districts that were hit later by mudslides.
 - It should be evident to governments that it is unconscionable to allow the pursuit of short-term profits at the cost of helpless communities.
 - A more benign development policy should treat nature as an asset, and not an impediment. Accurately mapped hazard zones should inform all decisions.
 - There is a similar threat from extreme weather, breaking glaciers and cloudbursts to Uttarakhand and Himachal Pradesh.
 - Several States face climate change impacts and extreme weather, and the response must be to strengthen natural defences
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Solar technologies

- ‘First-generation’ solar cells use mono-crystalline and multi-crystalline silicon wafers.
- While the former is made from a single crystal of silicon (of higher purity), the latter is made by combining several fragments.
- The efficiency of mono-crystalline panels is about 24%, while for multi-crystalline panels it is about 20%.
- Crystalline silicon technologies are one of the oldest in the market and occupy 95% of the global photovoltaic (PV) market. Mono-crystalline cells are dominant today.

- Although mono-crystalline panels are priced higher than multi-crystalline ones, the difference is diminishing and will soon attain parity.
- This would result in mono panels being preferred over multi due to their higher efficiency, greater energy yield and lower cost of energy.
- Newer technologies incorporating crystalline silicon focus on bifacial solar cells, capable of harvesting energy from both sides of the panel.
- Bifacial can augment the power output by 10-20%.
- Within this, the Passive Emitter and Rear Contact technology is predicted to gain popularity.
- However, it is yet to achieve price parity for large-scale deployment.
- The thin film technologies developed later are classified as the 'second generation' of solar PVs.
- They are manufactured by depositing single or multiple layers of PV material on a substrate, typically plastic or glass.
- In addition to being used in solar farms and rooftops, thin films with their low thickness, light weight and flexibility are also placed on electronic devices and vehicles.
- Mainstream thin films utilise semiconductor chemistries like Cadmium Telluride.
- However, the efficiency of thin films is lower than that of crystalline silicon. This has affected their popularity and market share.
- New and upcoming solar cells are grouped as 'third generation' and contain technologies such as perovskite, nanocrystal and dye-sensitised solar cells.
- Perovskites have seen rapid advances in recent years, achieving cell efficiency of 18%.
- They have the highest potential to replace silicon and disrupt the solar PV market, due to factors such as ease of manufacture, low production costs and potential for higher efficiencies.

- Nanocrystal and dye-sensitised solar cells are variants of the thin film technology.
- These are in early stages for large-scale commercial deployment.
- There is also interest in the use of Graphene Quantum-dots for solar PVs. Graphene is made of a single layer of carbon atoms bonded together as hexagons.
- Solar cells made of graphene are of interest due to high theoretical efficiency of 60% and its super capacitating nature.
- Quantum-dot PVs use semiconductor Nano crystals exhibiting quantum mechanical properties capable of high efficiency of about 66%.
- However, both these are in the early stages of research.
- Considerable advances have also been made in developing solutions that better integrate solar PVs into the grid.
- These include weather forecasting and power output prediction systems; operation monitoring and control systems; and scheduling and optimisation systems.
- Additionally, automatic systems have been developed for the smooth resolution of output fluctuations

Steps Needed

- Policy support is essential to fast-track adoption of new technologies.
- A portion of the budget for renewable energy targets should be set aside exclusively for new technologies.
- Grants and subsidies can also be provided for their adoption.
- This can mitigate the higher initial costs of such technologies and help establish the market.

- Efforts must be taken to address gaps in research, development, and manufacturing capabilities in the solar sector through sector-specific investment and incentives.
 - There must also be greater industry-academia collaborations and funding opportunities for start-ups.
 - A comprehensive sector-specific skilling programme is also required for workers
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INSACOG

- The Indian SARS-CoV-2 Genomics Consortium (INSACOG), jointly initiated by the Union Health Ministry of Health, and Department of Biotechnology (DBT) with Council for Scientific & Industrial Research (CSIR) and Indian Council of Medical Research (ICMR), is a consortium of 28 National Laboratories to monitor the genomic variations in the SARS-CoV-2.
 - INSACOG is a multi-laboratory, multi-agency, Pan-India network to monitor genomic variations in the SARS-CoV-2 by a sentinel sequencing effort.
 - The network carries out whole genome sequencing of SARS-CoV-2 virus across the nation, aiding the understanding of how the virus spreads and evolves, and provides information to aid public health response.
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Hot Jupiter

- Hot Jupiter's are gas giant planets closely bound to their stars.
- A paper published in Nature Astronomy can serve as a 'field guide' to hot Jupiter's and also offer insights into planet formation
- Hot Jupiter's are a class of gas giant exoplanets that are inferred to be physically similar to Jupiter but that have very short orbital periods ($P < 10$ days). The close

proximity to their stars and high surface-atmosphere temperatures resulted in the moniker "hot Jupiter's".

- Hot Jupiter's are the easiest extrasolar planets
 - One of the best-known hot Jupiter's is 51 Pegasi b. Discovered in 1995, it was the first extrasolar planet found orbiting a Sun-like star. 51 Pegasi b has an orbital period of about 4 days.
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Insulin and tissues

- Insulin is a hormone secreted by the b cells of the pancreas.
 - It is commonly associated with an ability to regulate glucose metabolism.
 - However, later studies (from around 1949 until recently) have shown it plays a larger role and helps in growth and maintenance of tissues.
 - Despite years of study, fundamental details as to how differential amounts of insulin impact cells are unknown.
 - An important mechanism in the cell is insulin signalling, which is a series of biochemical reactions that convey information about availability of insulin and the necessity to regulate the glucose in the blood.
 - There are two main pathways for insulin signalling, named AKT and ERK, which together balance metabolism and growth.
 - These specifically control storage of glucose in the liver and also stimulate glucose transport in skeletal muscle and fat.
 - Abnormalities in insulin signalling thus impact health and survival itself of organisms and the study addresses an important piece of the puzzle.
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Age segregation

- Fossils unearthed in Argentina's southern Patagonia region is the oldest-known evidence that some dinosaurs thrived in a complex, well organised herd structure, with adults caring for the young and sharing a communal nesting ground.
 - The fossils include more than 100 dinosaur eggs and the bones of about 80 juveniles and adults of a Jurassic Period plant-eating species called *Mussaurus patagonicus*.
 - The animals experienced a mass-death event, probably caused by a drought, and their bodies were subsequently buried by wind-blown dust.
 - The animals were found to have been grouped by age at the time of their deaths. This phenomenon, called "age segregation," signals a complex social structure
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Great oxidation event

- The Great Oxidation Event (GOE), also called the Great Oxygenation Event, was a time period when the Earth's atmosphere and the shallow ocean first experienced a rise in oxygen, approximately 2.4–2.0 Ga (billion years ago) during the Paleoproterozoic era.
- Geological, isotopic, and chemical evidence suggests that biologically-produced molecular oxygen (dioxygen, O₂) started to accumulate in Earth's atmosphere and changed it from a weakly reducing atmosphere practically free of oxygen into an oxidizing atmosphere containing abundant oxygen, causing many existing anaerobic species on Earth to die out.

- The event is inferred to have been caused by cyanobacteria producing the oxygen, which stored enough chemical energy to enable the subsequent development of multicellular life forms.
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India and china in Himalaya region

- The winter is setting in in the icy cold deserts of Ladakh and there is no respite for Indian and Chinese soldiers who will remain deployed against each other.
- Even if it is a period of calm at the tactical level, the rarefied atmosphere, low temperatures and high altitude take their toll on both men and materiel.
- Chinese stance in recent weeks, the PLA seems singularly uninterested in ending the prolonged deployment.
- The verbal attacks have been matched by massive infrastructure construction, induction of a large quantity of modern equipment, and a sharp increase in the number of military exercises directed towards India.
- These actions are not limited to Ladakh but have also been initiated in the middle and eastern sectors of the 3,488-kilometre long Line of Actual Control (LAC
- The PLA incursion into Barahoti in Uttarakhand in August was a significant pointer to the renewed Chinese aggression against India.
- Even though Barahoti is a disputed area between the two sides, it has been a demilitarised zone.
- Western scholars with Chinese connections point to two major drivers for the PLA's aggressive approach against India.
- The first is its institutional interest as the 'army of the revolution' which is now losing its primacy to the PLA Air Force and PLA Navy when it comes to Taiwan or the South China Sea.

- With China having resolved its boundary disputes with most countries, the only major adversary available for the PLA to reassert its importance is India
 - The second driver is the PLA's view that the Indian military has been registering a greater presence on "Chinese territory" in the border areas in the last 10-12 years.
 - In response to the PLA's actions on the LAC, the Indian military has also inducted more modern military platforms and systems on the China border which has been backed by infrastructure construction.
 - New Delhi is unable to generate enough resources for military modernisation.
 - Ashley Tellis had calculated in 2016 that the Indian Air Force (IAF) would need about 60 fighter jet squadrons by 2020 for a serious two-front threat from China and Pakistan but is down to 30 a
 - Closer ties between Washington DC and New Delhi, short of an alliance, leave the questions of actual support during a Sino-India military crisis unanswered.
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Disaster in Kerala

- With significant land use change across topographic boundaries. Population growth, agricultural expansion, economic growth, infrastructure development particularly road construction and intrastate migration have all led to settlement of the highlands. Kerala is experiencing high growth of residential buildings.
- The Census records that during the decade between 2001 and 2011, the population grew by 5% whereas the number of houses grew by 19.9%
- Such a pace of construction has serious implications for the geoenvironment.
- Not only the locations for siting settlements but also the demand for construction materials, with the attendant quarrying and excavations, is altering

the landscape through terracing, slope modification, rock quarrying, and the construction of roads.

- The basin characteristics of all rivers have been altered.
 - This has resulted in gross disturbance of the character of the terrain evolved through weathering and formation of soil under natural vegetation cover.
 - Consequently, the water absorbing capacity of the river catchment is lost, contributing to increasing surface run-off and reduction in ground water recharge.
 - Road construction in hilly areas, even when cutting across the toe of the slope, is destabilising and creates conditions conducive to landslides
 - The hesitancy towards the implementation of the recommendations by the Western Ghats Ecology Expert Panel, commonly known as the Gadgil Committee, on protection of the Western Ghats.
 - Kerala's achievements in human development are legion. However, it can no longer rest on its laurels in this area, ignoring the relentless assault on its natural assets.
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Why is India facing bouts of extreme weather?

- According to the India Meteorological Department (IMD), the Kerala and Mahe region received 124% excess rainfall from October 14 to October 20. Against the normal 72.1 mm rainfall for the period, the region had received 161.2 mm. Lakshadweep received 15% excess rainfall.
- From October 1 to October 22, Kerala recorded 121% excess rainfall, with all districts, except Alappuzha, recording above 70% excess rainfall. Alappuzha recorded 52% excess for the period.

- The latest fortnightly forecast from the agency says “above normal” rainfall is expected over the next fortnight.
- Uttarakhand recorded 192.6 mm against the usual 35.3 mm from October 1 to October 20

Why such increase?

- There are different factors at play in Kerala and Uttarakhand. There have been two rain-bearing ‘low pressure systems’ that are active in the Arabian Sea as well as the Bay of Bengal since the past week.
- The low pressure system in the Arabian Sea contributed to the heavy rain in Kerala, whereas western disturbances, which are periodic influxes of moisture-laden clouds from the Mediterranean, and common during winter, are what caused the rain in northern India.
- The Bay of Bengal is still warm and strong winds from there are reaching as far as Uttarakhand and will contribute to rainfall in several parts of north-eastern India.
- October is the month when the southwest monsoon entirely retreats from India and the northeast monsoon sets in, bringing rain over Tamil Nadu, Puducherry, coastal Andhra Pradesh and Kerala.
- Both low pressures as well as western disturbances are tangentially connected to the larger pattern of global warming.
- The Bay of Bengal is historically the warmer ocean that seeds low pressures and cyclones that bring rain to India. In recent years however, the Arabian Sea, too, has been warmer than normal, and leading to significant cyclonic activity.
- Overall elevated temperatures are also contributing to warmer waters in the Arctic Ocean and drawing colder air from the poles with greater intensity.

- This added to the increased moisture, thereby seeding more intense western disturbance activity over north India
 - When the atmosphere and the ocean is considered as a whole, rain everywhere is the result of moisture rushing up to fill differences in temperature between oceans and the land and while there is a broad agreement that warming oceans are contributing to intense spells of rainfall in pockets followed by long rainless spells, specific instances such as what is being seen in Kerala and Uttarakhand aren't unprecedented.
 - The monsoon cycle is prone to large variations, and every year regional factors get accentuated it's hard to predict which in advance that then lead to extreme climate events.
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Mullaperiyar dam

- The Supreme Court on October 25 directed the Supervisory Committee to take an immediate and firm decision on the maximum water level that can be maintained at the Mullaperiyar dam, amid torrential rain in Kerala.
- Kerala said the water level should not go above 139 feet, the same as what the court had ordered on August 24, 2018, when the State was hit by floods

About Mullaperiyar dam

- The Mullaperiyar dam is located on the confluence of the Mullayar and Periyar rivers in Kerala's Idukki district.
- It is operated and maintained by the Tamil Nadu for meeting the drinking water and irrigation requirements of five of its southern districts.
- According to a 999-year lease agreement made during the British rule the operational rights were handed over to Tamil Nadu.

- The tension between the two states over the issue has persisted since the 1960s, with Kerala citing concerns regarding the dam's safety and arguing for the reduction of the dam's water levels.
 - But with the water from the dam being diverted to five districts in Tamil Nadu and its importance in the state's irrigation and power production practices, Tamil Nadu has consistently opposed this.
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India and Sri Lanka in Palk Strait

- International Maritime Boundary Line, an invisible demarcation between India and Sri Lanka
- Indian Fishermen intercepted in Sri Lankan waters by the Sri Lankan Navy for “illegal fishing”, following which some of them returned dead.
- The fishermen's deaths serve as a stark reminder of the unresolved fisheries conflict festering in the barely 30-mile-wide (at its narrowest point) Palk Strait.
- In Tamil Nadu, daily wage fishermen are only too aware of the risks that come with working on mechanised fishing vessels used for 'bottom trawling'.
- Their wage depends on the catch they bring back. Using the bottom trawling fishing method, they drag large fishing nets along the seabed, scooping out a huge quantity of prawns, small fishes and virtually everything else at one go.
- The practice, deemed destructive the world over, has ensured sizeable profits for their employers the vessel owners and a small income for the fishermen taking the highest risk.
- Incessant bottom trawling along the coast of Tamil Nadu over the years has meant that the fishermen are drawn to the relatively resource rich Sri Lankan waters.

- The Sri Lankan state's response to the problem has been largely a military and legal one, tasking its Navy with patrolling the seas and arresting "encroachers", banning trawling, and levying stiff fines on foreign vessels engaged in illegal fishing in its territorial waters.
 - India and Sri Lanka have held many rounds of bilateral talks in the last decade between government officials as well as fisher leaders.
 - The outcomes have mostly ranged from deadlocks, with Tamil Nadu refusing to give up bottom trawling, to template responses from the governments, with India seeking a "humanitarian response" from Sri Lanka
 - At the heart of the conflict is a tale of competing livelihoods in a narrow stretch of the sea, amid a looming environmental threat, and a glaring asymmetry of power be it in numbers, equipment, or political backing between two Tamil-speaking fishing communities.
 - The growing trust deficit between them does not augur well for the prospect of a solution
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Parambikulam Aliyar Project (PAP)

- The prosperity of the Pollachi region of Tamil Nadu is attributed to the Parambikulam Aliyar Project (PAP).
- The project paved the way for surplus waters from eight west-flowing rivers to irrigate eastern Tamil Nadu. Of the eight rivers, six Anamalaiyar, Thunacadavu, Sholayar, Nirar, Peruvaripallam and Parambikulam are in the Anamalai hills.
- Two Aliyar and Palar are in the plains.
- The project is an exemplar of co-operative federalism, in this case between Kerala and Tamil Nadu.

- Using inter-basin diversion, the project irrigates drought-prone areas in the Coimbatore and Erode districts of Tamil Nadu.
- It also stabilises the existing irrigation system in the Chittoorpuzha valley in Kerala.
- The PAP agreement was signed between Kerala and Tamil Nadu on May 29, 1970, with retrospective effect from November 1958.
- It provides for the diversion of 30.5 thousand million cubic feet (tmc ft) annually from Kerala to Tamil Nadu. It also provides for Kerala 7.25 tmc ft through the Manacadavu weir and 12.3 tmc ft at its Sholayar dam annually (19.5 tmc in all).
- This major project with an outlay of ₹138 crore was completed in 1972

What are Aeroponics

Aeroponics states “working air,” originated from air, “aer,” and labor, “ponos.” This hydroponics form involves growing plants without the use of soil. It relies on air to deliver a nutrient-rich mist to the plant’s roots. Aeroponics addresses modern farming issues by offering an alternative way to produce greens and vegetables.

- Aeroponics uses 98% less land than traditional farming methods by making use of vertical space as well as horizontal is important advantage for AEROPONICS.
- This family practices of crops is known as “Soilless Controlled Environment Agriculture” (CEA). All types of indoor plant cultivation are covered in this umbrella term in which the environmental conditions, including temperature and sunlight, are controlled by the grower. Growing in a controlled environment improves a farm's ability to predict crop timing, grow quality plants, and maintain high food safety standards.
- **Less water consumption approximately 95 %** is considerably less variability in a controlled environment, lending to less waste and

lower cost. Although aeroponic systems use water-based solutions to perform properly, they use about 95% less water than standard farming.

- Growers design their systems and nutrient solutions to maximize the growth and production of their plants. Plants grown in these indoor gardens are known to grow as much as 3x faster than those in outdoor farms.
 - Safe for consumers: A closed environment eliminates possible contamination from soil or crossover with Mother Nature, so there is no need for herbicides or pesticides, resulting in a more organic product.
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Pollutants in Firecrackers

- Chemicals and metals are added to firecrackers for their light-producing qualities and emit pollutants when burst.
- All crackers were found to have chemicals listed in Schedule I 'List of Hazardous and Toxic Chemicals' of the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989, under the Environment Protection Act, 1986.
- Twelve of the 28 firecrackers had barium, a metal banned by the Supreme Court (SC) in 2018 when SC had also directed National Environmental Engineering Research Institute (NEERI) to develop green crackers, which do not use barium.
- Presence of lead, phosphorus and chromium in some crackers, which have been identified as dangerous metals by the World Health Organisation.
- "Significant proportion of chemical content was found present in all tested cracker results. These chemicals also form oxides, some of which

are extremely toxic to human health including sulphur trioxide, vanadium pentoxide, potassium oxides and copper oxides,”

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