

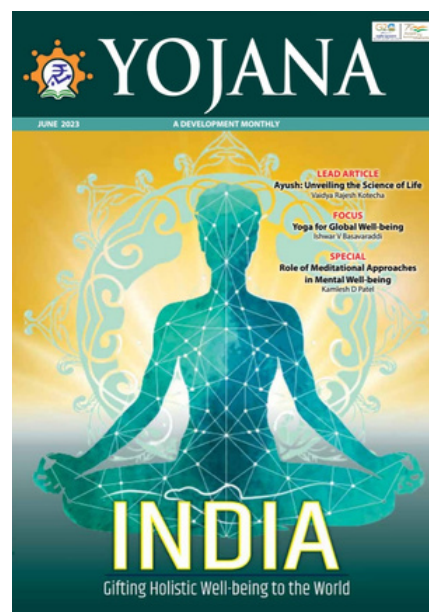
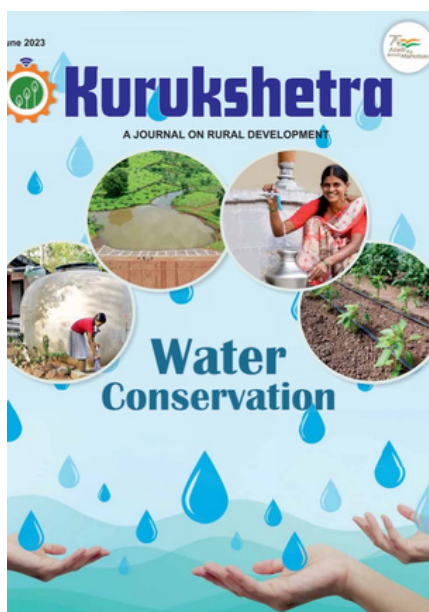
OFFICERS' Pulse

IN-DEPTH

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1) Direct Benefit Transfer in India

(GS2: Important Aspects of Governance, Transparency and Accountability, E-governance- applications, models, successes, limitations, and potential)

Introduction

- The **Economic Survey 2015-16** showed that in several price subsidies that governments offer, **rich households benefit more from the subsidies than do poor households** and **distortions** are created in the market that ultimately hurt the poor the most.
- Further, on account of their **leakages** not only are **direct wastages** created, but **opportunity costs** of how the government could have otherwise deployed those resources also pile up.
- It held that the benefit that price subsidies seek to create for the poor can be **directly transferred to the poor** through lump-sum income transfers, avoiding the distortions that subsidies induce.
- Against this backdrop, the **goal of converting subsidies into Direct Benefit Transfer (DBT)** mediated through the **Jan Dhan, Aadhaar and Mobile Number (JAM) trinity** was set into motion.

What is DBT?

- The DBT was originally envisaged as a **scheme**, where the welfare benefits provided by the Government are **directly credited to the bank or postal account** of the beneficiary.
- Till date, the DBT in India not only entails **cash support** to eligible beneficiaries but also **in-kind transfers** to them, covering over 300 Central and more than 2000 State schemes.
- Widely known examples of cash support include farmer income support programmes like the **Pradhan Mantri Kisan Samman**

Nidhi (PM KISAN), pensions for the old aged, Divyangjan, widows, etc., under the **National Social Assistance Programme (NSAP)**, **scholarships** for the deprived and other sections needing support; and instances of **in-kind support** like **fertiliser subsidy, food grains support** (Public Distribution System), **mid-day meals** for school children etc.

- Whereas the first set of support entails transfer of assistance in the **respective bank accounts** of the beneficiaries, the second bucket of schemes involves provision of **in-kind goods and services to intended beneficiaries**.

Use of Aadhaar

- The common theme is the **use of electronic-ID Aadhaar** for identifying and authenticating the intended beneficiaries.
- At the time of enrolling beneficiaries, the **Aadhaar** is captured; it is then **authenticated** vis-à-vis the details stored in the Unique Identification Authority of India (UIDAI)'s Central Identities Data Repository (CIDR).
- The use of Aadhaar doubles up not only as a **unique identifier** but also as a **financial address**. Under the **Aadhaar Payments Bridge (APB)**, the Aadhaar number is mapped against a **unique savings bank account** and transfers to such accounts can be done using the Aadhaar number as the address. Further, under the **Aadhaar-enabled Payment System (AePS)**, **biometric credentials** can be used by an individual to carry out banking transactions in Aadhaar-linked bank accounts.

World praises India's DBT

- India's Direct Benefit Transfer has been a **force multiplier** in

facilitating the transfer of social safety net payments directly from the government to beneficiaries' bank accounts, helping **reduce leakages, curb corruption**, and provide a **tool to effectively reach households** to increase coverage.

- The **International Monetary Fund** has hailed DBT for being a '**logistical marvel**', with the **World Bank** also lauding the scale at which DBT impacts people's lives.
- At the same time, DBT and accompanying governance reforms have been estimated to **save** the Government of India cumulatively a sum of **Rs 2.23 lakh crore** up till March 2021 or close to **1.1% of GDP**.
- This figure has subsequently gone up to **Rs 2.73 lakh crore** as of March 2022.

Future Scope of DBT

- Wheels are already in motion for realising the next big-bang reforms titled **DBT 2.0** and **DBT 3.0**.
- The **DBT 2.0** focuses on an **online eligibility verification mechanism using Aadhaar**. Briefly, the Schemes often require applicants to submit eligibility documents or certificates issued by different government agencies and departments. Subsequently, the scheme implementing agency has to spend time and incur expenditure for verifying authenticity of such documents.
- The **digitisation and Aadhaar seeding of such documents** ensure **citizen-friendly, real-time, and cost-effective verification or authentication**. Platforms such as **DigiLocker** offer convenient ways to issue and access eligibility certificates in electronic and machine-readable format.
- The **DBT 3.0** seeks to usher in a **transformative shift** in the

scheme of benefit delivery to citizens. As things stand, citizens have to discover the Government schemes for which they would be eligible and apply to the concerned scheme implementing agency for availing the benefits.

- However, by pooling in data residing in various government databases, the **State can suo motu reach out to eligible citizens** and start delivering the envisaged benefits to them by obtaining their consent and willingness thereof.
- Several States have put in place such '**Social Registries**' of varying levels of maturity and richness of data fields – such as **Kutumba** in Karnataka, **Parivaar Pehchaan Patra** in Haryana, **Samagra** in Madhya Pradesh, **Jan Aadhaar** in Rajasthan, **Social Protection Delivery Platform (SPDP)** in Odisha.
- The need now is to establish a **national level social registry** that builds on the states' best practices and places governance in India on a peerless pedestal.

Conclusion

- For the far-reaching contemporary impacts of, and the possibility of futuristic reforms in India's DBT paradigm, it is one of India's most remarkable contributions to the discourse in ongoing G20 discussions.
- It clearly has the potential to promote harmony within our 'One Family' and engender hope for our 'One Future'.

2) Fostering Water Management for Food Security

(GS3: Different Types of Irrigation and Irrigation Systems)

Introduction

- Water is an essential input for agricultural production and food security. Worldwide, the **agriculture sector is the biggest user of water**, withdrawing about **70 per cent of all surface and groundwater through irrigation**.
- In **India**, the **agriculture sector uses 80-90 per cent of total water** used in the country and, yet, **half of the area under agriculture remains rainfed**.

Threats to Food Security

- With rising population, climate change, changes in land use pattern and water cycle, particularly rainfall pattern, desertification-water management and conservation has become global priorities.
- India is the home to about **18 per cent of the world's population** and has only **4 per cent of its water resources**.
- The **per-capita availability of water is less than 1000 m²** and that poses **India as one of the most water stressed countries** in the world (NITI, 2018).
- It is projected that by 2030, the **country's water demand will be twice the available supply** that will have implications on millions of people and an eventual **around 6 per cent loss in the country's GDP** (NITI, 2018).
- With the increased size of population by 2050, agriculture will need to produce almost **50 per cent more food, livestock fodder and biofuel** than in 2012 to satisfy global demand and keep on track to achieve '**zero hunger**' (FAO, 2021).

- To address the gap in projected demand and supply, policy makers and scientists are working to bring a shift in farming from intensive to **resource efficient climate smart farming**.

Water Conservation Strategies in Agriculture

- **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)**: The PMKSY launched during the year 2015-16 with the vision of **extending the coverage of irrigation and improving water use efficiency**, i.e., '**Per Drop More Crop**'.
- The scheme offers an **end-to-end solution for irrigation** through creation, distribution, management, field application, and extension activities. With an outlay of 93,068 crore for 2021-26 under the PMKSY, it will benefit about 22 lakh farmers.
- **Per Drop More Crop**: Per Drop More Crop (PDMC) scheme was launched in the year 2015-16 as a **component under PMKSY** and focuses on **enhancing water use efficiency, productivity and reduction in input costs** through Micro Irrigation technologies, i.e., drip and sprinkler irrigation systems.
- **Promotion of Micro Irrigation**: Also, to **encourage installation of Drip and Sprinkler Irrigation systems**, the Government provides **financial assistance or subsidy** to small and marginal farmers @55 per cent of the indicative unit cost and @45 per cent to other farmers under the PDMC scheme.
- Also, a **Micro Irrigation Fund** of initial corpus **Rs 5000 crore** was created with NABARD to facilitate the States in mobilising the resources for expanding coverage of Micro Irrigation by taking up special and innovative projects.

- The **Water use efficiency of micro irrigation agriculture** including drip & sprinkler irrigation, is as high as **80-95 per cent** in comparison to **only 30-50 per cent in conventional flood irrigation** with several benefits in terms of **water saving** (30-60 per cent), **yield enhancement** (40-75 per cent) and **weed reduction** (20-50 per cent).
- **Mulching:** Mulching, either through **polythene sheets or organic materials** spread on top of the soil helps in **increasing water use efficiency by controlling evaporation losses** from the plant root zone. On average, there is about **10 per cent water saving** from the use of mulch materials in agriculture.
- **Bureau of Water Use Efficiency:** The Government of India has set up the Bureau of Water Use Efficiency (BWUE) for **promotion, regulation and control of efficient use of water** in irrigation, industrial and domestic sectors.
- **Sahi Fasal Campaign:** The 'Sahi Fasal' campaign is a **component of the National Water Mission** initiated by the **Ministry of Jal Shakti** in 2019. This campaign envisions **raising awareness amongst the farming community on water efficient farming** through selection of agricultural crops that utilises water more efficiently and micro irrigation technology.
- **Bhartiya Prakratik Krishi Paddhati:** **Natural farming** is promoted through the Bhartiya Prakratik Krishi Padhati (BPKP) Scheme of Government of India. The scheme aims at **minimising the cost cost of cultivation, recreation of soil ecosystem, resource conservation,**

enhancing farmers' income, and ensuring environmental sustainability.

- It is estimated that **Natural Farming requires 50 to 60 per cent less water and electricity and reduces methane emissions.**

Measures Required

- Along with these schemes, measures are underway to mitigate the water footprints of crops through diversification and dietary shifts.
- The **Economic Survey (2021-22)** highlighted that **increased paddy cultivation** has resulted in **overexploitation of groundwater resources**, particularly in the **northwest and some parts of South India**. Few States such as **Punjab and Haryana utilize more than 90 per cent of groundwater annually.**
- **Identification of cropping pattern** based on ideal agroclimatic condition, **availability of resources** like land, water and market are essential for water conservation.

Community Participation

- Water conservation methods in agriculture can be disseminated through **community participation, women self-help groups, cooperatives, etc.**
- **Rainwater harvesting measures, groundwater recharge, use of micro-irrigation technology, climate smart cropping patterns and resource conservation technologies** can be made available to all farmers through these community centres.

Way Forward

- Water is a **State subject** and requires cooperation to harness steps for **augmentation, conservation, and efficient**

management of water resources across States.

- India being an agrarian economy, ensuring food security and natural resources conservation is needed to guide land and water allocation to ensure sustainable agriculture and socio-economic development.
- **Ecosystem services, and incentives** should be considered to encourage efficient use of water.

3) Cybersecurity Challenges

(GS3: Challenges to Internal Security through Communication Networks, Role of Media and Social Networking Sites in Internal Security Challenges, Basics of Cyber Security)

Introduction

- The 5th Generation of the mobile network, or **5G** is the latest global standard for wireless communications.
- 5G is expected to bring in an **average data rate of 100 megabits per second** and promises to **go up to 20 gigabits per second**.
- These higher speeds will potentially ensure **lower latency rates** and, thus, **more reliability in mobile data communications**.

5G in India

- In India, 5G services were launched in 2022, with telecom companies services in select cities. The country is estimated to have over **150 million 5G users by the end of 2024** - a tiny fraction of the current 1.2 billion mobile phone users.
- However, this number will expand significantly once the 5G network is progressively deployed in tier-2 and tier-3 geographies.
- The ultra-fast speed of 5G will subsequently impact **edtech, autonomous and robotic systems, telemedicine, and precision agriculture**.

- Besides, 5G will unleash the benefits of **Internet of Things (IoT) technologies and connected devices**. High speed and low latency will enable the connected devices to communicate in real-time, offering better and more reliable performance.
- This will benefit **household purposes** (such as IoT-enabled smart homes) and the **industrial sector** (for example, smart factories and automated manufacturing).
- According to one study, by 2035, 5G will enable **US\$ 13.2 trillion of global economic output and support 22.3 million jobs**.

5G and Cyber Threat Landscape

- The fundamental drivers (**geopolitical rivalries, commercial motives, and data harvesting**) behind the recently increased cyberattacks and data breaches from adversarial states and other threat actors remain intact. Therefore, they will pose threats to even 5G networks.
- Among these is the increased tendency among threat actors to **target critical national infrastructure**.
- Considering the potential role that 5G will play in national development and economic growth, it can undoubtedly be regarded as a **critical infrastructure**. Hence, 5G communication networks will represent a **valuable target for cyberattacks**, including sabotage.
- Threat actors might exploit several vulnerabilities of the 5G network and ecosystem. Therefore, 5G will require an **enhanced focus on the security of the connections, devices, and applications**.
- Due to the higher speeds and enhanced capacity, 5G requires **more access points and network**

edges, where the local network or device connects with the internet.

- This shifts much of the core network functions to the edges, closer to the end-user, making it **challenging to enforce the requisite security compliance and ensure trusted third-party vendors**. These conditions thus **expand the attack surface for threat actors**.
- In addition, the 5G network will bring about a **wider proliferation of IoT-enabled devices**. This **magnifies the threat canvas**, as these devices will offer **new malware and botnet distribution vectors**. These will bring increased avenues for attacks such as **Distributed Denial-of-Service attacks or Man-in-the-Middle attacks**.
- Another important dimension in the context of 5G is **privacy risks**. Unlike 4G, networks running on 5G have a **much smaller area of coverage**. Hence, they require **several smaller antennas and base stations**. This can allow **precise location tracking** of mobile phone or internet users inside and outside, potentially compromising their privacy.
- These cybersecurity challenges and privacy risks will not remain restricted to only 5G. Even as 5G networks are progressively rolled out worldwide, leading tech companies have already begun to explore next-generation technologies.
- The **Quad countries**, for instance, have announced plans to **collaborate on space-based 6G** to ensure that security-by-design and best cybersecurity practices are incorporated as the technology takes shape.

Conclusion

- To sum up, 5G offers new opportunities for digitalisation and development, but the technology and network are not secure by design. Therefore, countries, like India, adopting 5G must have a **cyber resilience plan** in place.
- A critical element of this resilience will also be the **awareness of end-users**. Their **cyber hygiene** - their understanding of safe practices in cyberspace - can help them better tackle the threats and protect themselves.

4) Energizing the sciences

(GS3: Achievements of Indians in Science & Technology; Indigenization of Technology and Developing New Technology)

Context

- A draft bill, to legislate the creation of a National Research Foundation (NRF), has been approved by the Union cabinet.

About National Research Foundation (NRF) Bill

- The bill will pave the way to **establish NRF** that will seed, grow and promote Research and Development (R&D) and **foster a culture of research and innovation throughout India's universities**, colleges, research institutions, and R&D laboratories.
- The **Department of Science and Technology (DST)** will be the administrative Department of NRF which will be governed by a Governing Board consisting of eminent researchers and professionals across disciplines.
- Since the scope of the NRF is wide-ranging - impacting all ministries - **the Prime Minister will be the ex-officio President of the Board** and the Union

Minister of Science & Technology & Union Minister of Education will be the ex-officio Vice-Presidents.

- NRF's functioning will be governed by an **Executive Council chaired by the Principal Scientific Adviser** to the Government of India.
- NRF will forge collaborations among the industry, academia, and government departments and research institutions, and create an interface mechanism for participation and contribution of industries and State governments in addition to the scientific and line ministries.
- It will focus on **creating a policy framework** and putting in place regulatory processes that can encourage collaboration and increased spending by the industry on R&D.
- The bill will also **repeal the Science and Engineering Research Board (SERB)** established by an act of Parliament in 2008 and subsume it into NRF which has an expanded mandate and covers activities over and above the activities of SERB.

Significance of NRF

- As India has been **lagging behind countries** like the US, UK, Japan, China and South Korea in **research funding, researchers per million population, publications and patents**, the NRF is expected to galvanize the research enterprise in the country to bridge these gaps and raise Indian science to global peaks of excellence.
- NRF aims to provide a **unifying platform for multi-disciplinary research** and multi-sectoral implementation.

- NRF goes beyond **discipline-restricted channels** to support inter-disciplinary research which is currently underfunded.

- For example, **transformation of primary health care** calls for confluence of public health, social and behavioral sciences, management, digital technologies and health economics, apart from biomedical sciences.

Way Forward

- Mindsets for engaging in **multi-disciplinary research** must be created **early in scientific careers**, by inviting young researchers to collaborate on problem solving research in identified areas where progress needs to be speeded up or solutions are currently unavailable.
- Undergraduate and postgraduate college students too can be stimulated to do collaborative research projects across departments and conduct interdisciplinary seminars.
- Existing government research agencies should also align themselves to the mandate of interdisciplinary, problem solving research that advances our development agenda, while continuing to support scientific research that augments knowledge within their specific disciplines.
- **Private sector contributions** are expected both through untied funds to assist NRF's initiatives as well as project specific funds through identified sponsorship.
- **Engagement of state governments and state level institutions** too will be vital if

India's capacity for conducting locally relevant scientific research is to be enhanced.

5) Flood control

(GS3: Disaster and Disaster Management)

Context

- As floods begin to wreak havoc in various parts of the country including Assam, Odisha, and Himachal Pradesh, the issues surrounding flood management have to be addressed holistically.

India's vulnerability to floods

- Vast stretches totalling over **40 million hectares of land**, equivalent to around **12 per cent of the country's geographical area**, are known to be **flood-prone**.
- However, around 32 million hectares of land, around 80 per cent, is amenable to a reasonable degree of protection against flooding.
- The incidence of floods, as well as the extent of the damage caused by them, has been steadily climbing.

Reasons for steady worsening of the flood menace

- Climate change** induced an increase in the frequency of **freakish rainfall events**.
- Reckless deforestation** and the **degradation of the vegetative cover** of the catchments of rivers and their tributaries have increased siltation, thereby curtailing their water-holding capacity.
- The riverbeds and their floodplains, which are supposed to be buffer zones, have been **encroached** upon.
- Regulation of water flows** in river systems through coordinated opening and shutting

of floodgates of dams has been lacking.

Urban floods

- Urban flooding is the **inundation of land or property** in a built environment, particularly in more densely populated areas, caused by **rainfall overwhelming the capacity of drainage systems**.
- Major deluges were witnessed in cities like **Mumbai (2005)**, **Srinagar (2014)**, **Chennai (2015)**, and **Patna (2019)** in the recent past.

Reasons for urban floods in particular

- Inadequate, outmoded and improperly maintained **drainage systems**.
- Flawed town planning**.
- The shrinking or disappearance of natural water outlets due to **illegal intrusions**.
- The **indiscriminate disposal of garbage** into the drains.

Issues associated with flood management

- Involvement of multiple agencies:** There is no single agency to oversee the flood-management task across the country.
 - While the **India Meteorological Department** makes rainfall predictions, the job of flood forecasting is entrusted to the **Central Water Commission**. Once flooding occurs, rescue and relief work is carried out by **national- and state-level disaster-management agencies**. The subsequent rehabilitation of the affected population and restoration of damaged infrastructure are handled by **local civic bodies**,

which invariably require the state or Union government's help to do so.

- **No statutory provision:** There is no specific statutory provision for flood management in the Indian Constitution.
- **Vague constitutional provisions:** Though water, irrigation, and their related aspects are mentioned among the state subjects, **flood management does not figure in any of the Constitution's three well-defined lists** — the Union list, the State list, and the Concurrent list.

Way Forward

- A **high-level expert panel**, of the type of the **Rashtriya Barh Ayog (National Commission on Floods)** of the 1970s, can be constituted to address the critical issues concerning floods and to suggest a practical plan of action to deal with them in a holistic manner.

6) How India's G20 presidency can address global hunger

(GS2: Issues relating to Poverty and Hunger)

Context

- The **G-20 ministerial meeting on agriculture** was recently held in Hyderabad which highlighted the issues of global hunger.

Status of global hunger

- For the first time in decades, there is a **rising number of hungry people**, even though we produce enough food to feed 10 billion people.
- Today, more than **800 million people** go to bed hungry.
- Many of them are **small-scale farmers** who produce one-third of the world's food.

- **Hunger is rural:** Three-fourths of the world's poorest and food insecure live in rural areas.

Status of rural agriculture

- Rural economies, specifically agriculture, have suffered from **chronic under-investment**.
- Today, low- and middle-income countries are increasingly **indebted**, and **global inflation and local currency depreciation** are making it **challenging** for them to **finance their development and climate action**.
- Small-scale producers still **lack access to credit, markets, technology, infrastructure, information and land**.

Significance of investing in rural agriculture

- Investing in rural agriculture makes a lot of sense for both governments and companies.
- **For governments**
 - Boosting local production, local food chains and local markets means **global food security, jobs and less conflict**.
 - It will also mean **lower GHG emissions** (agriculture is responsible for up to 21 percent of total emissions).
- **For the private sector,**
 - Investing in small-scale farmers should be a win-win.
 - Production costs are low, **returns on capital are high**, farmer organizations and cooperatives have shown they can achieve economies of scale, and crop diversification can defray risk for farms and markets.

- These investments can **build long-term resilience** and reduce the impact of climate change and other shocks.
- Investing in agriculture is **at least 2-3 times more effective in reducing poverty** than investment in other sectors.
- **De-risking investments through innovative financial instruments** and mechanisms can help agriculture become the center of growth.

India's role being G-20 President

- India's G-20 presidency assumes critical importance in **mobilizing resources** to ensure that every person has access to affordable, safe, sufficient and nutritious food.
 - This can be done by **increasing digitisation, making insurance attractive** for farmers and insurers, providing access to **easy and discounted loans, securing land rights** and strengthening farmers' organizations.
- India is a crucial partner in the mission to **end rural poverty and hunger**.
 - **Leveraging the panchayat system**, India has successfully built robust community institutions that have strengthened people's ability to manage their own development.
 - The G-20 countries attempting to become food secure can take inspiration from India to address chronic hunger and food insecurity by **building more sustainable food systems**.

- India has shown thoughtful leadership in **advancing South-South and triangular cooperation**.
- The G-20 can help **mobilize commitments from governments**, global financial institutions, investors and companies to **invest in medium-term sustainable rural development and agriculture**.

Conclusion

- The Indian presidency can deliver an operationally **feasible roadmap for inclusive, resilient and sustainable food systems**.
- This will end hunger for 800 million people, create over 120 million decent rural jobs, boost incomes for the bottom 20 per cent and combat climate change, while also protecting biodiversity.

7) India's effective renewable energy approach

(GS3: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment)

Context

- With a population of 1.4 billion living in areas exposed to sea-level rise, increased cyclonic activity, extreme heat waves, flooding, and impacts of erratic monsoons and landslides, **sustainable development has taken on a renewed relevance** in India.

India's approach towards renewables National Solar Mission

- India launched its **National Solar Mission** in 2010 that strives towards integrating solar power into mainstream energy supply.
- It had set the **target of installing 20,000 megawatts** of renewables by 2022 however the target was **achieved four years before the deadline**.

KUSUM scheme

- **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM)** scheme stresses the need to **power the 10 lakh grid-connected agriculture pumps with solar energy.**
- Under this scheme, individual farmers who have grid-connected agricultural pumps are supported to run their water pumps on solar power – **two-thirds of the cost is covered by the Centre and state governments.**
- The farmer can use the generated solar power to **meet irrigation needs** and the **surplus energy can be sold** to the distribution company at a pre-fixed tariff.

International Solar Alliance

- At the international level, **India and France** spearheaded the International Solar Alliance (ISA), at the **2015** Paris climate conference, to **promote the use of solar energy.**
- The ISA aims to promote solar energy adoption globally, facilitate collaboration among member countries, and mobilize funds for solar projects.

India's strategy towards SDGs

- **Combining Policy and Science:** India's drive towards renewables is a wonderful example of combining science and policy to design solutions that can address the needs of a complex and vast country like ours. This approach provides a just and equitable solution to the millions employed in the coal ecosystem and **facilitates just energy transition.**
- **Innovative policies:** Implementing sustainability goals through innovative policies. Eg: **Swachh Bharat Mission** directly

addresses **Sustainable Development Goal 6** which emphasizes the importance of sanitation, cleanliness, and hygiene.

- **Emphasizes technological solutions:** India leverages technology in addressing sustainable development challenges. Integrating technology-based solutions with public policies centered around sustainability can potentially have cascading effects, and ultimately make for good governance.
- **Technological innovation:** Proper use of technology helps achieve **systemic shifts like carbon neutrality.** Various instrumentalities including market-based mechanisms for the pricing of carbon and cutting-edge know-how in the effective sequestration of carbon, help to increase the **transparency** of systems, ensure **last-mile delivery** of the benefits of sequestration, and help design plans and policies regarding compliance and liabilities.

Conclusion

- Technological innovation, public participation and solutions for sustainable development will provide opportunities for scaling up solutions.
- As the world eyes India's leadership of the G20, planning for structural shifts and innovation could lead to good **"sustainable" governance.**

8) Governors cannot indefinitely hold back Bills

(GS2: Structure, Organization and Functioning of the Executive and the Judiciary—Ministries and Departments of the Government)

Context

- Recently issues have arisen in various States between Chief Ministers and Governors, with regard to the passing of Bills. Chief Ministers feel that Governors have not acted for a long period of time on Bills presented for their assent.

Governor's role and constitutional position

- The Legislature of a State comprises the **Governor and the Legislative Assembly** (if the State has one House) and a **Legislative Council** (if the State has two Houses).
- The Governor has **little autonomy** in his functioning because he can **act only on the "advice" of his Council of Ministers**, with the Chief Minister as the head of the Council.
- However there are certain instances where a Governor can exercise his **discretion** independent of the Council of Ministers.
- As per **Article 163(2) of the Constitution**, this decision of the Governor acting on discretion **cannot be challenged**.
- In **Shamsher Singh v State of Punjab (1974)**, the Supreme Court held that a President or a Governor can exercise their discretion independent of their Ministers **only where the Constitution expressly permits them to do so**.

Governor's power with respect to bills passed by the assembly

- Article 200** states that when the Governor is presented with a Bill, he can either
 - give his assent or
 - withhold it or
 - return the Bill with certain suggestions.
- The **first provision** of the Article states that after a Bill is presented to him, the Governor may **return the Bill** if it is not a Money Bill with a message to reconsider the Bill.
- The House has **six months** to decide whether or not to accept this request.
- Once the House returns the Bill to the Governor, he has **no choice but to give his assent** whether his recommendations have been accepted or not.
- The second provision of the Article **gives the Governor discretion to refer a Bill to the President** if he is of the opinion that the Bill, if passed, would take away the powers of the High Court.
- Article 201** of the Constitution provides for the procedure to be followed when presidential assent for such a Bill is required.

Extent of Governor's autonomy

- To what extent the Governor's autonomy is recognised under the Constitution can be seen from a few judgments of the Supreme Court.
 - In **Purushothaman Nambudiri v State of Kerala**, while deciding whether a Bill pending the Governor's assent would lapse upon the dissolution of the House, the Court considered the provisions of Article 200 and 201 to hold that it would not.

- In **Shamsher Singh**, the Court held that the Governor's power to reserve Bills for the President's consideration is a **discretionary power**. The Court also highlighted the **exceptional circumstances** of the Governor acting independent of the Council of Ministers.
- In **Nabam Rebia and Bamang Felix vs Dy. Speaker**, the Court also held that the Governor exercises discretion only with regard to whether a Bill ought to be reserved for consideration of the President or not. This is important because the Court has also held only those matters where the Constitution expressly permits the Governor to act autonomously cannot be challenged before a court of law.
- Though the Constitution prescribes **no express time limit**, the first provision mentions that the Governor ought to either give his assent or send the Bill back to the House **as soon as possible**. The Governor, therefore, has **no discretion to indefinitely withhold assent to a Bill**.

Conclusion

- **Refusing to act on a Bill is in violation of the Constitution**, and a Governor's action or inaction in this regard would be susceptible to judicial review.
- If an elected government cannot legislate, it could lead to a **breakdown of parliamentary democracy**.

9) Amplify the subject of adolescent girl nutrition

(GS2: Issues relating to Poverty and Hunger)

Context

- To unlock the full potential of India's future, the **health and nutrition of its adolescent girls** have to be prioritized.

Significance of adolescent nutrition

- Adolescence is an important period of **cognitive development** and is the "**second window of opportunity of growth**".
- Improving access to nutrition during adolescence **compensates for any nutrient deficiencies** acquired during early developmental stages in the girl child.
- Adolescent health is a significant **indicator of women's labor force participation** in India in the long term and hence better nutrition improves every young girl's prospect to participate in productive activities.
- By investing in nutrition interventions in adolescent girls India **can add to its nation's demographic dividend**.

Ever-growing nutritional concern

- Adolescent girls are particularly **vulnerable to undernutrition and anemia** due to the onset of menstruation.
- According to the findings of the **National Family Health Survey-5 (2019-21)**, **59.1%** of adolescent girls were found to be **anemic** and NFHS-4 reported that **41.9% of school-going girls were underweight**.
- A range of factors, from **environmental conditions to cultural norms** that lack a gender-neutral environment within a household, affects the

nutrition uptake in adolescent girls.

Adverse impact of malnourished adolescent

- **Impairs cognitive development:** Poorly balanced and insufficient diets can lead to cognitive impairments that affect one's academic performance.
- **Limits opportunities:** Poor academic performance can result in lower educational attainment, which can limit opportunities for employment and economic self-sufficiency later in life.
- **Health risks and complications:** Undernourished adolescent girls are also at a higher risk of **chronic diseases and pregnancy complications**, which can lead to a higher health-care burden on both families and communities. It potentially leads to **financial instability and increased poverty**.
- If adolescent girls are less healthy and less educated, they are **less likely to participate fully in society**, whether through work, politics, or community involvement.

Interventions to be made

- Adopt a **life-cycle approach**, ensuring that no girl gets left behind.
- **Investment in improving their nutrition** should be made that helps break the intergenerational cycle of poverty, as well-nourished girls are more likely to have healthy babies and provide better care for their families.
- A few **strategic modifications to existing interventions** can significantly expand the scope of its outcomes.
 - The **convergence of various government initiatives** such as the

Scheme for Adolescent Girls (**SAG**) within the umbrella of the Prime Minister's Overarching Scheme for Holistic Nutrition programme (**POSHAN**) 2.0 is a step in the right direction, provided it is implemented effectively.

- **Targeted adolescent-oriented schemes** such as the Rashtriya Kishor Swasthya Karyakram (RKSK) could include even **stronger awareness and nutrition education programmes** that would help sustain beneficiary compliance.
- Targeted and regionally contextualized **Social and Behaviour Change Communication (SBCC)** efforts around adolescent girls' nutrition generate greater demand and the adoption of good practices.
- **Routine training of health workers** for effective implementation and monitoring of various schemes, and to adapt with an evolving landscape, is also a crucial step in this process.
- A **holistic narrative on adolescent girls' nutrition**, explaining its linkages with overall mental and physical well-being, individual productivity and overall economic growth of the country is needed.

Conclusion

- Tackling the complex issue of nutrition among adolescent girls is not just a health concern but also an **investment in India's future**.
- Thus, investing in girls' nutrition is **not only the moral obligation of the state but also an economic one**, with potential returns in the form of greater and

more sustainable economic growth of the nation.

10) Is India missing the graphene bus?

(GS3: Awareness in the fields of IT, Space, Computers, Robotics, Nano-technology, Bio-technology and issues relating to Intellectual Property Rights)

Context

- **Artificial Intelligence (AI), quantum computing and graphene** are the three emerging technologies that will disrupt the existing human-machine interface in the next couple of decades.
- While India is among the leaders in AI and a potential challenger in quantum computing, it needs to catch up in the area of graphene.

About Graphene and its properties

- Graphene is the world's **thinnest, strongest, and most conductive material** of both electricity and heat.
- **Conductivity:** It conducts electricity better than copper.
- **Strength and weight:** It is 200 times stronger than steel but six times lighter.
- **Transparency:** It is almost perfectly transparent as it absorbs only 2% of light.
- **Permeability:** It is impermeable to gasses, even those as light as hydrogen and helium.
- It has the potential to revolutionize electricity, conductivity, energy generation, batteries, sensors and more.

Applications of graphene

- Graphene composites are used in **aerospace, automotive, sports equipment** and construction.
- It is used for **high-performance batteries and supercapacitors**, touchscreens, and conductive inks.

- Graphene-based sensors are used for **environmental monitoring**, healthcare and wearable devices.
- Graphene oxide membranes are used for **water purification and desalination**. Graphene-based masks were made during COVID.
- Graphene's exceptional strength makes it a promising material for **armor and ballistic protection**.
- Graphene has the potential to absorb and dissipate electromagnetic waves, making it valuable for **developing stealth coatings** and materials that reduce radar signatures and electromagnetic interference.
- Graphene is highly sensitive to environmental changes, which makes it an excellent candidate for **sensing chemical and biological agents**, explosives, radiation, and other hazardous substances.
- Graphene-based materials can also **protect us against chemical and biological attacks**.
- Better energy storage and electronics properties make graphene attractive in defense and aerospace as well as in civil and commercial applications.

Status of graphene industry

- The global graphene market size was valued at \$175.9 million in 2022 and is expected to grow at a compound **annual growth rate of 46.6%** between 2023 and 2030.
- At least one graphene-enhanced product was launched every week in 2022 and over 300 companies are now producing graphene or its derivatives.
- **China, the U.S., the U.K., Japan, South Korea, Russia, and Singapore** are among the leading countries in graphene research.

- **China and Brazil** are global leaders in the commercial production of graphene.

India's progress in graphene industry

- India's graphene production is about **one-twentieth compared to China** and **one-third compared to Brazil**.
- The **Centre for Nano Science and Engineering** at IISc Bangalore along with KAS Tech produced a graphene-based system several years ago.
- Some start-ups and foreign subsidiaries have started graphene or graphene derivatives in India. Eg: Tata Steel has succeeded in growing graphene and has also mixed graphene with used plastic products to recycle them as new.
- India had set up the **India Innovation Centre for Graphene in Kerala**. It is being implemented by the Digital University Kerala.

Way Forward

- A nodal Ministry needs to be entrusted with the **responsibility of creating a national graphene mission**.
- India needs to be **among the leaders in graphene** as its production may get concentrated in a few locations in the world, as in the case of semiconductors.

11) A new chapter in India-Africa ties can be written

(GS2: Bilateral, Regional and Global Groupings and Agreements involving India and/or affecting India's interests)

Context

- The **20-member Africa Expert Group (AEG)**, established by the Vivekananda International Foundation, recently presented a report entitled '**India-Africa Partnership: Achievements,**

Challenges and Roadmap 2023' which says that India-Africa relations have developed steadily in the past 15 years but more progress is achievable.

Key Takeaways of the Report

- The report notes that India has a substantive partnership with Africa however it is "**essential for New Delhi to review its Africa policy periodically**, stay resilient by making the required changes, and focus on its implementation".

Gist of Recommendations

- The central part of the report is '**Roadmap 2030'**, a set of nearly 60 policy recommendations that are designed to deepen and diversify the India-Africa partnership.

Political and diplomatic cooperation

- It should be strengthened by **restoring periodic leaders' summits** through the medium of the India-Africa Forum Summit; the last summit was in 2015.
- A new **annual strategic dialogue** between the chairperson of the African Union (AU) and India's External Affairs Minister should be launched in 2023.
- A consensus among G-20 members should be forged on the **AU's entry into the G-20** as a full member.
- The **Ministry of External Affairs (MEA)** should have a secretary exclusively in charge of African affairs to further enhance the implementation and impact of the Africa policy.

Defense and security cooperation

- The government needs to increase the number of defense attachés deployed in Africa, **and expand dialogue on defense issues**.
- It should widen the footprint of maritime collaboration, and

expand **lines of credit to facilitate defense exports.**

- The number of defense training slots can be increased and enhance **cooperation in counter-terrorism**, cyber security and emerging technologies.

Economic and development cooperation

- India-Africa trade touching **\$98 billion** in FY22-23 can go up if access to finance through the creation of an **Africa Growth Fund (AGF)** is ensured.
- A special package of measures to **improve project exports** and build up cooperation in the shipping domain has been suggested.
- A special focus on promoting **trilateral cooperation and deepening science and technology cooperation** could pay rich dividends.

Socio cultural cooperation

- Socio-cultural cooperation should be increased through **greater interaction between universities**, think tanks, civil society and media organizations in India and select African countries.
- Setting up a **National Centre for African Studies** will be the right step.
- **Indian Technical and Economic Cooperation (ITEC) and Indian Council for Cultural Relations (ICCR) scholarships** awarded to Africans should be named after famous African figures.
- Visa measures for African students who come to India for higher education should be **liberalized**.

Way Forward

- The report suggests a **special mechanism for implementing the 'Roadmap 2030'**.

- This can best be secured through **close collaboration between the MEA and the National Security Council Secretariat** through a team of officials working under the joint leadership of the Secretary, Africa in the MEA, and a designated Deputy National Security Adviser.

12) How India can lead multilateralism at WTO

(GS2: Important International Institutions, agencies and fora - their Structure, Mandate)

Context

- **World Trade Organisation (WTO) reform** has been on the global agenda for a while including that of the G20, whose members are key players in the WTO.
- The recently concluded meeting of the G20 working group on trade and investment focused on the important issue of WTO reform.

Need for WTO reform

- Today's world is dominated by **geoeconomic considerations and heightened securitisation** of international economic relations which is contrary to the founding principles of WTO.
- The pursuit of **unilateralism** in international economic relations, especially by developed countries like the US, is on the rise.
- Economic policies such as industrial subsidies and local content requirements have made a comeback.
- There is a deliberate effort to **weaken trade multilateralism** in favor of external plurilateral alignments keeping the big power confrontation in mind.

Focus areas of WTO reforms

Special and differential treatment (SDT) principle:

- Given the varying levels of development of different WTO member countries, SDT provisions give **special rights to developing countries and obligate developed countries to treat the former more favourably.**
- However, only **21 per cent of the SDT provisions in various WTO agreements oblige developed countries** to actually provide differential treatment to developing countries.

Appellate body

- The second tier of the WTO's two-tiered **dispute settlement body remains paralyzed** from 2019 because of the US which, in turn, allows it to pursue trade unilateralism without many checks.

Consensus based decision making

- There has been a **shift away from consensus-based decision-making in the WTO toward plurilateral discussions** on select issues such as investment facilitation.
- Forcing plurilateral agreements on non-willing members will accentuate the trust deficit between developed and developing countries.

Transparency gap

- Although WTO member countries are obliged to notify all their laws and regulations that affect trade, **compliance with this obligation is poor.** This increases the cost of trade, especially for developing countries.

Way Forward

- The push for WTO reforms must come from G20's "middle

powers" such as India, Indonesia, Brazil, and South Africa.

- **SDT provisions need to be given more teeth** and efforts to weaken this treaty-embedded right in the name of WTO reform should be opposed.
- The G20 countries need to either **persuade the US** to change its position or resurrect the appellate body without the US.
- There is a need to **develop a multilateral governance framework** for plurilateral agreements. This governance framework should include key principles of non-discrimination, transparency, and inclusivity in incorporating the results of plurilateral negotiations in the WTO rulebook.
- It is imperative to **address the transparency gap in the WTO**, especially in terms of notification requirements.

Conclusion

- Trade multilateralism might be out of fashion, but remains of vital salience for countries like India.
- Hence, India, under its Presidency of the G20, should work with others to drive the WTO reforms agenda aimed at **making trade multilateralism inclusive.**

13) India's efforts at tiger conservation must shift gears

(GS3: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment)

Context

- After 50 years of sustained efforts (**Project Tiger launched in 1973**), India is now home to more than **3,167 tigers in 53 reserves** across 18 states. However, the **tiger remains an endangered animal globally.**

- Hence India's efforts at **tiger conservation must shift gears** to ensure the positive trend in tiger conservation is sustained, and the benefits towards **stemming biodiversity degradation** are realized.

Significance of tiger

- The tiger is a unique animal that plays a **pivotal role in the health and diversity** of an ecosystem.
- It is a **top predator** that is at the **apex of the food chain** and keeps the population of wild ungulates in check, thereby **maintaining the balance between herbivores and the vegetation** upon which they feed.
- The presence of tigers in the forest is an indicator of the well being of the ecosystem.
- The extinction of this top predator indicates that its ecosystem is not sufficiently protected.

Why should we conserve tigers?

- The conservation of the tiger was based on the understanding that as the top of the wildlife food chain, a **strong population would result in an improved ecosystem** for other wildlife and flora and fauna as well.
- If the tigers go extinct, the **entire ecosystem system would collapse**.
 - For instance, when the Dodos went extinct in Mauritius, one species of the acacia tree stopped regenerating completely.
- For survival of forests which are **water catchment areas**, tigers have to be preserved.
- To make sure that our well being is maintained as the forests are known to provide **ecological services like clean air, water, pollination, temperature regulation etc.,**

Issues to be considered

- The prevalence of **invasive alien species** in nearly **44%** of Indian forests is a cause of concern, specifically for herbivorous wildlife, which are part of the tigers' food chain.
- **Human-tiger conflict** that is prevalent in many parts is also a significant cause of concern.

Way Forward

- India should move away from a **tiger reserve-protected area approach to a landscape one**.
- The focus must be on **creating corridors for their free movement** that ensures equal protection to tigers living outside reserves.
- Reducing chances of inbreeding and **allowing tiger migration** to reserve areas where populations are low is also needed which will address the issue of **overpopulation and the carrying capacity** in some reserves.

14) India's blue economy sets sail to unlock a sea of opportunities

(GS3: Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, Development and Employment)

Context

- India, with its **vast coastline and strategic location** in the Indian Ocean, is poised to harness the potential of the blue economy and unlock a sea of opportunities.
- However, to realize the potential of our oceans in a sustainable way, we must **embrace technology**, enhance our understanding of the ocean and address climate change.

What is the blue economy?

- Blue economy refers to the **sustainable use of marine**

resources for exploration, economic growth, improved livelihoods, and transport while preserving the health of marine and coastal ecosystems.

- It offers a **vast array of resources** that have immense potential for various industries, including **food, medicine, fresh water, minerals, and renewable energy**.

How to harness the full potential of the blue economy?

- **Embrace technology:** Given that India has been allocated areas rich in rare metals and polymetallic nodules in the central Indian ocean for exploration, by utilizing advanced technology, we can strike a balance between a sustainable future for both our economy and the ocean.
- **Mapping the availability of renewable resources:** To fully harness the numerous renewable energy sources offered by ocean, including tidal energy, offshore wind energy, wave energy, ocean current energy, ocean thermal energy, and salinity gradient energy, it is crucial to map their availability spatially and temporally, usability, economic feasibility within the Indian Exclusive Economic Zone (EEZ).
- **Manage climate change effects:** To effectively manage the challenges of climate change, it is crucial to monitor ocean dynamics with floats, buoys, and remote sensing technologies. This allows us to predict future sea-level rise along the Indian coastline, providing insights for coastal mapping.
- **Build workforce in blue biotechnology:** It is also imperative to build a strong

workforce dedicated to the study of ocean biology, particularly in the field of blue biotechnology which can help extract valuable drugs, chemicals, and nutraceuticals.

Government efforts towards blue economy

Deep Ocean Mission:

- Spearheaded by the **Ministry of Earth Sciences**, this initiative brings together various line ministries, research institutions, and academia to **tackle the multifaceted opportunities and issues plaguing the oceans**.
- With the implementation of the Deep Ocean Mission, the government endeavors to **harness the boundless potential of the ocean** and fortify India's blue economy.
- It aims to **elevate the contribution of the blue economy** from single-digit figures to double-digit growth in our nation's GDP.

Conclusion

- The **United Nations** announced the **decade (2021 to 2030) as the "UN decade of Ocean Science for sustainable development"** seeks knowledge of Ocean, essentially to drive "**the Science we need for the ocean we want**".
- Let us embark on this transformative journey to secure the future of our oceans, safeguard the well-being of coastal communities, and secure a prosperous future for our nation.

15) A rising India

(GS2: Bilateral, Regional and Global Groupings and Agreements involving India and/or affecting India's interests)

Context

- India and America are Best Friends Forever and each need the other more than ever before today, united by powerful mutual interests.
- In 1700, India accounted for over **35% of global GDP**, making it the world's biggest, and by the time of the economic crises in 1991, it was down to almost 1%. Today, it is at around **4%-5% and rising**.
- The United States needs this market desperately, and India needs America's capital and its technology — military and non-military, both.

A rising India

- By 2030, India will have a **working population of one billion**.
- India's **per capita mobile data consumption is ranked at one**, more than that of the U.S. and China combined, which is helping bring prosperity to every nook and corner of India.
- India gets **\$100 billion in remittances**.
- Earlier, India would stand as one among the 195 countries of the world at any global gathering, but, today, it stands **shoulder to shoulder with the G-7**, as an equal.

Successful Infrastructure due to successful reforms

- **Infrastructure spend has shot up**, while fiscal prudence has been maintained.
 - Eg: **Carbon tax** on fuel coupled with a **coal cess** and an **infrastructure development cess**, found enough savings to fund at

least a part of the rail, roads and ports expansion.

- Listing of a project on **PRAGATI**, or Pro-Active Governance and Timely Implementation (the monthly review of every Union, State government stakeholder by the Prime Minister) makes officials issue long-pending government orders or clearances, and generally positively smoothens the system to **'debottleneck' infrastructure**.
- **GatiShakti**, a Geospatial Information Systems overlayer powerful tool **prevents unnecessary and random cutting of roads and forests, saving time and resources**.
- For the first time, the **private sector was allowed into commercial coal mining**, leading to Odisha, West Bengal and Chhattisgarh reaping huge rewards.
- Money for mega infrastructure spend was also made possible due to **reform of the Public Financial Management System (PFMS)**.
 - It is a **centralized transaction system** to improve the transparency, accountability, and efficiency in government financial spending and to plug waste and leakages. It is a **centralized core database integration of different platforms with banks**, thereby enabling direct payments to beneficiaries, reducing time and cost while enhancing efficiency.
- **Parivahan** system, which is a one-stop system for transport across 1,400 transport offices,

enables leakage proof revenue collection.

Challenges ahead India

- **Increasing trade deficit:** India has a \$290 billion balance of trade deficit (9% of GDP).
- **Stagnant sectoral GDP contribution:** Almost 50% of India is still stuck in agriculture and manufacturing remains stuck at 14%-15% of GDP.

Way Forward

- India needs to **give up its non-alignment hang-ups** of the past and **measure each situation on its merit and national interest.**
 - U.S. capital and technology can help India to modernize and build its own capabilities.
- India needs **greater digitalisation** of internal processes and better services delivery.
- India has to **revive stalled agriculture reforms, build up supply chain capability and move manufacturing to India** as companies look for other homes outside China.

16) Displaced by disasters

(GS3: Disaster and Disaster Management)

Context

- **Climate emergency** replaces wars and conflicts as the **biggest global cause for internal displacement** of people.

Internal Displacement

- Internally Displaced persons are persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or

human-made disasters, and who have not crossed an internationally recognized border.

Indian Scenario

- India records some of the highest numbers of internal displacements in the world every year. The vast majority of them are triggered by **disasters.**
- **Floods triggered 96 per cent of Internal Displacements** in the country.
- The most affected state was **Assam**, where the same areas were hit by floods in May and again in June.

The Global Report on Internal Displacement 2023

- The **Internal Displacement Monitoring Centre** has released the Global Report on Internal Displacement 2023 (GRID-2023).
- IDMC provides high-quality data, analysis and expertise on Internal Displacement with the aim of informing policy and operational decisions that can reduce the risk of future displacement.
- The report has revealed that the **number of people displaced by disasters rose by 40% in 2022.**

Findings

- The number of people living in internal displacement reached a record high of **71.1 million people** across 110 countries and territories.
- Out of which 62.5 million people were displaced as a result of **conflict and violence**, and 8.7 million due to **disasters.**
- **Pakistan** had the **highest number of disaster displacements** in the world in 2022, at 8.16 million, which is primarily attributed to **floods.**
- **India** recorded the **fourth largest disaster displacement**, with 2.5 million displacements.

Factors for internal displacements due to disasters

- The increase in weather-related disasters is largely the result of the **effects of La Niña** which continued for a third consecutive year.
 - La Nina is the **“cool phase” of El Nino Southern Oscillation**, a pattern that describes the **unusual cooling of the tropical eastern Pacific**.
 - While La Nina causes drought in the South American countries of Peru and Ecuador, it causes **floods in Australia**.
- The **“triple-dip” La Nina** led to record levels of **flood displacement** in countries including Pakistan, Nigeria and Brazil, and caused the **worst drought** in Somalia, Ethiopia and Kenya.
 - Triple Dip La Nina is a period where the La Niña period extends for up to **three consecutive winters** and results in multiyear cooling of the surface temperature of the equatorial Pacific Ocean.

Conclusion

- It is evident that the effects of climate change have an impact of the most poor countries, i.e., the countries that contribute the least to climate change
- There is a need for an immediate and concerted action to reduce global emissions and support green, inclusive and resilient development to reduce climate migration

17) Ominous Change

(GS1: Important Geophysical Phenomena, geographical features and their location-changes in critical geographical features

and in flora and fauna and the effects of such changes)

Introduction

- India has not experienced a normal winter in three years. During last winter, for instance, the country experienced its **hottest ever December**, as per the India Meteorological Department (IMD).
- The **northwest region**, which receives almost **30 per cent of its annual rainfall in the season**, saw an **83 per cent rainfall deficit**.
- The reason for the abnormal winter seasons since 2020-21 lies in the **changing character of the Western Disturbances**.

Western Disturbances

- They are a series of cyclonic storms that **originate in the Mediterranean region**, and travel over 9,000 km to **bring winter rains to northwest India**.
- A Western Disturbance is in the **shape of a spiral** with a narrow mouth at the bottom (formed at a height of about 5,500 meters above sea level) and a wide mouth at the top (formed at a height of more than 9,000 meters above sea level).
- The **low-pressure storm systems help farmers** in India grow their rabi crop, bring **snow** to the Himalayas and **maintain the flow** of the northern rivers.
- They reach the country riding on a wind system called the **subtropical westerly jet stream** that circles the Earth throughout the year.
- During its journey, a Western Disturbance **collects moisture** from the Mediterranean Sea, Black Sea and Caspian Sea and traverses over Iran and Afghanistan before hitting the western Himalayas.
- Strong Western Disturbances reach the central and eastern Himalayas

and cause rain and snow in Nepal and northeast India.

Changes in Western Disturbances

- The last time the storm systems visited the country in all their glory was in 2019. Since then, their **arrival has either been delayed or weakened.**
- On an average, India receives **four to six intense Western Disturbances a month** between December and March, or 16 to 24 such events in the entire period.
- During last winter, the country received **only three intense Western Disturbances:** two in January and one in March. December and February passed without a single intense Western Disturbance.
- A migrating Western Disturbance is preceded by **warm, moist air**, and is followed by **cold, dry air**. This keeps the **temperatures warm** in the peak winter months of December and January and **stops the temperature from rising in February and March.**
- Clouds formed by the Western Disturbances have a **moderating effect on the maximum temperatures** during the winter season. As they were missing this winter season, the north Indian plains experienced **severe cold waves and cold days** in December and most of January due to the cold northern winds flowing down from the Himalayas.
- One of the reasons for the **abnormally hot February** was the formation of a **high pressure area** near the land surface, which caused the air to descend, compress and heat up. A **strong Western Disturbance would have dissipated the high pressure.**

Delicate balance

- Western Disturbances are cyclonic storms that form over land, and they occur mostly in the **Mediterranean region** due to a **temperature gradient** caused by the mixing of warm air from the tropics and cold air from the northern polar regions.
- For the past three years, the world has been in a **La Niña phase**, which refers to the **cooling of ocean surface temperature in the Pacific Ocean.** It **weakens the temperature gradient** for the formation of Western Disturbances as it reduces the temperature of the hot tropical air.

Changing Patterns

- While Western Disturbances are avoiding the winters, they have started visiting India **more frequently during the summers.** Owing to the **warming in the Arctic region**, we are observing that the subtropical westerly jet stream is moving downward in the summer season.
- Western Disturbances during **summer, monsoon, and post-monsoon periods increase the chances of them interacting with the southwest monsoon and other associated local convection systems** such as tropical depressions that travel northward from either the Bay of Bengal or the Arabian Sea. Such interactions can cause **catastrophic weather disasters.**
- When tropical depressions hit land, they start to run out of the fuel as they need warm surface temperatures and shear to maintain themselves. Western Disturbances help them last longer and cause heavy rainfall over parts of India they normally do not travel.

- Such an interaction triggered the **Uttarakhand floods** in June 2013, which killed over 6,000 people, and caused damages worth US \$1.1 billion. The floods were triggered after a tropical depression associated with the southwest monsoon transferred moisture to a Western Disturbance.

Conclusion

- There is a need to effectively study the change in behavior of western disturbances and its impact.

Model Questions

- 1) Analyze the role of Direct Benefit Transfer (DBT) in transforming social welfare in India.
- 2) Discuss how water management is crucial in sustaining food security. Elaborate various water conservation strategies in Agriculture.
- 3) Discuss various cybersecurity challenges that could potentially arise in the 5G era.
- 4) Explaining its significance, enumerate the salient features of the National Research Foundation Bill.
- 5) How vulnerable is India to floods? What are the causes of urban floods and challenges associated in managing them?
- 6) India's G20 presidency can deliver an operationally feasible roadmap for inclusive, resilient and sustainable food systems. Comment.
- 7) How effective is India's approach towards renewable energy? Explain with examples.
- 8) To what extent the Governor's autonomy is recognised under the Constitution with respect to passing of bills? Explain with recent judgments of the Supreme Court.
- 9) To unlock the full potential of India's future, the health and nutrition of its adolescent girls have to be prioritized. Discuss. Suggest measures to improve the same.
- 10) Enumerate the properties of graphene and discuss its applications in various fields.
- 11) What steps need to be taken to ensure cooperation in political, security and economic spheres and to deepen the India-Africa ties?
- 12) What are the focus areas of long pending WTO reforms? How can India play a role in achieving the reforms?
- 13) India's efforts at tiger conservation must shift gears. Comment.
- 14) What is the blue economy? How can its full potential be harnessed?
- 15) How far do we excel in infrastructure with the help of successful reforms by the government?
- 16) What are the challenges faced by climate refugees? What are the measures that governments can adopt to tackle the challenges of climate-related human migration?
- 17) Assess the impact of change in behaviour of western disturbances on India.