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SPECIAL SUPPLEMENT

ENVIRONMENT AND ECOLOGY

- Learning Through Maps
- Academic Vitamins
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THIS MAGAZINE IS A RESULT OF TEAM COLLABORATION. WE EXPRESS OUR GRATITUDE TO ALL OUR TEAM MEMBERS. APART FROM THE GIVEN NAMES, SEVERAL FREELANCE WRITERS HAVE ALSO MADE IMPORTANT CONTRIBUTIONS.

DEAR ASPIRANTS,

Last month, the country observed the 63rd Mahaparinirvan Diwas of Dr. Bhimrao Ramji Ambedkar - a man of versatile qualities. His persona was unique in the sense that it had something for everybody, be it a political leader, a social worker, a lawmaker or a student. He was a true embodiment of qualities which the society need today. He rightly said, "A great man is different from an eminent one in that he is ready to be the servant of the society."

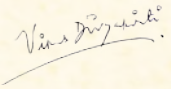
Dr. Ambedkar's student life was also inspiring. The struggle he faced and the success he achieved needs no explanation. A person like him who turned out to be the strongest pillar of our Constitution is a pioneering ideal from whose life lessons can be learnt.

*We present this issue of Drishti Current Affairs Today as a homage to the towering personality of Dr. Ambedkar. We, at Drishti, constantly endeavour to improve the quality of our magazine. With this issue, we are pleased to present a new segment, '**Editorials**', as part of the Academic Vitamins. It seeks to provide a summary of important editorials that have appeared in major newspapers. These have been curated to meet the demand of the examination. We also continue to provide you additional content for Prelims 2020. This edition of the Drishti Current Affairs Today comes with a **special supplement** on **Environment and Ecology** which will be of immense use to our aspirants.*

Wishing you all the best in your future endeavours.

We look forward to your feedback and suggestions.

With Best Wishes



(Dr. Vikas Divyakirti)

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Contents

CURRENT AFFAIRS

(Coverage from 24th November to 23rd December)

CONTENTS

Polity & Governance

Review Petition

Recently, the **Supreme Court** agreed to **review its Sabarimala verdict.**

Key points

- **Constitutional Provision:** Under **Article 137** of the Constitution, the Supreme Court has the power to review any of its judgments or orders.
- **Scope of Review:** The Court has the power to review its rulings **to correct a "patent error"** and not "minor mistakes of inconsequential import". A review is by no means an appeal in disguise. That means the Court is allowed **not to take fresh stock of the case** but **to correct grave errors** that have resulted in the miscarriage of justice.
- **Filing Review Petition:** As per the Civil Procedure Code and the Supreme Court Rules, **any person aggrieved by a ruling can seek a review.** This implies that it is not necessary that only parties to a case can seek a review of the judgment. A Review Petition has to be filed **within 30 days** of the date of judgment or order. In certain circumstances, the court can condone the delay in filing the review petition if the petitioner can establish strong reasons that justify the delay.

NOTE: It needs to be noted that judgment is a final decision in a case whereas order is an interim ruling that is subject to its final judgement.

Grounds for considering review petition

- It needs to be noted that the **Court does not entertain every review petition filed.** It exercises its discretion to allow a review petition only when it shows the grounds for seeking the review.
- The Supreme Court has laid down **three grounds** for seeking a review of a verdict it has delivered:
  - The **discovery of new and important matter or evidence** which, after the exercise of due diligence, was not within the knowledge of the petitioner or could not be produced by him;
  - Mistake or error apparent on the face of the record;
  - Any other sufficient reason that is analogous to the other two grounds.
- Review petitioWns are **heard by the same combination of judges who delivered the original order or judgment** that is sought to be reviewed.
- The judges then **decide in-chamber** whether there is any merit in the review petitions to rehear the case in open court.

Option after review petition fails

- In *Roopa Hurra v Ashok Hurra* case (2002), the Court evolved the concept of a **curative petition,** which can be heard after a review petition is dismissed. The SC held that in order to prevent abuse of its process and to cure gross miscarriage of justice, it may reconsider its judgements.
- The SC has outlined certain specific conditions for filing a curative petition:
  - The petitioner will have to establish that there was a genuine violation of principles of natural justice.
  - The petition is to be **sent to the three senior-most judges** and **judges of the bench which passed the judgment** affecting the petition.
  - If the **majority** of the judges on the above bench agree that the matter needs hearing, then it would be sent to the same bench (as far as possible).
- A curative petition is also **entertained on very narrow grounds** like a review petition and is generally **not granted an oral hearing.**

Creamy Layer and SCs/STs

Recently, the Union Government asked the Supreme Court to refer to a seven-judge Bench the question whether the creamy layer concept should apply or not to the Scheduled Castes/Scheduled Tribes (SC/ST) while providing them reservation in promotions.

How the issue evolved?

- In simple terms, the 'creamy layer' means the members of a backward class who are highly advanced socially as well as economically and educationally. They constitute the forward section of that particular backward class - as forward as any other forward class member. This first found expression in the Supreme Court's landmark judgment in Indra Sawhney case (or Mandal Commission case).
- The **Indra Sawhney judgment, 1992**
  - Upheld the government's move to give 27% reservation to Other Backward Classes.

Nation & States

NATION

Extra-Judicial Killings and Retributive Justice

The recent Hyderabad encounter of rape-murder accused has raised questions over the legality and propriety of the police action.

Key points

- An **extrajudicial killing** (also known as **extrajudicial execution**) is the killing of a person by Government authorities or personnel without the sanction of any judicial proceeding or legal process.
- Such a killing amounts to retributive justice where the criminal justice system is based on the **punishment of offenders rather than on their rehabilitation.** In other words, when an offender breaks the law, he or she must **suffer in return,** in proportion to the committed offence and at the earliest.
- However, the Constitution has guaranteed the right to life or personal liberty except according to procedures established by law and the extra-judicial killings are direct infringement of this important Fundamental Right. Moreover, under our laws the **police have not been conferred any right to take away the life** of another person.
- Nevertheless, extra-judicial or encounter killings have been a contested and divisive police procedure for decades. This is what the National Human Rights Commission (NHRC) and the Supreme Court have said on the proper procedures to be followed during such action by police.

Views of the Supreme Court

- In People's Union for Civil Liberties (PUCL) case (2014), the Supreme Court issued a detailed procedure to be followed in this regard:
  - If pursuant to the receipt of any intelligence, encounter takes place and firearm is used by the police party and as a result of that, death occurs, an FIR shall be registered and the same shall be forwarded to the Court under Section 157 of the Criminal Procedure Code.
  - A Magisterial inquiry under Section 176 of the Criminal Procedure Code needs to be conducted.
  - The involvement of NHRC is **not** necessary unless there is serious doubt about independent and impartial investigation. However, the information of the incident without any delay must be sent to NHRC or the State Human Rights Commission.
  - These requirements must be strictly observed in all cases of death and grievous injury in police encounters by treating them as law declared under **Article 141** of the Constitution of India.
- In *Om Prakash Singh* case (2012), the SC observed that such killings must be deprecated. They are not recognized as legal by criminal justice administration system. They amount to state sponsored terrorism.
- In *Extrajudicial Execution Victim Families* case (2017), the SC held that even when dealing with an enemy, the Rule of Law would apply.

Guidelines of the National Human Rights Commission (NHRC)

- When the in-charge of a police station receives information about the deaths in an encounter between the police party and others, he/she shall enter that information in the appropriate register.
- Information as received shall be regarded as sufficient to suspect the commission of a cognizable offence and immediate steps should be taken to investigate the facts.
- If the police officers belonging to the same police station are the members of the encounter party, the cases are made over for investigation to some other independent investigation agency, such as State CID.
- A magisterial enquiry must be held in all cases of death which occurs in the course of police action, as expeditiously as possible, preferably within three months.
- All cases of deaths in police action in the states shall be reported to the Commission by the Senior Superintendent of Police/Superintendent of Police of the District **within 48 hours** of such death.

Way forward

- Justice in any civilised society is not just about retribution but about **deterrence**, and in less serious crimes, **rehabilitation** of the offenders. Although

Economic Scenario

Draft Seeds Bill

Recently, the Ministry of Agriculture & Farmers' Welfare finalised the Draft Seeds Bill 2019. It will amend the Seeds Act, 1966.

Key points

- **Objective:** The Bill seeks to regulate the quality of seeds sold and facilitate the production and supply of these seeds to farmers. The objective is to ensure the supply of modern, high quality, cutting edge seed technologies to the farmers which will help them in enhancing their productivity and profitability.
- **Classification:** In the proposed Bill, there is a differentiation between the **seed producer**, **seed processor** and **seed dealer** for the purpose of licensing.
- **Minimum Standard:** All varieties of seeds for sale have to be registered and are required to meet certain prescribed minimum standards. For instance, for transgenic varieties of seeds, registration is to be obtained under the **Environment (Protection) Act, 1986**. This can bring greater accountability to seed companies.
- **Labelling of Seeds:** Currently, a large percentage of seed is sold under a self-certification programme called **Truthfully Labelled Seeds**. The Bill has kept certification voluntary.
- **Price Regulation:** The Bill empowers the government to fix prices of **selected varieties in case of emergent situations** such as seed shortage, abnormal increase in its price, monopolistic pricing, profiteering, etc.
- **Non-performance of Seeds:** Consumer Protection Act, 1986 to be used against the producer to deal with complaints related to the non-performance of seed or seed failure.
- **Penal Provisions:** The Bill differentiates the agronomic performance of the seed, its physical quality and the supply of spurious seed, and consequently penalises the offences and prescribes punishment.
- **Exemption:** The Bill exempts farmers from obtaining registration for varieties developed by them. However, if the farmer sells such seeds for a monetary consideration, then that sale needs to be registered. Besides, farmers are allowed to sell their farm seeds and planting material without having to conform to the prescribed minimum limits of germination, physical purity and genetic purity (as required by registered seeds).
- **Central Seed Committee:** The Bill authorises the Central government to reconstitute a Central Seed Committee that will be responsible for the effective implementation of the provisions.

Classification of Seeds

- **Nuclear seed:** This is the 100% genetically pure seed with physical purity and produced by the original breeder/Institute/State Agriculture University (SAU) from basic nucleus seed stock. A **pedigree certificate** is issued **by the producing breeder**.
- **Breeder seed**: The progeny of nuclear seed multiplied in the large area under the supervision of plant breeder/institute/SAUs and monitored by a committee. This is also 100% physical and genetic pure seed for the production of foundation seed. A **golden yellow colour certificate** is issued for this category of seed **by the breeder**.
- **Foundation seed**: The progeny of breeder seed produced by recognised seed producing agencies under the supervision of seed certification agencies according to prescribed field seed standards. A **white colour certificate** is issued for foundation seed **by seed certification agencies**.
- **Registered seed:** Registered seed shall be the progeny of foundation seed that is so handled as to maintain its genetic identity and purity according to standard specified for the particular crop being certified. A **purple colour certificate** is issued for this category of seed.
- **Certified seed:** The progeny of foundation seed produced by registered seed growers **under supervision of seed certification agencies** to maintain the seed quality as per minimum seed certification standards. A **blue colour certificate** is issued **by seed certification agencies**.

Issues involved

- **Profit Sharing:** The Bill does not require the seed companies to declare the **parents of the variety** they register. According to the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA), if a plant breeder uses farmer varieties to breed his variety, he is required to pay a part of the profits into a **National Gene Bank**.
- **Benefit Sharing:** In the absence of parentage data of a variety, the new seed owners could have free access to all available crop genetic diversity, without having to go through prior informed consent or engaging in benefit sharing. All this amounts to legalising the

International Relations

Royal Couple of Sweden Visits India

Recently, the Royal Couple of Sweden, King Carl Gustaf Folke Hubertus and Queen Silvia Renate Sommerlath, visited India.

Key outcomes of the visit

- The countries agreed to expand cooperation in diverse areas including trade, investment, innovation and culture.
- The countries agreed to expand the research and innovation by optimising bilateral collaboration and increase synergies in policy areas under the Joint Declaration on India-Sweden Innovation Partnership for a Sustainable Future signed in 2018.
- Collaborative Industrial Research and Development Programme in the area of 'Smart Cities and Clean Technologies' and 'Digitisation and Internet of Things' was announced.
- A joint program in the area of 'digital health' was announced which will aim to provide innovative, sustainable and flexible health solutions using Artificial Intelligence (AI) based technologies.
- A 'Joint Centre of Excellence in Innovation and Entrepreneurship' was to be set up between KTH Royal Institute of Technology and IIT Madras.

- India in partnership with Bioendev, Sweden, has set up a **torrefaction** pilot plant for the conversion of agri-waste into bio-coal at National Agri-Food Biotechnology Institute in Punjab.
  - Agri-Waste to High Energy **Bio-coal** is a pilot project established under the **PM-STIAC** 'Waste to Wealth' Mission.
- An MoU (Memorandum of Understanding) on **Polar Science Cooperation**. The two countries committed to cooperate in the study of polar research by coordinating and sharing resources and data.

India-Sweden relations

- **Background**
  - Bilateral relations between India and Sweden are friendly and based on principles of democracy and transparency, right to freedom, and the rule of law.
  - Besides, the partnership is based on the principles of co-funding, co-development, and co-creation, towards mutual benefits, making full use of Sweden and India's complementary strengths.
  - Diplomatic ties between India and Sweden were established in **1949.**
  - Sweden supports India's membership of the expanded United Nations Security Council (UNSC) and Nuclear Suppliers Group (NSG).
  - Mechanism of Inter-Governmental dialogue between India and Sweden happens through **Indo-Swedish Joint Commission for Economic, Industrial and Scientific Cooperation.**
- **Commercial Relations**
  - The bilateral trade between India and Sweden stands at around $2 billion.
  - The main items of **Indian exports** are articles of apparel, clothing accessories; textile yarn, manufactures of metals; road vehicles etc.
  - The main items of **Indian imports** are pulp and waste paper; vehicles; general industrial machinery and equipment; iron and steel; machinery for particular industry; electrical machines, apparatus and appliances.
  - The Avoidance of Double Taxation Agreement and Bilateral Investment Protection Agreement between the two countries is in effect.
- **Cultural Relations**
  - Indian music, dance, art, literature, films and cuisine are widely appreciated in Sweden. In the absence of a Cultural Exchange Agreement, cultural ties are promoted mainly by local associations and

Environment & Ecology

COP 25 at Madrid

The 25th Conference of Parties (COP 25) of the UN Framework Convention on Climate Change (UNFCCC) was recently held in Madrid, Spain. However, it concluded with little substantial outcome on the issue of the century i.e. Climate Change.

Background

- COP 25 was an important conference as countries prepare to move from pre-2020 period under the Kyoto Protocol to post-2020 period under the Paris Agreement.
- The Paris Agreement was hammered out in the 21st COP, in 2015. In that agreement, all countries agreed upon a common target of '2° Celsius' i.e. they resolved not to allow the world to warm more than 2° Celsius over the average temperatures that existed in the pre-industrialisation period of the mid 19th century.
- To limit global warming to not more than 2° Celsius, all countries brought in their own action plans - **Nationally Determined Contributions (NDCs)** - and pledged to walk the talk.
- They also agreed that the **developed countries should mobilise funds** for the developing countries to undertake climate-action projects. But neither any quantum of funds nor the nature of such funds was specified.
- It was also agreed that the **developed countries would provide technology** and that all countries would sit for a review of the status once in five years – called '**global stocktake**' – and would 'raise ambition'.
- The meetings that followed – **COP 22 (Marrakesh, Morocco)**, **COP 23 (Bonn, Germany)** and **COP 24 (Katowice, Poland)** – involved discussions about framing rules for implementing the Paris Agreement.
- The COP 25, in Madrid, was aimed to finalise the 'rulebook' of the Paris Agreement i.e. the operating manual needed when it takes effect in 2020 by settling on rules for **carbon markets** and other forms of international cooperation.

India and Climate Change negotiation

- On climate negotiations, India's approach has been guided by the principles and provisions of UNFCCC particularly the **principles of Equity and Common But Differentiated Responsibilities and Respective Capability (CBDR-RC)**. It means that while all countries should do their best to fight global warming, developed countries – with deeper pockets, who were primarily responsible for the climate mess – should take a bigger share of the burden than the developing and under-developed countries.
- At COP 25, India emphasised that developed countries should take the lead in undertaking ambitious actions and fulfil their climate finance commitments of mobilizing $100 billion per annum by 2020 and progressively and substantially scale up their financial support.
- India also sought to stress upon need for fulfilling pre-2020 commitments by developed countries and that pre-2020 implementation gaps should not present an additional burden to developing countries in the post-2020 period.
- As part of its efforts to mobilize world on climate action, India has recently been associated with three major initiatives:
  - **International Solar Alliance (ISA)** for enhanced solar energy capacity
  - **Coalition for Disaster Resilient Infrastructure** to serve as a platform to generate and exchange knowledge on different aspects of climate and disaster resilient infrastructure
  - **Leadership Group for Industry Transition**, launched jointly by India and Sweden, to provide a platform for government and the private sector in different countries to work together on accelerating low carbon growth and cooperation in the area of technology innovation
- **India's NDCs**
  - To adopt a climate-friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
  - To reduce the emissions intensity of its GDP by 33% to 35% by 2030 from 2005 level.
  - To achieve about 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030, with the help of transfer of technology and low cost international finance, including from Green Climate Fund.

Science & Technology

India Puts Cartosat-3 and RISAT-2BR1 Satellites in Orbit

Recently, in two separate launches, the Indian Space Research Organisation (ISRO) has placed advanced **earth imaging** and **mapping satellite** Cartosat-3 and **radar imaging earth observation** satellite RISAT-2BR1 in their intended orbits.

Key points

- Cartosat-3 was launched using **Polar Satellite Launching Vehicle** (PSLV) along with 13 other satellites belonging to two US companies.
- In a separate launch, the PSLV injected India's advanced radar imaging satellite RISAT-2BR1 and 9 other customer satellites from Japan, Italy, Israel and the USA into their intended orbits.
- The launch of PSLV carrying RISAT-2BR1 was a milestone - it was the 50th flight of PSLV and 75th launch mission from Satish Dhawan Space Centre, Sriharikota.
- The commercial satellites belonging to other countries were launched under a commercial agreement with New Space India Limited (NSIL), the commercial arm of ISRO.

New Space India limited (NSIL)

- NSIL is a wholly owned Government of India undertaking under the administrative control of Department of Space (DoS).
- It seeks to commercially exploit the research and development work of ISRO and constituent units of DoS.
- NSIL was set up to commercially exploit the emerging global space market and spur the growth of Indian industries in the space sector.

Cartosat-3

- Cartosat is made up of two words, i.e. carto and sat which refers to mapping (remote sensing) and satellite respectively.
- Cartosat-3 is a third generation advanced satellite placed in **Sun-Synchronous Polar orbit** at around 509 km above Earth's surface. It is the **9th satellite of the Cartosat series** and it will have a mission life of about 5 years.
- Also known as the '**sharpest eye**' in the sky, it is India's highest resolution civilian satellite and most advanced earth observation satellite built by ISRO so far.
- The best ground resolution till now was 31 cm offered by WorldView-3, a satellite owned by U.S. company Maxar. Cartosat-3 has a panchromatic resolution of 25cm - this means it can pick up an object of a minimum of that size from a height of around 500 km. **Panchromatic** means that it is sensitive to all colours of the visible spectrum.
- Such a resolution of the on board camera finds uses in urban planning, infrastructure development, coastal land use and land cover. It will also have use in military services, cartography and other weather mapping related services.
- Cartosat-3 was launched by the 49th mission of **Polar Satellite Launching Vehicle** (PSLV) and 21st in '**XL**' configuration. This was the **first time** the PSLV was navigated by an indigenous **Vikram Processor** designed by ISRO.
- So far, ISRO has orbited eight Cartosats since May 2005. Data from most of them, especially the last four Carto-2 series ones, launched in relatively quick succession in the last three years, are exclusively used by the armed forces.

RISAT-2BR1

- RISAT-2BR1 is a radar imaging earth observation satellite launched by ISRO. It will have a mission life of 5 years. It has been placed in Lower Earth Orbit at around 576 km altitude.
- It is an earth observation satellite which will have its applications in agriculture, disaster management and forestry. It will also have its uses in national security through a system of surveillance from the sky.
- RISAT (Radar Imaging Satellite) is a series of Indian radar imaging reconnaissance satellites built by ISRO. They provide all-weather surveillance using Synthetic Aperture Radar (SAR).
- The RISAT series is the first all-weather earth observation satellites from ISRO. Previous Indian observation satellites relied primarily on optical and spectral sensors which were hampered by cloud cover.

Background

- An **Earth observation satellite** or **Earth remote sensing satellite** is a satellite used or designed for Earth

History, Art & Culture

Sattriya Dance

Dance historian **Dr. Sunil Kothari** has recently been bestowed with the Madhabdev Award by the Government of Assam for popularising Sattriya dance.

Key points

- Sattriya originated in **Sattra monastery,** as a part of a **neo-Vaishnavite movement** started by **Srimanta Sankardev in Assam,** in the **15th Century.**
- It is one of eight classical dances of India**.** Other classical dances are **Bharatanatyam** (Tamil Nadu), **Kathakali** (Kerala), **Kuchipudi** (Andhra Pradesh), **Kathak** (North India), **Mohiniyattam** (Kerala), **Manipuri** (Manipur) and **Odissi** (Odisha).
- Sattriya dances differ from other dance forms in **its basic stance.** For a male, it is known as **Purush Pak** while for female, **Prakriti Pak.** The dance is based on **mythological themes.**
- A dance accompanies special mnemonic bols, typical **Assamese music known as Borgeet,** musical instruments like large cymbals, drums, colourful costumes, besides complicated choreographic patterns using various talas for each stanza sung by the vocalist.
- Corpus of Sattriya dances consists of Ankiya Bhaona and also Ojapali dances in which the main singer sings and enacts abhinaya, telling stories and a group of dancers dance as back up dancers playing small cymbals.
- Sattriya dance tradition is governed by strictly laid down principles in respect of hastamudras, footwork, aharyas, music etc.
- This tradition has **two distinctly separate streams** - the **Bhaona-related** repertoire starting from the Gayan-Bhayanar Nach to the Kharmanar Nach, secondly the dance numbers which are **independent**, such as Chali, Rajagharia Chali, Jhumura, Nadu Bhangi etc. Among them, the Chali is characterized by gracefulness and elegance, while the Jhumura is marked by the vigour and majestic beauty.
- **Popular Artists:** Guru Jatin Goswami and Sharodi Saikia among others.

Subramania Bharathi

11th December marked the 137th birth anniversary of **Subramania Bharathi**.

Key points

- Chinnaswami Subramania Bharathi was born in Tamil Nadu on 11 December 1882. He was a poet, freedom fighter and social reformer.
- He was known as **Mahakavi Bharathiyar**. His songs on nationalism and freedom of India helped to rally the masses to support the Indian Independence Movement in Tamil Nadu.
- He published the sensational '**Sudesa Geethangal**' in 1908. Some of his poems are **Kannan Pattu, Nilavum Vanminum Katrum, Panchali Sabatam** and **Kuyil Pattu.**
- Bharathi published weekly newspaper named **'India'** printed on red paper. It was the first paper in Tamil Nadu to publish political cartoons. He also published and edited **'Vijaya'**.
- His participated in Benaras Session (1905) and Surat Session (1907) of the Indian National Congress.
- He died in September 1921.

63rd Mahaparinirvan Diwas

Mahaparinirvan Diwas is observed every year on December 6 to commemorate the death of Dr. Bhimrao Ramji Ambedkar. 2019 marked the 63rd Mahaparinirvan Diwas.

Key points

- Dr. B.R. Ambedkar was born on 14 April 1891 in Mhow, Central Province (now Madhya Pradesh). He was a social reformer, jurist, economist, author, polyglot orator, a scholar and thinker of comparative religions.
- He led the Mahad Satyagraha in March 1927 to throw open the Mahad tank (Maharashtra) to all communities, including the untouchables.
- He participated in all the three Round Table Conferences.
- In 1932 Dr. Ambedkar signed the **Poona Pact** with Mahatma Gandhi. It abandoned the idea of separate electorates for the depressed classes (Communal Award). However, the seats reserved for the depressed classes were increased.
- In 1936, he was elected to the Bombay Legislative Assembly as a legislator (MLA). He was also appointed to the Executive Council of Viceroy in 1942.

Social Issues

Global Gender Gap Report

Recently, World Economic Forum released the Global Gender Gap Report, 2020.

Key highlights

- The time it will take to close the gender gap (globally) narrowed to 99.5 years i.e. it will **take 99.5 years** to achieve full parity between men and women at the current rate of change. Last year, the gap was calculated to take 108 years to close.
- The top position for gender parity is retained by **Iceland** (for the 11th year). It has closed almost 88% of its gender gap, followed by Nordic neighbours Norway, Finland and Sweden.
- **Yemen** is ranked 153rd (the worst), while Iraq is 152nd and Pakistan 151st.
- **India specific finding**
  - India has slipped to the **112th** spot from its **108th position** in the last edition. India was ranked relatively higher at **98th place in the 2006 Report.**
  - While India has improved to 18th place on political empowerment, it has slipped to 150th on health and survival, to 149th on economic participation and opportunity and to 112th on educational attainment.
  - India is the only country where the economic gender gap is larger than the political gender gap.
  - India has been ranked below countries like China (106th), Sri Lanka (102nd), Nepal (101st), Brazil (92nd), Indonesia (85th) and Bangladesh (50th).

Background

- Gender gap is defined as the difference between women and men as reflected in social, political, intellectual, cultural, or economic attainments or attitudes.
- The **World Economic Forum** launched the Gender Gap Report in **2006**.
- The report benchmarks 153 countries on their progress towards gender parity on a scale from 0 (disparity) to 1 (parity) across four key pillars:
  - Economic Participation and Opportunity
  - Educational Attainment
  - Health and Survival
  - Political Empowerment
- Looking to the future, the report also examines the economic gender gap with respect to professions of the future i.e. women's under-representation in emerging roles like cloud computing, engineering and Data and AI.
- Notably, the report measures gender-based gaps in access to resources and opportunities in countries, rather than the actual levels of available resources and opportunities. Through this report, the stakeholders within each country are able to set priorities relevant in each specific economic, political and cultural context.

World Economic Forum

- The World Economic Forum is the international organisation for public-private cooperation.
- The Forum engages the foremost political, business, cultural and other leaders of the world to shape global, regional and industry agendas.
- It was established in 1971 as a not-for-profit foundation and is headquartered in **Geneva**, Switzerland.
- Reports published by WEF are
  - Global Competitiveness Report
  - Travel and Tourism Competitiveness Report
  - Global Risks Report
  - Global Gender Gap Report

EXERCISES

1. Consider the following statements with respect to Global Gender Gap Report 2019:
   1. It is published by United Nations Development Programme.
   2. India has performed better than Bangladesh.
   3. Iceland has been ranked first for 11 consecutive years.

   Which of the statements given above is/are correct?
   (a) 1 and 2 only (b) 3 only
   (c) 2 and 3 only (d) 1, 2 and 3 only

2. Which of the following is *not* published by the World Economic Forum?
   (a) Global Competitiveness Report
   (b) Global Risk Report
   (c) World Economic Situation and Prospects Report
   (d) Travel and Tourism Competitiveness Report

ANSWERS 1. (b) 2. (c)

DCAT

ETHICS

Ethics in Business of Innovation

There has been a debate regarding innovations and their consequences over the society, environment and economy. Awareness of huge systemic problems that need new solutions is spreading around the world.

What is innovation?

- Innovation is a new idea and creative thought in form of device or method. It applies to products, services and processes which through the use of technology introduces quite often, radical changes.
- Innovation is not just technological or economical, but also ethical and social.
- Innovation can contribute to creation or destruction of jobs, fight against crime, invasion of privacy, finding cure for hereditary diseases or the manufacture of synthetic genomes and a vast array of issues.

When ethics and innovation are not coherent?

- There has been a rise in inequality and wealth differences around the world. For example, the Gini coefficient of wealth inequality is estimated at over 0.9 where a value of 1 represents maximum inequality.
- Egregious failures of corporate governance have destroyed corporate reputations and livelihoods of thousands of employees have caused outrage at the lack of ethics in business.
- The paradigm of innovation and enterprise that has over-run the world of capitalism do not seem to be good for the society and has led to outrage and discontent among people.
- Conduct of any person who is concerned only with himself, and not with the impacts of his actions on others, is fundamentally unethical, which means that the principle that the business of business must be only business, which has driven corporate governance, is an unethical principle.
- Profit is not a bad word, as **Mahatma Gandhi** said. The question is, who owns the enterprise and makes the profit, financial investors or workers and producers?

What role ethics can play in innovation?

- In a complex era full of disruption that requires careful consideration, especially in relation to the positive and negative consequences, responsible innovation is crucial. Concepts of innovation and capitalist enterprise must be changed to make growth more **inclusive and sustainable.**
- Ethics not only evaluates but also **impulses one to do the right thing**. This way we have a proactive role in innovation. Moral motivation leads to moral imagination, which is why great innovative social companies have come about from thinking of how to make the world a better place, in finding a **solution to world poverty** or **creating employment** for disabled.
- **Distributive justice:** Ownership of the means of production must be dispersed more widely amongst workers, so that people at the bottom can accumulate wealth too.
- **Access to all:** The system of intellectual property rights must enable innovations to be disseminated more widely to multiply its benefits, rather than enabling the perpetuation of intellectual monopolies.
- **Corporate Governance:** The corporate needs to be managed effectively and efficiently so that the interests of shareholders, customers, board members, investors, etc. are kept in priority.

Conclusion

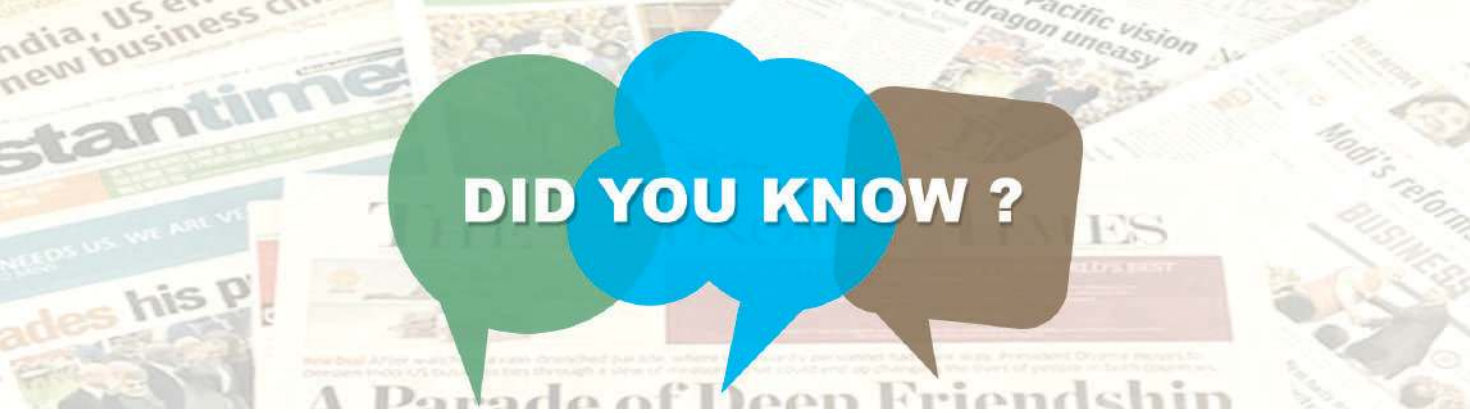
- Business without Morality (ethics) is one of the Seven Sins given by Mahatma Gandhi.
- Ethics brings criteria for evaluation, it show us ways to humanise innovation and increase moral imagination for innovation built around people and serving their needs.

Code of Conduct for Lok Sabha MPs

The **Lok Sabha Ethics Committee** is working to **form a code of conduct** for the Members of Parliament (MPs) in the Lok Sabha.

Key points

- A **code of conduct** is a set of rules outlining the norms, rules, and responsibilities of, and or proper practices for an individual.
- A Code of Conduct for members of Rajya Sabha has been in force since 2005; there is no such code for Lok Sabha.



EVMs Not under RTI Act

- Recently, the Delhi High Court quashed an order of the Central Information Commission (CIC) which had held that Electronic Voting Machines (EVMs) fall within the definition of 'information' under the Right To Information (RTI) Act.
- CIC had observed that EVMs available with the EC in a **material form or as a sample** is a **piece of information** under **section 2(f) of the RTI Act.**
- **Section- 2 (f)** states that "Information" means any material in any form, including Records, Documents, Opinions, Advice, Circulars, Orders, Logbooks, Reports, Models**,** Data material held in any electronic form, information relating to any private body which can be accessed by a Public Authority, etc.

Digital India Land Records Modernisation Programme (DILRMP)

- According to DILRMP, land records in 90% of Indian villages have been computerised.
- About 53% of cadastral maps showing the boundaries and ownership of land parcels have been digitised.
- DILRMP, a central sector scheme, provides online, single-window, at a glance access to all available and relevant information.
- It is under the **Ministry of Rural Development**.
- **The main aims of DILRMP are:**
  - Updated land records
  - Automated and automatic mutation
  - Integration between textual and spatial records
  - Inter-connectivity between revenue and registration
  - Replace the present registration with digitised one.
- The **District** is the unit of implementation.

Nagpur Resolution for Empowering Citizens

- Recently, the **'Nagpur Resolution- A Holistic Approach for Empowering Citizens'** was adopted during the session on **'Improving Public Service Delivery – Role of Governments', in Nagpur, Maharashtra.**
- Under the resolution, the Government of India, Maharashtra, and other participating States shall collaborate **to empower the citizens** by policy interventions, and adopting a bottom-up approach for good governance.
- The conference was organised by the **Ministry of Personnel, Public Grievances & Pensions,** in collaboration with the Government of **Maharashtra and the Maharashtra State Commission for Right to Public Services.**
- For **good governance**, **Shillong Declaration** and **Jammu Resolution** have been adopted earlier.

Three Capitals for Andhra Pradesh

- Recently, the Chief Minister of **Andhra Pradesh** has proposed to set up three Capitals for the State, on the lines of the ones in the **Republic of South Africa.**
- The state is planned to have three capitals, **Visakhapatnam-** executive capital**, Amaravati -** legislative capital**, Kurnool -** judicial capital**.**
- Among Indian states, **Maharashtra** has two capitals, **Mumbai** and **Nagpur** (which usually holds the winter session of the state assembly).
- **Himachal Pradesh** has capitals at **Shimla** and **Dharamshala** (winter). The former state of **Jammu & Kashmir** had **Srinagar** and **Jammu** (winter) as capitals.

Spandana: An Andhra Pradesh Initiative

- **Spandana** is an **Andhra Pradesh** Government initiative to make **police stations more approachable for the public, especially women**.
- Spandana (means response) centres have been established within the premises of all District Collector offices and police stations.
- These centres, equipped with **modern technologies** such as video conferencing facility, mostly have a female

Disinvestments and Implications on National Security

The Government of India has initiated the sale of its stake in Bharat Petroleum Corporation Limited (BPCL). BPCL has been a profit making PSU and government's decision regarding such sale has raised some questions regarding the strategy of disinvestment in India.

What are the implications in economic terms?

- BPCL has been a profit making company with the government's present share being about 53%. Besides, the current market value of the PSU is estimated to be between ₹85,000 crore to ₹1,11,000 crore.
- Sale of this PSU, thus, may imply that the government is not good in managing the profitable ventures.
- Moreover, meeting fiscal deficit targets by way of selling PSUs cannot be a sustainable exercise. The number of PSUs is limited and their sale cannot be repeated every year.
- The real way of meeting this target can be to cut out wasteful Government expenditure, most of which is on salaries and pensions, and ensuring that the bureaucracy delivers.

How is it related to national security?

- Natural resources like crude oil are of strategic importance to any country.
- India's underground crude oil reserves are far behind that of the USA, China, and South Korea.
- State ownership of crude oil in India can help us mitigate the impact of any externality.
- India has been planning to set up world's largest refinery with the help of Saudi Arabia (ARAMCO) but, ownership and control lies in foreign hands.
- With such strategic disinvestments, the Government will lose control over crude and refining.
- Nothing can prevent China or any other country for that matter from buying up refining capacity in India which will undermine our control over assets.

Conclusion

- Such strategic disinvestments have been compared to killing the goose that lays the golden eggs.
- Financially and strategically, India is at a vulnerable position at the global front. India needs to grow in a situation where protectionism is on the rise when it was our turn to develop using global trade.

Economy in Need of Structural Reforms

The economic slowdown which India is going through has raised the demand of structural reforms in India.

What are structural reforms?

- Economists suggest that the economy should be free from Government control and markets should allocate resources themselves.
- The classical liberal economists of the 19th century believed that a minimalist 'night-watchman' state that limited its role strictly to the efficient provision of police, and courts that protected people's property rights and enforce contracts, could bring economic prosperity.
- It would allow private individuals to own and exploit all economic resources. No sector of the economy would be shielded from private ownership.
- Individuals can freely buy and sell anything they wish through voluntary trade. Such unhindered free trade, while it benefits consumers, will likely create winners and losers among producers.
- A minimalist government, however, will have no legal powers to save any business, whether small or large, from failure. People will be allowed to freely enter or exit a market as they wish and compete against anyone they want.
- Such genuine free market competition would ensure that the production of goods and services rises, prices fall, and the standard of living of the masses increases.
- It was through such a drastic cut-down in the role of the government in the economy that countries such

ECONOMIC AND POLITICAL WEEKLY

SUMMARY OF EDITORIALS AND ARTICLES: 26 OCTOBER, 2, 9, 16 NOVEMBER

The Future of Globalisation

Globalisation is a process associated with increasing economic openness, growing economic interdependence and deepening economic integration among countries in the world economy. This process extends beyond trade and flows, to flows of services, technology, information, ideas and people across borders. Thus, **Globalisation** is a multidimensional phenomenon that has profound implications for economies, polities, societies and cultures.

Is Globalisation a New Phenomenon?

- The movement of goods, people, skills, ideas, knowledge, cultures and religions across the world goes back a long time, even before there were borders or nation states. It is believed that it all began in the first millenium itself.
- For centuries, communication routes and trade paths, both land and sea, criss-crossed Eurasia, linking the East and the West. Such routes traded in a wide range of goods. The traders were Arabs, Armenians, Chinese, Georgians, Greeks, Indians, Persians, Romans, Sogdians and Syrians. It was in the late 19th century that Ferdinand von Richthofen - a German geologist named the network of routes across Central Asia as **Die Seidenstraßen** (the Silk Roads).
- But the major developments towards globalisation started in the 2nd millenium when the **voyages of discovery** led by the Iberian states (Portugal and Spain) started searching for sea routes to various continents and countries. The Europeans were trying to bypass the Arabs who has earlier monopolised the Asian maritime trade. In this search, the first milestone was achieved in 1488 AD by Bartolomeu Dias when he found the southern tip of Africa aptly named as the **Cape of Good Hope.** Christopher columbus went in search of America , Vasco da Gama sailed and reached Malabar Coast of India in May 1498. Such voyages came to completion on Magellan's circumnavigation of the globe in 1521.
- The sequence of discoveries led to the starting of European colonial expansion. The Slave trade from Africa, the search for silver in the New World and America's colonisation formed a part of its consequences. It established the age of mercantilism in Europe.
- Europe paid for its imports of textiles, spices, porcelain and silks from Asia by exports of silver obtained from the Americas. The New World provided Europe with a source of primary commodities such as **sugar, tobacco, cotton and timber**, apart from the windfall ecological gains through access to indigenous plants like maize and potatoes. These colonies also provided export markets for manufactured goods from Europe.
- The slaves from Africa provided the labour for plantations, mines and agriculture, while the migrants from Europe provided entrepreneur in the New World. This period from 1500 to 1780 was clearly the **second wave of globalisation** during the second millennium.

The Fall of Globalisation in the 2nd Millenium

- The growing network of world trade laid the foundations for a specialisation in production among continents, the benefits of which accrued in large part to Europe which coincided with the power struggle for hegemony.
- In the late 16th century, Portugal and Spain were displaced by Holland, a merchant oligarchy, as the Dutch rose to primacy in world trade. Their dominance continued into the 18th century before it was lost to the British. This power struggle was sustained by the economy, technology and geopolitics.
- The period after 1780 experienced a worldwide military conflict and further **Napoleonic Wars** from 1803 to 1815. Independence for the United States (US) in **1776**, and for most countries in Latin America beginning around 1810, deprived the European powers of most of their colonies in the New World.
- In **1807**, the Slave Trade Act for abolishing slave trade between the British colonies and Africa was passed in the British Parliament, while the US banned its transatlantic slave trade in **1808**.

- This era of globalisation has witnessed a marked increase in economic inequality between people within countries, and between the rich and the poor in the world. These mounting inequalities are not the only sources of potential conflict but are also ethically unacceptable and politically unsustainable.

What is the Present Scenario?

- **Economic Problems:** The present phase of globalisation experienced its first setback with the financial crisis in the US that surfaced in late 2008. It was attributable to the domestic deregulation of financial sectors and external capital account liberalisation. The downturn moved quickly into a recession. Unemployment levels remain high, while real wages for a large proportion of workers stagnated or declined.
- **Social Problems:** The super-rich have become richer so that income inequalities among people have risen sharply. It creates frustration and alienation among those excluded. Such economic problems have social and political consequences within countries.
- **Political Challenges:** Economies might have become global, but politics remains national or local, instead of catering to international financial markets or global economic obligations. The Brexit and election of Donald Trump are examples which mark the rise of pro-nationalist tendencies and an ignition to the deglobalisation wave. The political mobilisation of economic discontent exploits fears about openness in immigration and trade as threats to jobs.

What Lies Ahead?

- The emergence of the developing world, particularly the powerhouse economies of Asia, constitutes a striking transformation that is attributable to globalisation. But dominant powers are reluctant to cede economic and political space to newcomers.
- Currently globalisation is under stress, **its present is disrupted and its future is uncertain**. However, it is exceedingly difficult to predict how the future might unfold for the age of globalisation we live in. Even so, it would be idle to pretend that nothing has changed and that it will be business as usual. D C A T

GIST OF MAJOR ARTICLES FROM THE DECEMBER 2019 ISSUE

Building Urban Infrastructure through AMRUT

India is witnessing a rapid increase in the urban population and as per the **UN World Urbanisation Prospects Report 2018**, around 34% of the Indian population lives in cities which is expected to cross the 50% mark by 2051. Such a surge poses significant challenges in terms of demands for basic infrastructure services such as water supply, sanitation, etc.

Urban India: Key Challenges and Opportunities

- Cities are likely to contribute nearly **70% of the country's GDP**, thus, basic infrastructure will play a vital role in enabling the cities to adequately provide civic services to improve the quality of life of citizens in becoming true engines of economic growth.
- But, as per Census 2011, only **49% of urban households had access to water supply within premises**. Further, due to the lack of adequate treatment capacity, **more than 65% of the wastewater was being discharged untreated** in the open drains resulting in environmental damage and pollution of water bodies (CPCB 2015).
- According to World Bank estimates, the total annual economic impact of **inadequate sanitation in India amounted to a loss of ₹2.4 trillion in 2006** which was equivalent to about 6.4% of India's GDP. Further, access to clean water and sanitation are essential for the country in order to achieve Sustainable Development Goal 6.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

- AMRUT was launched in 2015 under the Ministry of Housing and Urban Affairs (MoHUA) with the aim of providing basic civic amenities.
- It is a centrally sponsored scheme which seeks to
  - ensure that every household has access to assured supply of water and sewerage connection;
  - increase the amenity value of cities by developing greenery and well maintained open spaces e.g. parks and;
  - reduce pollution by switching to public transport or constructing facilities for non-motorized transport e.g. walking and cycling.
- Besides creating basic infrastructure, the Mission has a reform agenda spread over a set of 11 items to be achieved by the States/UTs over a period of four years. These reforms broadly cover **offering online services** such as Online Building Permission System (OBPS), **establishing a single window** for all approvals, **credit rating** of Urban Local Bodies (ULBs) and issuance of **municipal bonds**, **audit of energy and water**, etc.
- The Mission is covering 500 cities that includes all cities and towns with a population of over one lakh, capitals of States and UTs, Heritage cities classified under the Heritage City Development and Augmentation Yojana (HRIDAY), and certain cities on the banks of main rivers and from hill State/islands and tourist destinations.

NOTE: In order to address the national issue of water scarcity, Ministry of Jal Shakti (MoJS) has undertaken Jal Shakti Abhiyan (JSA). The key thrust areas of the JSA are **Rain Water Harvesting (RWH), Reuse of treated wastewater, Rejuvenation of water bodies, and Plantation.**

AMRUT: Aligned with the Needs of Urbanising India

- **Cooperative Federalism:** State Governments have been empowered to appraise, approve, and sanction projects for their AMRUT cities.
- **Framework for Institutional Reforms:** Emphasis on institutional reforms which aim to improve governance and institutional capacities of ULBs. Reforms are targeted for better service delivery and enhanced accountability and transparency.
- **Principles of Incrementalism and Prioritisation:** Principle of 'incrementalism' is a step-wise approach towards service level benchmarking by the ULBs to ensure coverage of water supply and improve sanitation.
- **Incentivising over Penalising:** In order to encourage States and reward their initiatives constructively, reform implementation is incentivised under AMRUT.

GIST OF MAJOR ARTICLES FROM THE DECEMBER 2019 ISSUE

Agro-Industries to Increase Farmers' Income

The agro-based industries are becoming more important in view of impressive growth in high value commodities alongwith rising incomes in recent years. It has larger scope for acceleration in future, given the thrust on doubling farmers' income.

Key Points

- Food processing is one of the major employment intensive segments and it is the biggest expense for an urban and rural Indian household.
- The traditional food processing industries include rice and flour mills, gur, manufacture of edible oils and processing of plantation crops like tea, coffee etc.
- The modern food processing industries include dairy products, confectionary marine products, horticulture and meat products.
- Processing and packaging are important components of food processing industry in order to provide easy transportability and marketability of food products e.g. milk processing industry.
- Food processing also includes extending the storage life of seasonal food products e.g. processing of fruits and vegetables would help in reducing post-harvest losses and provide stable income to growers by eliminating seasonal fluctuations in income.
- **Food processing policy of India** was brought in 2018 by Ministry of Food Processing Industries (MoFPI). It emphasised to make India Global food Factory and Global Food Market. It announced several initiatives to bring zero post-harvest wastage by creating national food grid and national cold chain grid.

Associated Benefits

- The Annual Survey of Industries, 2016-17 shows that agriculture contributes about 36% of the industrial employment. Of these, substantial employment is generated in production agriculture and supply chain.
- According to the Economic Survey 2014-15, agro-based food and non-food activities can enhance the income of rural households by tackling the risk of high food inflation and short-term price spike in some commodities.
- Agro-based industries have been a major employer close to the hinterland. They need to play a much larger role in the diversification of the source of income in rural India.
- The contribution of cropping and animal husbandry in total income of the farm households is only 35% while wages and services contribute 50% of the average monthly income of the agri-households.
- Agro-food processing industries located near source raw materials especially for perishable items can generate direct rural employment through production activities and indirect employment through forward and backward linkages.
- This industry can reduce post-harvest losses and waste as well as use the by-products more efficiently.

Issues Involved

- Poor road, access to electricity, communication and other infrastructure lacunae poses a challenge to agro-based industry. Proper storage facilities to improve the shelf-life of perishable products is also lacking.
- Due to the diversity of activities in agro-based industry, policies apply differently for different activities depending on the purpose or need.
- Currently, agro-based industry production in India is more or less limited for domestic uses with little export orientation.
- Although most of the technology is readily available in the country, it is not adopted extensively because of missing economic incentives and lack of institutional arrangements for collection, processing and marketing of by-products.

GIST OF MAJOR ARTICLES FROM 30 NOVEMBER AND 15 DECEMBER ISSUES

Antimicrobial Resistance (AMR)

Antimicrobial resistance (AMR) is the ability of a microorganism (like bacteria, viruses, and parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it. As a result, standard treatments become ineffective, infections persist and may spread to others. AMR is already a worldwide concern because at least 10 million people are likely to die of AMR every year by 2050.

Agriculture and AMR

- The indiscriminate use of crucial antibiotics in agriculture sector of India is alarming, as this practice may lead to the development and spread of Antimicrobial Resistance (AMR).
- When antibiotics are used in crops, the unspent antibiotics find their way into the surrounding environment. Microorganisms exposed to this increasing load of antibiotics in soil and water can develop a resistance to it which can spread to other bacteria through transfer of genetic material.
- When humans or animals get infected by such resistant microorganisms, their treatment becomes difficult.
- Besides, there is a possibility that traces of antibiotics remain in edible parts of the plant long after it is sprayed and affects human health or makes them resistant to the antibiotics.

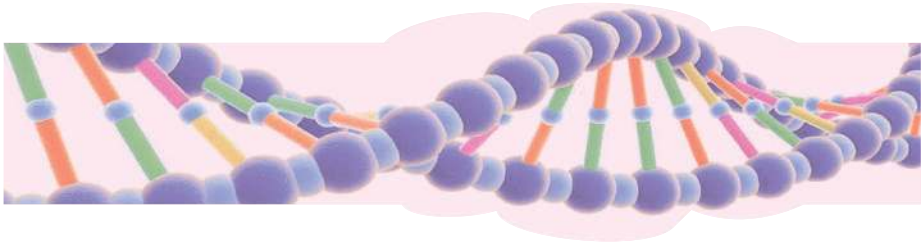
Issues Involved

- There are grave irregularities in the way streptocycline (an antibiotic) is being used.
- The Central Insecticide Board and Registration Committee CIBRC recommends specific dosages and usage of streptocycline for different crops, but farmers rarely follow the recommendations.
- The Central Drugs Standard Control Organisation (CDSCO), does not have any role in regulating antibiotics used on crops because the antibiotics meant for plants or crops do not fall within the purview of the present drug laws.
- Studies have shown the presence of antibiotic residues in crops at a later stage, but the Food Safety and Standards Authority of India (FSSAI) does not provide any separate tolerance limit for streptocycline in food products.
- In the absence of a robust extension machinery, the farmers' actions are highly influenced by what pesticide dealers say.

Way Forward

- The European Union has put a ban on certain antibiotics and allowed its use only under exceptional circumstances, like disease outbreak that cannot be controlled by other means.
- The Food and Agriculture Organization and World Health Organisation recommend integrated pest management as an effective approach to limit the use of antimicrobials in crops.
- Pesticides are agro-chemicals used to protect plants from pest attacks whereas antibiotics are drugs meant for treatment of bacterial diseases in humans. Antibiotics should not be used as pesticides except only after a bacterial disease has been diagnosed in a crop under the supervision of an expert.
- CDSCO needs to bring antibiotics used in plants as drugs under its purview. Necessary law, such as schedule H for antibiotics, should be introduced to ensure that no antibiotic is sold for use in agriculture without prescription.
- CIBRC should reclassify streptocycline as an antibiotic and ensure that it is not sold as fungicide or pesticide. It should also set withdrawal periods for streptocycline, and revisit its toxicity labelling taking into account AMR.

SCIENCE REPORTER



GIST OF MAJOR ARTICLES FROM THE DECEMBER 2019 ISSUE

Controlled Human Infection Model (CHIM)

The possibility of introducing CHIM into research in India is being considered by scientists in order to develop biomedical technologies, including new vaccines.

What is CHIM?

- In a CHIM study, a well-characterised attenuated (weakened) strain of an infectious agent is administered in a controlled dose by a specific route of administration into consenting healthy volunteers.
- After a period of time during which the volunteers would have developed immunity. They are deliberately infected with the pathogen (disease-causing microbe) and are monitored for a specified period. If the vaccine works, the volunteer will not fall ill.
- In recent years, CHIM studies have contributed to the development of vaccines for diseases such as malaria. 'Vaxchora', a traveler's vaccine against cholera has been licensed by the USFDA based on a CHIM study.

Why Opt for CHIM?

- The procedure for developing a new drug or vaccine presently involves using animal models, which are deliberately infected. This process helps determine the safety and efficacy of the drug or vaccine and those proven safe products are then tested on human volunteers - clinical trials.
- Not all diseases have good animal models i.e. for many of the infectious diseases, animal models do not replicate the way the disease progresses in humans. For example, a vaccine that works on a rat may not work on humans.
- Approval of drugs and vaccines is based on large-scale clinical trials, which involve a large number of people. As compared to CHIM studies, clinical trials require as many as 200,000 volunteers while a CHIM study would require not more than 150 people. Clinical trials are also expensive to conduct.
- CHIM could help fast-track drug and vaccine development and testing its efficacy for diseases. It would speed up research at the early stages and would bring down the research cost.

What are the Challenges Associated with CHIM?

- Less than 10% of the CHIM studies are carried out in lower-middle-income countries which house endemic pathogens that do not affect populations in more industrialised countries. To-date no CHIM study has ever been done in an LMIC before being carried out in high-income countries.
- The problem is that for many diseases, interventions, which work well in high-income countries, are not as effective in endemic settings. Factors such as exposure patterns, naturally acquired immunity, diet, intestinal microbes, environment, the genetic profile of the host population, etc. influence the epidemiology of the disease.
- Another important challenge is maintaining the volunteer's safety. In any CHIM study, the volunteers have to be carefully monitored by trained health professionals and scientists.
- CHIM study also needs the involvement of skilled scientists, microbiologists, excellent clinical facilities and careful recruitment, monitoring and governance.
- The idea of deliberately infecting a human volunteer is obviously alarming. Public engagement, informed consent and volunteer selection are important aspects.
- The issue of compensation for lost time, income and transport cost to participants is a tricky one. Money could influence poor people to participate in human infection studies.
- Convincing people for the benefit of health and medical science is a difficult task.

Why should India Consider CHIM Studies?

- Infectious diseases contribute to about 20% of the disease burden in India.

PALLAVA ART AND MAMALLAPURAM

Why in news?

Recently, the UNESCO World Heritage Site of Mamallapuram hosted the second India-China informal summit. Mamallapuram was created by Pallava rulers who ruled from the 6th century till the end of the 9th century.

Pallava Art

- The capital of Pallavas - **Kanchipuram**
- Religious center - Mamallapuram (a port city)
- Important ruler - **Narasimhavarman I** (commissioned the monuments at Mamallapuram)

Mamallapuram stone sculptures

- These are characterised by a wide forehead, hanging ears and oval-shaped face, usually with double chins.
- Noted among the creations are open **rock bas-relief sculptures**, like the **Great Relief** (**Arjuna's Penance** or **Descent of Ganga**), the **Pancha Rathas**, and the **Shore Temple**.

The Shore Temple

- The Shore Temple, featuring Dravida style of temple architecture, has its superstructure (**vimana**) with an octagonal neck (**griva**) topped by a **finial** with **gopura** as the gateway tower**.**
- The complex consists of **three separate shrines**: two dedicated to the god **Shiva**, and one to **Vishnu**.

The Great Relief

- These were **carved from massive granite boulders**.
- The **'Descent of the Ganges'** is a story about the origins of the river Ganges. Lord Shiva allowed the water to get caught in his long, matted hair so that it trickled out in gentle tributaries.
- Shiva is depicted as one of the largest figures with the common attributes viz. four arms, a crown of hair piled atop his head and a trident in his hand.
- A **second interpretation focuses on Arjuna**, beseeching the god Shiva to provide him with his powerful weapon in aid against his enemies.

The Pancha Rathas

- These monoliths were named after the **Pandava brothers** and **Draupadi**. These are formed by carving the rocks in the shape of chariots or rathas.
- Each of the rathas is carved from one single large piece of granite in-situ and each one is sculpted in a different style. Most of these have **reflections of the Buddhist Viharas** and **Chaityas**.
- These monolithic shrines were of **Saivite** attribution and were surrounded with the carved images of a **lion**, an **elephant** and a **bull** symbolizing **Durga**, **Indra** and **Shiva** respectively.

Other structures of Mamallapuram

- **Kaneri mandapa** (pillared halls), dedicated to Shiva, has five cells.
- **Varah cave temple**, a small rock-cut temple, dedicated to Vishnu.
- **Krishna mandapa** showing Krishna lifting mount Govardhan to protect Braj against the torrential rains of the God Indra.
- **Ramanuja mandapa**, a cave temple.

What they tell about the Pallavas?

- According to legend, sailors and merchants at sea could spot and use the majestic vimanas of the Shore Temple to mark their arrival to the port city.
- The temple symbolised **political** and **economic strength of the Pallavas** due to its coastal location.
- The protagonists, Arjuna and Bhagiratha, have a special relationship with gods. The Great Relief may express the idea that Pallava rulers, through their connection to gods, were **protectors of lands and people**.

Significance of Pallava art

- The Shore Temple demonstrates progression from rock-cut structures to free-standing temples and displays all the **elements of mature Dravidian architecture**.
- The temple also signifies **religious harmony** with sacred spaces dedicated to both Shiva and Vishnu.
- Pallava art and architecture spread to South-East Asian countries. For Example, **Angkor Wat** in Cambodia shows the influence of Pallava architecture.

- PAPER-I (250 Marks, UPSC CS Main Examination): "Essay: Candidates may be required to write essays on multiple topics. They will be expected to keep closely to the subject of the essay to arrange their ideas in orderly fashion and to write concisely. Credit will be given for effective and exact expression." That is what the UPSC says about the Essay paper in the CSE notification. Through an essay, the commission wants to know if you will make the right civil servant who has balance of judgement, variety and depth of interest, logical exposition and other such bureaucratic qualities.
- Keeping this in mind, we present a forum where you are asked to practice your writing skills by writing essays on the given topics. The topics are decided keeping in view the thematic trends in CS (Mains) examination.
- If that is not all, the best essays shall be rewarded and published. We'll judge the essay based upon four parameters viz. Structure of the essay, Content, Flow and Language.
- The prize details are as follows:

First Prize: 6 Months Subscription **Second Prize: 4 Months Subscription** **Third Prize: 2 Months Subscription**

Essay Writing Competition—45

Topic:

'Justice cannot be instant.'

Terms and Conditions—

1. The essay shall be of length between 1000-1200 words.
2. It should be neatly written or printed on A4 sheets.
3. Only one entry per participant is allowed.
4. Entries are to be sent by Registered/speed post only on following address: EXECUTIVE EDITOR, DRISHTI CURRENT AFFAIRS TODAY, 641, FIRST FLOOR, DR. MUKHERJEE NAGAR, DELHI-110009. Please mention 'For Essay Competition' in capital letters on the envelope.
5. Remember to submit your personal details on the form printed on this page after neatly tearing it off the marked pointers. Submissions without this form shall not be entertained.
6. Your essay must reach the given address before **20th January, 2019**. Entries reaching us after the given date will not be accepted.
7. Essays should be original and not plagiarized or copied except for properly quoted references. Prior published or awarded essays will not be accepted.
8. All rights related to the results of the competition are secure with 'Drishti Current Affairs Today'. The winners shall be announced in the subsequent issue of the magazine and the winners shall be contacted by email and telephone.
9. Copyrights of the rewarded essays will lie with the magazine which may be used in any way by 'Drishti Publications'.

Form for Essay Competition–45

(Kindly cut and attach this form along with your essay. Use original form and not photocopy.)

Name of participant: ..... Mobile no. .....

Address: .....

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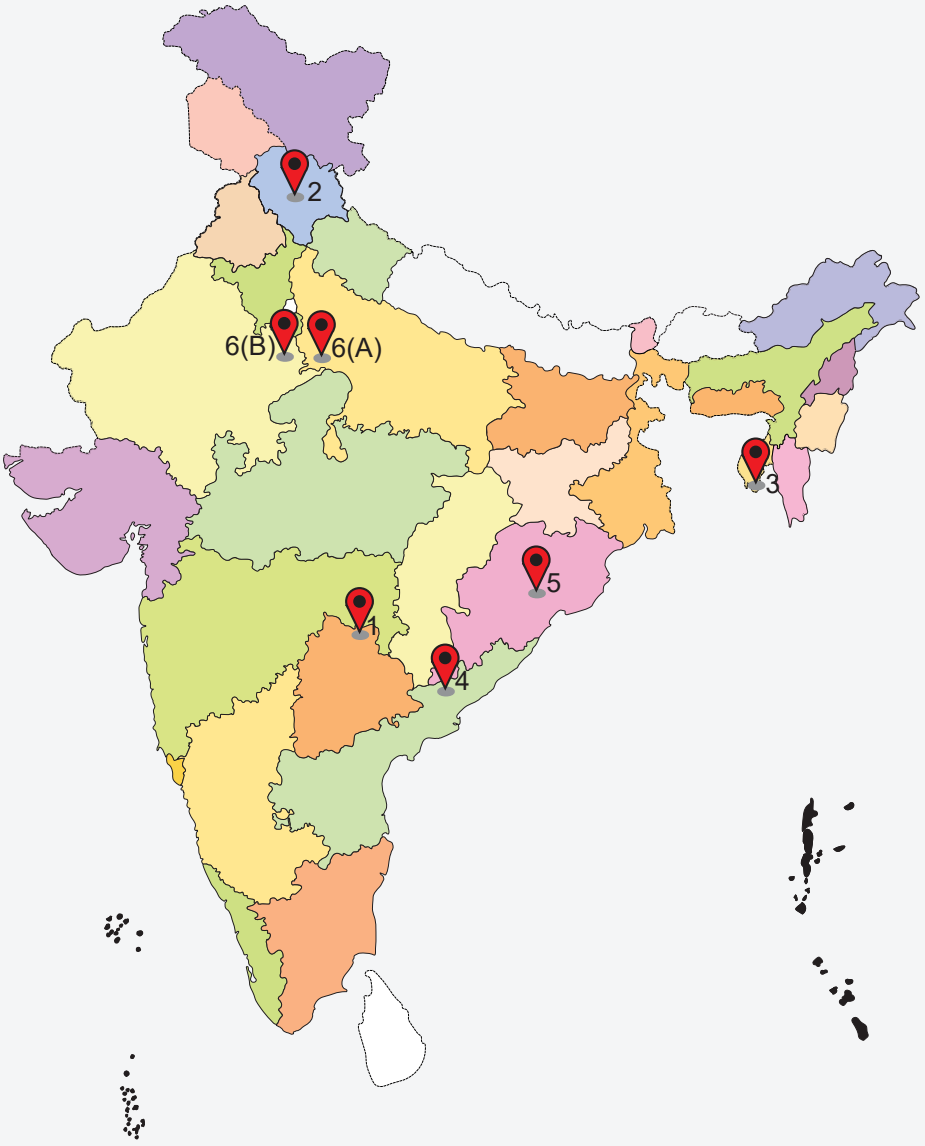
Pin code: ..... Email ID: .....

LEARNING

MAP-1

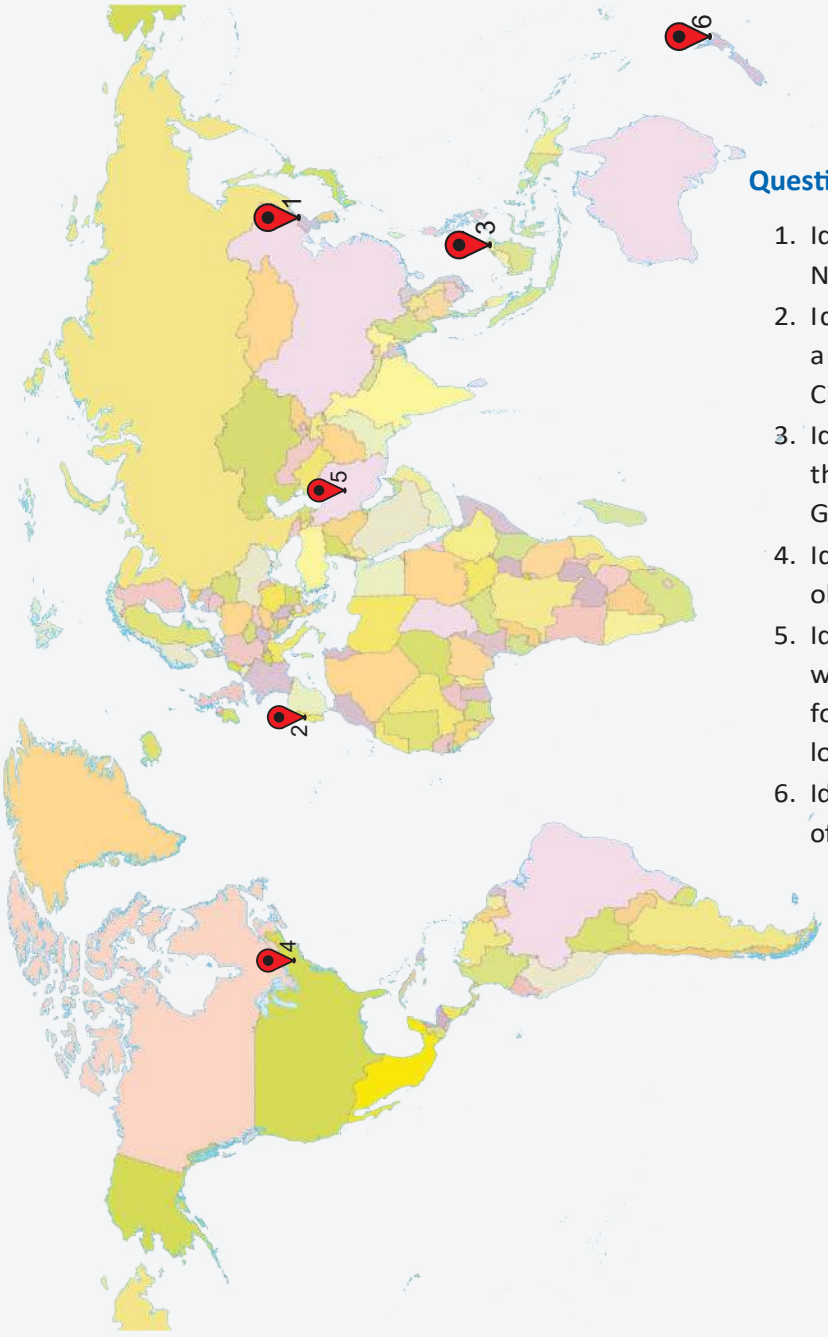


Questions

1. Identify the place where Bird Walk Festival was recently organised?
2. Identify the state where Kirti Jheypa Monastery is located?
3. Identify the city where Tripura's first Special Economic Zone is being set-up?
4. Identify the National Park where the maiden butterfly survey was conducted?
5. Identify the state which is implementing Jaga Mission?
6. Identify the divisions which are covered under the Taj Trapezium Zone?

(Answers : Refer to Page No. 162)

THROUGH MAPS



Questions

1. Identify the city recently unveiled by North Korea?
2. Identify the country which has announced setting up of Gandhi Citizenship Education Prize?
3. Identify the city which recently held the 10th Asian Elephant Specialist Group (AsESG) Meet?
4. Identify the city where the world's oldest fossil forest was discovered?
5. Identify the country where 'Khuzestan' which was recently seen in the news for the discovery of the oil field is located?
6. Identify the volcanic Island off the coast of New Zealand which recently erupted?

(Answers : Refer to Page No. 162)

MAP-2

PAPER-I

Question 1. *Most of the art and architectural remains that survive from ancient and medieval India are religious in nature. Examine.*

Answer: Art is an expression of human creative skills resulting in the production of painting, sculpture, or architecture. The development of an art form is usually impacted by the level of advancement of the society, the mindset and beliefs of the people and the type of patronage provided by the rulers and other stakeholders.

- With changing times, better articulation of religious and socio-cultural beliefs develop which reflect in the contemporaneous art forms. Thus, the prehistoric art forms are confined to secular paintings like that of Bhimbetka rock shelters.
- Later, the animistic religious beliefs of Harappan Civilisation gets reflected in the terracotta figurines of mother goddess. With the further passage of time and emergence of Brahmanism, Buddhism, Jainism etc. more religious art forms in terms of Ajanta caves and paintings, Dashavatara temple (Deogarh) etc. surfaced.
- Later, in medieval India, under the patronage of Delhi Sultans, tombs and mosques emerged.

Nevertheless, it must also be noted that non-religious or secular art forms were also getting importance.

- For example, the seals, terracotta toys, granary from Harappan Civilisation and palaces, gardens from medieval India.
- Similarly, the patronage provided by the rulers or the society also defines the type of art that gets developed. The Ashokan edicts, whose form and content was largely non-religious, incorporated principles of social conduct.
- Likewise, Akbar's period witnessed art and architecture of religious as well as secular forms (Fatehpur Sikri). The Mughal paintings also highlight the same feature as it depicted non-religious themes in terms of royal portraits and natural beauty.
- Another aspect of the development of art is those possessed by people in their homes. It is important to note that most of the art and architectural artworks were made from wood and clay which have perished over the course of time. Besides, several domestic items made of metals (like iron, bronze, silver and gold) were later melted down and reused from time to time.

Thus, the art and architectural forms of ancient and medieval India never confined themselves only to the making of mammoth buildings of religious places, though it contributed the most.

Question 2. *Discuss the impact of the Sanskritisation, Westernisation, Modernisation on Indian society.*

Answer: **Sanskritisation:** It is a process through which lower castes try to achieve upward social mobility by emulating the customs and rituals of the upper castes. It is a cultural process, but changes in social status and occupations as a consequence of the upward mobility brought about by Sanskritisation, also makes it a structural process.

- It accepts the ways of the 'upper caste' as superior and that of the 'lower caste' as inferior. Therefore, the desire to imitate the 'upper caste' is seen as natural and desirable.
- **Impacts:**
  - It seems to justify a model that rests on inequality and exclusion. It appears to suggest that to believe in the concept of pollution and purity of groups of people is justifiable.
  - It results in the adoption of upper caste rites and rituals which leads to the practice of secluding girls and women, adopting dowry practices instead of bride-price and practising caste discrimination against other groups, etc.
  - The effect of such a trend is that the key characteristics of Dalit culture and society are eroded. For example, the very worth of labour which 'lower castes' do is degraded and rendered 'shameful'.

Westernisation

- The contact with the West, particularly with England set in motion another process of transformation in India, known as Westernisation. It is characterised by Western patterns of administration, legal system, culture and education through the medium of the English language.

- **Impacts:**
  - Under the impact of the Western way of life, a sizeable section of educated and urbanised Indians have adopted the Western style of dress, food, drink, speech and manner.
  - The emulation of the West inculcated the values of Western democracy, Industrialisation and Capitalism.
  - There are cultural as well as structural aspects of Westernisation. It brought about structural changes by the growth of modern occupations related to modern education, economy and industry.

Modernisation

- Modernisation is a process by which modern scientific knowledge is introduced in the society with the ultimate purpose of achieving a better and more satisfactory life in the broadest sense of the term accepted by the society concerned.
- **Impacts**
  - It has introduced structural changes in social institutions like marriage, family, caste etc. The concept of joint families is rapidly decreasing, everyone wants to remain aloof from others.
  - There are some eliminative changes like the disappearance of cultural traits, behavioural patterns, values etc.
  - Modernity assumes that local ties and parochial perspectives give way to universal commitments and cosmopolitan attitudes.
  - The truths of utility, calculation, and science take precedence over those of the emotions, the sacred, and the non-rational.

India is considered to be the cradle of civilizations. We have continued dissemination of our culture since ages and have tried to adapt according to the changes that arise. Modernisation and Westernisation has been the external factor and Sanskritization is more of an internal factor which has impacted Indian society in a multitude of ways.

Question 3. *Explain the concept of geomagnetism. Discuss the impact of the recent shift in the Earth's magnetic north pole.*

Answer: Geomagnetism is the study of the dynamics of the Earth's magnetic field, which is produced in the outer core. The Earth's magnetic field is predominantly a geo-axial dipole, with north and south magnetic poles located near the geographic poles.

- Recently, Earth's magnetic North Pole has drifted so fast that the World Magnetic Model (a large spatial-scale representation of the Earth's magnetic field) have had to officially redefine the location of the magnetic North Pole much earlier than expected.
- Earth's magnetic North Pole is quickly moving from the Canadian Arctic towards Russia.

Possible Impacts of Shifting Earth's Magnetic North Pole

- The shifting geomagnetic field, along with its associated phenomena can both assist and hamper navigation and surveying techniques.
- It can impede geophysical exploration; can disrupt electric power utilities and pipeline operations; and can also influence the functioning of modern communication systems, spacecraft etc.
- Shifting pole can also affect the power of Earth's magnetic field to deflect harmful solar radiation and cosmic rays from entering Earth's atmosphere.
- Changes may occur in Aurora Borealis and the Aurora Australis.
- Animals that use the Earth's magnetic field for navigation—including birds, salmon, and sea turtles—could get lost during their routine journeys.

The shift in Earth's magnetic field is a minor change for most of us noticeable only to people who are attempting to navigate very precisely and very close to the Arctic. But the north magnetic pole's inexorable drift suggests that something strange and potentially powerful is taking place deep within the Earth.

PAPER-II

Question 4. *The recent judgement of the Supreme Court that brings the office of Chief Justice of India under the ambit of the Right to Information Act will give a fillip to people's quest for transparency and accountability. Comment.*

Answer: The Right To Information(RTI), is a strong weapon that enhances accountability, citizen activism and, consequently, makes democracy participative. It was introduced into the Indian ambit in through RTI Act,2005.

- The higher judiciary was often criticized for opaqueness under the notion of **independence of the judiciary.**

The announcement of a new urbanisation policy that seeks to rebuild Indian cities around clusters of human capital, instead of considering them simply as an agglomeration of land use, is a welcome transition. We need to empower our cities with a focus on land policy reforms, granting urban local bodies the autonomy to raise funds and enforce local land usage norms.

PAPER-IV

Question 10. *Analyze with an example, the role of discretion in decision making.*

Answer: The lines separating right from wrong or good from evil are not like the fine lines of geometry. They are broad and deep and permit exceptions. Conventional wisdom, thus, stipulates that the official on the spot alone is best equipped to decide how to achieve the objectives of the policy he/she is trying to implement.

The broad characteristics of discretion cover the following key aspects:

- Discretion embodies some leeway or freedom to independently judge or act.
- Administrative use of discretion also assumes possession of some wisdom and ability to carefully make adjustments of one's actions as circumstances dictate or require.
- Civil servants are considered as the backbone of administration as they perform important functions in the public sphere which requires wielding of immense powers with freedom and discretion to make decisions.
- The problem with discretionary powers lies in its widespread abuse. For eg. Use of discretionary power by **T N Seshan** who was Chief Election Commissioner enthused a new life in the Election Commission. On the other hand, the discretionary power has often been used by corrupt officials for their personal gain, for eg, an officer granting tender to a known person.
- Opportunities for corruption are greater in a system with excessive discretion in the hands of the officials, particularly at the street-level bureaucracy. Such tendencies can be minimized by reducing discretion and maximizing transparency in the system and introducing strict accountability for actions. The most successful anti-corruption reforms are those that seek to reduce discretionary benefits, which are controlled by public officials.
- It must also be accepted that the existing framework for maintaining and promoting the norms of 'right conduct' cannot be enforced through rigid mindless enforcement of laws and rules. Within the civil services, there are formal, enforceable codes setting out norms of expected behaviour with 'sanctions' prescribed for unacceptable departures from such norms.

Discretion is a tool only when properly used; like an axe, otherwise, it is a potential weapon for mayhem. When public administrators make use of their discretionary powers, it should be very reflective of the intentions of their departments/organizations and in essence that of the government.

D C A T

ENVIRONMENT & ECOLOGY

ENVIRONMENT & ECOLOGY *covers a major area of UPSC Civil Services Exam (CSE) syllabus. The number of questions as well as the range of questions in previous years point to the importance of this section in the UPSC scheme of things. The trend of asking a good number of questions from Environment and Ecology looks set to continue owing to two main reasons.*

The first is contextual, which is based on how environmental and ecological concerns have gained global prominence in the light of climate change and drive for sustainable development. It becomes a prerequisite for an aspiring Civil Servant to keep track of pressing issues of society.

The second is because of the structural changes in the CSE itself. By conducting common Preliminary Examination for civil services as well as Forest Services since 2013, the UPSC is giving clear signal to aspirants about the importance of environment and ecology section of syllabus. Although it is difficult to accurately predict what question will be asked in the exam by UPSC we have prepared this supplement to act as a good and reliable source for revising information on this segment in quick-time.

CONTENTS

Environment & Ecology

ENVIRONMENT

Environment is the natural component in which biotic (living) and abiotic (nonliving) factors interact with each other. These interactions shape the habitat and ecosystem of an organism.

Habitat

Habitat is the physical environment in which an organism lives. It is an ecological or environmental area inhabited by particular species of plants, animals, fungi, etc. Many habitats make up the environment. A single habitat may be common for more than one organism which have similar requirements. The main components of habitat are shelter, water, food and space.

Biosphere

- The biosphere is the biological component (supporting life) of earth which includes the lithosphere, hydrosphere and atmosphere.
- It is the layer of our planet where life exists. This layer ranges from heights of up to 8-10 km above Sea level, used by some birds in flight, to depth of Ocean such as Puerto Rico trench, at more than 8 km deep.
- **Gaia Hypothesis:** Proposed by James Lovelock.
  - It proposed that the Earth functions as an interactive system in which living organism have an influence on their physical characteristics and vice versa. **Gaia** was the Greek Goddes of Earth.
- Biosphere is deficient at extremes of the North and South poles, the highest mountains and the deepest oceans, since existing hostile conditions there do not support life [Life is the characteristic feature of biosphere]. Occasionally spores of fungi and bacteria do occur at great height beyond 8,000 metres, but they are metabolically inactive, and hence represent only dormant life.

ECOLOGY

- Ecology is the branch of biology concerned with the relations of organisms to one another (energy flow and mineral cycling) and to their physical surroundings (environment).

Galaxies > **Universe**
∧
Solar Systems
∧
Earth
∧
Biosphere
∧
Biomes
∧
Ecosystems
∧
Communities ←
∧
Populations
∧
Organisms
∧
Organs
∧
Tissues
∧
Cell
Protoplasm
∧
Atoms > Molecules

Ecology

Levels of Organization

SUPPLEMENT

- Ecology encompasses study of individual, organisms, population, community, ecosystem, biome & biosphere which form the various levels of ecological organization.

Levels of Organizations in Ecology

The five levels of ecological organization are species, population, community, ecosystem and biosphere

Levels of Organisations	
Individual	Organism is an individual living being that has the ability to act or function independently. It may be any organism.
Species	Species is a group of living organisms consisting of similar individuals capable of exchanging genes or of interbreeding, considered as the basic unit of taxonomy and denoted by a Latin binomial, e.g. *Homo sapiens*.
Population	Population is a community of interbreeding organisms [same species], occupying a defined area during a specific time.
Population Growth Rate	It is the percentage variation between the number of individuals in a population at two different times. It can be positive due to birth and/or immigration or negative due to death and/or emigration.
Population Density	The number of individuals per unit area at a given time is termed as population density.
Community	It is an aggregation of populations of different species living together (inter dependent) in a specific area. Communities in most instances are named after the dominant plant form (species). For eg. A grassland community is dominated by grasses, though it may contain herbs, shrubs, and trees, along with associated insects and animals of different species. A community is not fixed or rigid. ■ **Major Communities:** These are large sized and self regulating, self sustaining, relatively independent unit. They depend only on the Sun's energy from outside. Eg: Tropical evergreen forests. ■ **Minor Communities:** These are dependent on neighbouring communities and are often called **societies**. They are secondary aggregations within a major community. Eg: A mat of lichen on a cow dung pad.
Ecosystem	An ecosystem is defined as an entity of system where organisms interact with each other and with their environment such that energy is exchanged and system-level processes, such as the cycling of elements, emerge.
Biome	Biome is a large naturally occurring community of flora and fauna occupying a major habitat. e.g. Rainforest biome or tundra biome. ■ Plants and animals in a biome have common characteristics due to similar climates and can be found over a range of continents. ■ Biomes are distinct from habitats, because any biome can comprise a variety of habitats.
Biosphere	The biosphere is the biological component of earth which includes the lithosphere, hydrosphere and atmosphere. The biosphere includes all living organisms on earth, together with the dead organic matter produced by them.

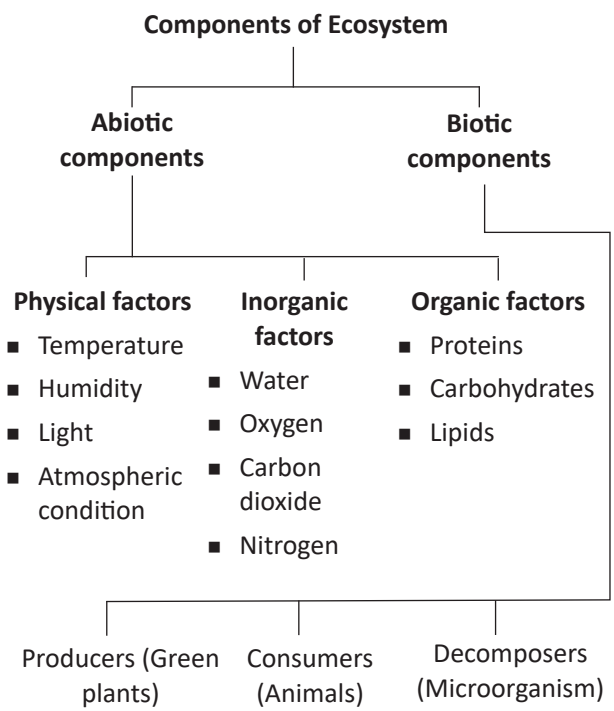
ECOSYSTEM

An ecosystem can be visualised as a functional unit of nature, where living organisms [producers, consumers and decomposers] interact among themselves and also with the surrounding physical environment. In the ecosystem, biotic and abiotic components are linked together through nutrient cycles and energy flows.

- An ecosystem can be of any size but usually encompasses specific and limited species. Eg: Aquatic Ecosystem.
- Everything that lives in an ecosystem is dependent on the other species and elements that are also part of that ecological community. If one part of an ecosystem is damaged or disappears, it has an impact on everything else.

Environment	→	Can be almost everything or a small region.
Habitat	→	Area where an organism lives.
Biosphere	→	The region on earth that supports life.
Ecosystem	→	Producers, Consumers, Decomposers and their relationships (tiny environment). It is the functional unit of the environment.

Components of Ecosystem

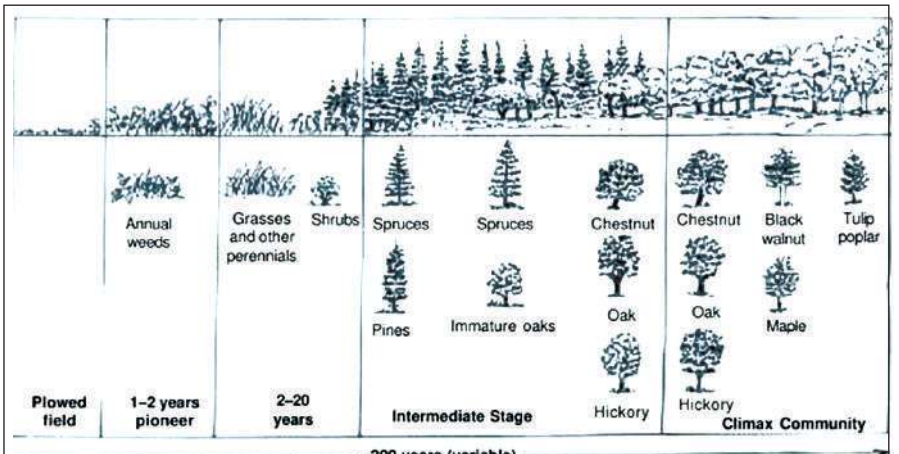


Sources of Adaptation	
Variation	■ Variations are induced by changes in genetic makeup due to addition or deletion of certain genes. ■ Mutations, change in climate, geographical barriers etc. induce variations over a period of time. ■ Species are generally composed of a number of distinct populations which freely interbreed even though they appear to be different in appearance [e.g. American man and Chinese women can interbreed. They are sub species under *Homo sapiens*].
Adaptive Radiation	■ In evolutionary biology, adaptive radiation is a process in which organisms diversify rapidly from an ancestral species into a multitude of new forms, particularly when a change in the environment makes new resources available, creates new challenges, or opens new environmental niches.
Speciation	Speciation is the process by which new species are formed and evolution is the mechanism by which speciation is brought about. ■ The most common way a population undergoes speciation is by geographic isolation (**Allopatric speciation or geographic speciation**). ■ After a long period of time, the sub-populations become very different and get isolated, reproductively, i.e. they no longer interbreed. ■ Later even when the barrier is removed, the sub-populations are unable to interbreed and thus subsequently the sub-populations become two different species.
Mutation	Mutation (a change in genetic material that results from an error in replication of DNA, Mitosis, meiosis and other types of damages to DNA causes new genes to arise in a population. ■ Further, in a sexually reproducing population, meiosis and fertilization produce new combination of genes every generation, which is termed **recombination**. ■ Thus, members of the same species show 'variation' and are not exactly identical. Variations are heritable.
Natural Selection	Natural Selection is the mechanism proposed by Darwin and Wallace. Natural selection is the process by which species adapt to their environment. ■ It is an evolutionary force that selects among variations i.e. genes that help the organism to better adapt to its environment. Such genes are reproduced more in a population due to natural selection.
Evolution	Evolution is the process of heritable changes in population of organisms over multiple generation. It happens in order to make the organism better suit to the present environment. ■ Climate change, competition, adaptability, need, changing environment etc. are the major forces behind evolution. ■ Evolution involves the processes of natural selection, adaptation, variation etc. Evolution leads to speciation or formation of new species. ■ A valid theory of evolution was propounded by Charles Darwin and Alfred Wallace in 1859. This theory has been extended in the light of progress in genetics and is known as **Neo-Darwinism**.
Extinction	■ Extinction occurs when species cannot evolve fast enough to cope with the changes taking place in their environment. ■ The primary reason for these extinctions is environmental change or biological competition. ■ Extinction may take place due to catastrophic natural phenomena such as tsunami, volcanoes etc. ■ In recent time, human activities such as deportation, over exploitation, environmental pollution and environmental change are other factors responsible for extinction.

Biotic Components		
Primary Producers – Autotrophs (self-nourishing)	**Consumers — Heterotrophs or Phagotrophs (other nourishing)**	**Decomposers**
■ Primary producers are basically green plants, certain bacteria and algae that carry out photosynthesis. ■ **Primary Production:** It is the synthesis of new organic material form inorganic molecules such as H_2O and CO_2. It is dominated by photosynthesis.	■ Consumers are incapable of producing their own food. They depend on organic food derived from plants, animals or both. ■ Consumers can be divided into two broad groups namely macro and micro consumers. **Macro consumers** ■ Herbivores are primary consumers feeding mainly on plants e.g. cow. ■ Secondary consumers feed on primary consumers e.g. wolves, dogs, etc. ■ **Secondary Production:** It is the generation of biomass of heterotrophic organism (consumers) in a system. It is driven by transfer of organic material between trophic levels.	■ Decomposers are small consumers like bacteria, fungi and worms that cause the decay of dead organisms. Some decomposers like fungi are Saprotrophic, which means they take in food by absorbing dissolved organic substances that were products of organic decay.

Secondary Succession

- Secondary succession occurs when plants recognize an area in which the climax community has been disturbed.
- Secondary succession is the sequential development of biotic communities after the complete or partial destruction of the existing community due to natural events such as floods, droughts, fires, or storms or by human interventions such as deforestation, agriculture, overgrazing, etc.



Secondary succession on land

- Secondary Succession is faster as compared to primary succession

Autotrophic and Heterotrophic succession

Succession in which, initially the green plants are much greater in quantity is known as **autotrophic succession**; and the ones in which the heterotrophs are greater in quantity is known as **heterotrophic succession**.

Succession in Plants

- Based on the nature of the habitat – whether it is water (or very wet areas) or it is on very dry areas – succession of plants is called **hydrach** or **xerarch**, respectively.
- Hydrarch succession takes place in wetter areas and the successional series progress from hydric to the mesic (intermediate) conditions.
- As against this, xerarch succession takes place in dry areas and the series progress from xeric to mesic conditions.
- Hence, both hydrarch and xerach successions lead to medium water conditions (mesic)– neither too dry (xeric) nor too wet (hydric). With time the xerophytic habitat gets converted into a mesophytic one.

Succession in Water

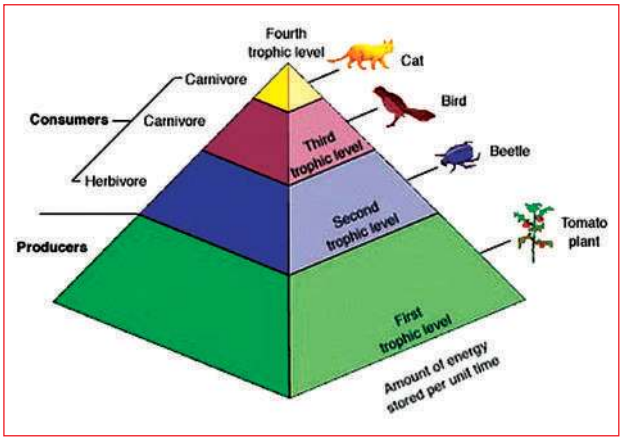
- In primary succession in water, the pioneers are the small phytoplanktons which are replaced with time by free-floating angiosperms, then by rooted hydrophytes, sedges, grasses and finally the trees. The climax again would be a forest. With time the water body is converted into land.
- All succession whether taking place in water or on land, proceeds to a similar intermediate community – the mesic.

ENERGY FLOW IN AN ECOSYSTEM

- The flow of energy from producer to top consumers is called energy flow which is unidirectional. Energy flows through the trophic levels from producers to subsequent trophic levels.
- Energy level decreases from the first trophic level upwards due to loss of energy in the form of heat at each trophic level.

Trophic Level

- The trophic level of an organism is the position it occupies in a food chain. Trophic level interaction deals with how the members of an ecosystem are connected based on nutritional needs.



The trophic level interaction involves three concepts namely

- Food Chain
- Food Web
- Ecological Pyramids

Food Chain

The sequence of transfers of matter and energy in the form of food from organism to organism is called food chain. Types of food chains include:

- Grazing food chain
- Detritus food chain

Grazing Food Chain

- The consumers which start the food chain, utilizing the plant or plant part as their food, constitute the grazing food chain. This food chain begins from green plants at the base and the primary consumer is herbivore.
- For example, in terrestrial ecosystem, grass is eaten by caterpillar, which is eaten by lizard and lizard is eaten by snake.
- In aquatic ecosystem phytoplankton (primary producers) are eaten by zoo planktons which are eaten by fishes and fishes are eaten by pelicans.

Detritus Food Chain

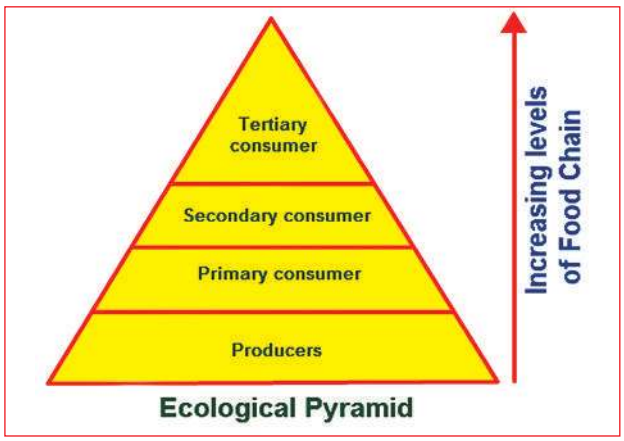
- This type of food chain starts from dead organic matter of decaying animals and plant bodies.
- Dead organic matter or detritus feeding organisms are called **detrivores** or **decomposer**. The detrivores are eaten by predators.
- The two food chains are linked. The initial energy source for detritus food chain is the waste materials and dead organic matter from the grazing food chain.
- In an aquatic ecosystem, grazing food chain is the major conduit for energy flow. As against this, in a terrestrial ecosystem, a much larger fraction of energy flows through the detritus food chain than through the grazing food chain.
- Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called **catabolism**.
- Humification and mineralization occur during decomposition in the soil.
- Humification leads to accumulation of a dark coloured amorphous substance called **humus** that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate.
- Being colloidal in nature, humus serves as a reervoir of nutrients. The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as **mineralization**.
- Warm and moist environment favor decomposition whereas low temperature and anaerobiosis inhibit decomposition resulting in build-up of organic materials.
- The sequence of important steps in the process of decomposition are Fragmentation, Leaching, Catabolism, Humification and Mineralisation.

Food Web

- Multiple interlinked food chains make a food web. Food web represents all the possible paths of energy flow in an ecosystem.
- If any of the intermediate food chain is removed, the succeeding links of the chain will be affected largely.
- The food web provides more than one alternative for food to most of the organisms in an ecosystem and therefore increases their chance of survival.

Ecological Pyramids

- The pyramidal representation of trophic levels of different organisms based on their ecological position [producer to final consumer] is called an ecological pyramid.
- The food producer forms the base of the pyramid and the top carnivore forms the tip. Other consumer trophic levels are in between.
- The pyramid consists of a number of horizontal bars depicting specific trophic levels. The length of each bar represents the total number of individuals or biomass or energy at each trophic level in an ecosystem.

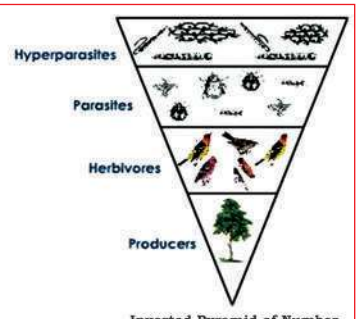


SUPPLEMENT

Pyramid of Numbers

- Pyramid of numbers represents the total number of individuals of different species (population) at each trophic level.
- Depending upon the size, the pyramid of numbers may not always be upright, and may even be completely inverted.
- **Pyramid of numbers–Upright:** e.g., grassland ecosystem and pond ecosystem.
- **Pyramid of numbers–Inverted:** e.g. Tree ecosystem, parasitic food chain.

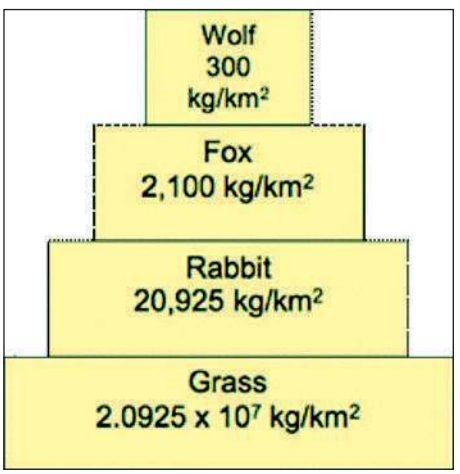
This type of ecological pyramid is seen in parasitic food chain where one primary producer supports numerous parasites which support more hyperparasites.



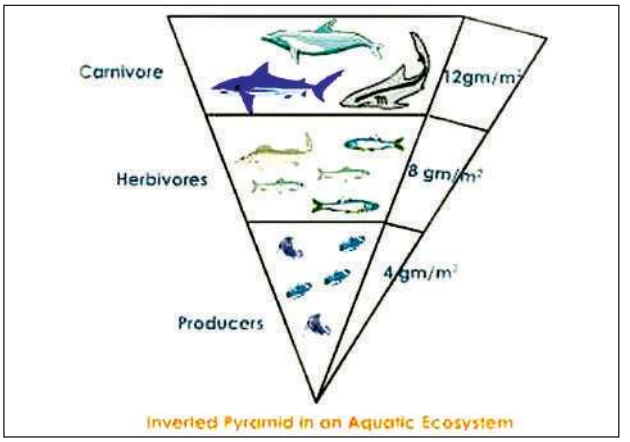
Inverted Pyramid of Number

Pyramid of Biomass

- Pyramid of biomass is usually determined by collecting all organisms occupying each trophic level separately and measuring their dry weight.This overcomes the size difference problem because all kinds of organisms at a trophic level are weighed. Biomass is measured in g/m^2.
- Each trophic level has a certain mass of living material at a particular time called the standing crop.
- **Pyramid of Biomass – Upright:** e.g. Terrestrial ecosystem



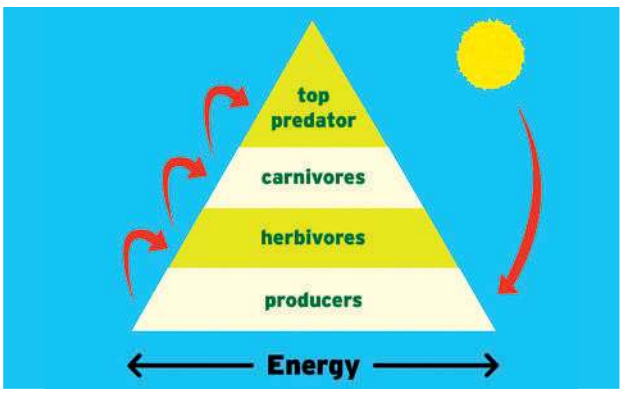
- **Pyramid of Biomass–Inverted:** Aquatic ecosystem



Inverted Pyramid in an Aquatic Ecosystem

Pyramid of Energy

- An energy pyramid represents the amount of energy at each trophic level and loss of energy at each transfer to another trophic level. Hence the pyramid is **always upward**, with a large energy base at the bottom.
- Energy pyramid concept helps to explain the phenomenon of **biological magnification** – the tendency of toxic substances to increase in concentration progressively with higher trophic levels.



Biotic Interaction

- The interaction that occurs among different individuals of the same species is called **intraspecific interaction** while the interaction among individuals of different species in a community is termed as **interspecific interaction**.
- Specific terms are applied to interspecific interactions depending upon whether the interaction is beneficial, harmful or neutral to individuals of the species.
- '0' is no effect, '–' is detrimental and '+' is beneficial.

Types of Biotic Interactions	
Amensalism (– and 0)	■ One species harms or restricts the other species without itself being adversely affected or harmed by the presence of the other species. ■ Organisms that secrete antibiotics and the species that get inhibited by the antibiotics are examples of amensalism. For example, the bread mould fungi Pencillium produce penicillin, an antibiotic substance which inhibits the growth of a variety of bacteria. ■ A large tree shades a small plant, retarding the growth of the small plant. The small plant has no effect on the large tree
Competition (– and –)	■ This is an interaction between two populations in which both species are harmed to some extent. ■ Competition occurs when two populations or species need a vital resource that is in short supply. ■ The vital resource could be food, water, shelter, nesting site, mates or space. ■ Such competition can be: ● interspecific competition-occurring between individuals of two different species occurring in a habitat and ● intraspecific competition-occurs between individuals of same species. ■ According to evolutionary theory, competition for resources plays a critical role in Natural Selection. ● e.g. Cheetah and Lion in Grassland Ecosystem.
Parasitism (+ and –)	■ In this type of interaction, one species is harmed and the other is benefited. ■ Many organisms like animal, bacteria and viruses are parasites of plants and animals. ■ Plants like dodder plant (*Cuscuta*) and mistletoe (*Loranthus*) are parasites that live on flowering plants. ■ Parasites that feed on the external surface of the host organism are called **ectoparasites**. E.g. lice on humans. ■ **Endoparasites** are those that live inside the host body at different sites (liver, kidney, lungs, red blood cells, etc.). ■ Brood parasitism in birds is a fascinating example of parasitism in which the parasitic bird lays its eggs in the nest of its host. E.g. cuckoo (koel).
Commensalism (+ and 0)	■ In this relationship one of the species benefits while the other is neither harmed nor benefited. ■ Some species obtain the benefit of shelter or transport from another species. For example sucker fish (Remora) often attaches to a shark by means of its sucker which is present on the top side of its head. This helps the remora get protection, a free ride as well as meal from the left over of the shark's meal. The shark does not however get any benefit nor is it adversely affected by this association.
Mutualism (+ and +)	■ This is a close association between two species in which both the species benefit. For example, the sea anemone, gets attached to the shell of hermit crabs for benefit of transport and obtaining new food while the anemone provides camouflage and protection by means of its stinging cells to the hermit crab. ■ However, some mutualisms are so intimate that the interacting species can no longer live without each other as they depend totally on each other to survive. Such close associations are called symbiosis (symbiosis is intense mutualism – e.g. coral and zooxanthellae). ■ Lichens represent an intimate mutualistic relationship between a fungus and photosynthesizing algae. ■ Similarly, the Mycorrhizae are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates.
Predation (+ and –)	■ In this one species is harmed and the other is benefited. ■ They keep prey populations under control. Without predators, prey species could achieve very high population densities and cause ecosystem instability. ■ Predators also help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species. ● e.g. Lion and Buffallo.

NATURAL ECOSYSTEM

- A natural ecosystem is an assemblage of plants and animals which functions as a unit and is capable of maintaining its identity. There are two main categories of ecosystems:

1. Terrestrial ecosystem/ Biomes

Ecosystems found on land e.g. forest, grasslands, deserts, tundra.

2. Aquatic ecosystem

Plants and animal community found in water bodies. These can be further classified into two sub groups.

- **Fresh water ecosystems,** such as rivers, lakes & ponds.
- **Marine ecosystems,** such as oceans, estuary and mangroves.

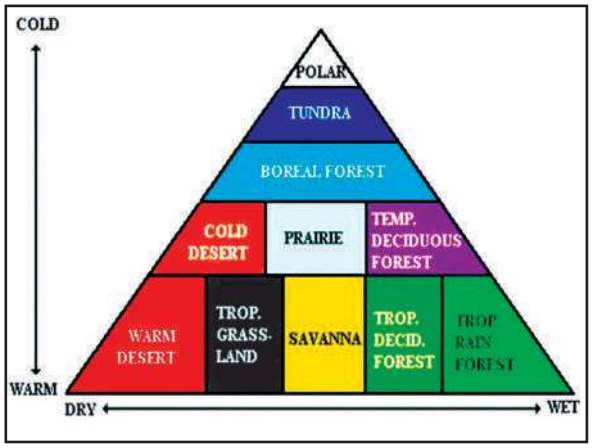
Terrestrial Ecosystem			
Tundra	**Forest**	**Grassland**	**Desert**
Arctic and Alpine Tundra Biome	Taiga or Boreal Biome [Coniferous forests] ■ Temperate Deciduous Biome [North Western Europe] ■ Temperate Rainforest Biome ■ Sub-Tropical Deciduous Biome in Eastern China, South Eastern USA ■ Temperate Deciduous Biome [Mediterranean Region] ■ Tropical Deciduous Biome [Monsoon Climate] ■ Savanna or Tropical Wet and Dry Biome ■ Tropical Rain Forest Biome	Steppe or Temperate Grassland Biome ■ Savanna or Tropical Wet and Dry Biome [Tropical Grasslands]	Tropical desert biome ■ Mid Latitude Desert Biome

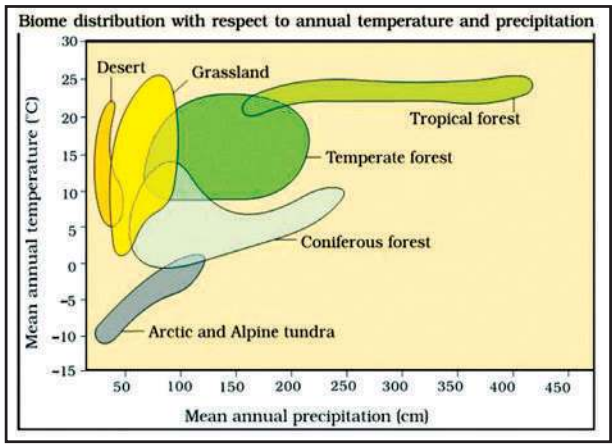
Biomes or Terrestrial Ecosystems

- The terrestrial part of the biosphere is divisible into enormous regions called biomes, which are characterized, by distinct climate [precipitation and temperature mainly], vegetation, animal life and general soil type.
- No two biomes are alike. The climate determines the boundaries of a biome and abundance of plants and animals found in each one of them. The most important climatic factors are temperature and precipitation.

Aquatic Ecosystems

- Aquatic ecosystem refers to plant and animal communities occurring in water bodies. Aquatic ecosystems are classified on the basis of salinity into following types:
- **Fresh water ecosystems:** Water on land which is continuously cycling and has low salt content (always less than 5 ppt) is known as fresh water. There are two types of fresh water ecosystems:
  - Static or still water (Lentic) ecosystems e.g. pond, lake, bogs and swamps.
  - Running water (Lotic) ecosystems e.g. springs, mountain brooks, streams and rivers.
- **Marine ecosystems:** The water bodies containing salt concentration equal to or above that of sea water (i.e., 35 ppt or above). e.g. shallow seas and open ocean.
- **Brackish water ecosystems:** These water bodies have salt content in between 5 to 35 ppt. e.g. estuaries, salt marshes, mangrove swamps and forests.





Montreal Protocol (1987)

- The Montreal Protocol on Substances that deplete the Ozone Layer (a protocol to the Vienna Convention (1985) for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.
- As a result the ozone hole over Antarctica is recovering.
- Climate projections indicate that the ozone layer will return to 1980 levels between 2050-70. It is the single most successful international agreement to date.
- The two ozone treaties (Vienna Convention and Montreal Protocol) have been ratified by 197 parties making them the first universally ratified treaties in United Nations history.

Water Pollution

Water pollution is the presence of undesirable substances in water such as (in)organic, biological, heat which degrades the quality of water.

Point and non-point sources of pollution

- When pollutants are discharged from a specific location such as a drain pipe carrying industrial effluents discharged directly into a water body it represents **point source pollution**.
- In contrast **non-point sources** include discharge of pollutants from diffused sources or from a larger area such as run off from agricultural fields, grazing lands, construction sites, abandoned mines and pits, roads and streets.

Causes of Water Pollution

- Increased sediment from soil erosion improper waste disposal and littering
- Leaching of soil pollutants into water supplies and
- Organic material decay in water supplies.

Ground Water Pollution

- In India at many places, the ground water is threatened with contamination due to seepage from industrial and municipal wastes and effluents, sewage channels and agricultural runoff.
- Pollutants like fluorides, uranium, heavy metals and nutrients like nitrates and phosphates are common in many parts of India.

Major Water Pollutants	
Plastics, Detergents, Oil and Gasoline	■ They are a waste from industries, household and farms. They trigger organic pollution and is harmful to health.
Inorganic Chemicals	■ Like acids, salts, metals are a result of industrial effluents, household cleansers and surface run-offs are injurious to health. ■ Radioactive Materials
	■ Mining and ores processing, power plants, weapons production lead to pollutants like Uranium, Thorium, Caesium, Iodine and Radium
Sediments	■ Sedimentation of soil, silt due to land erosion and deposition causes disruption in ecosystem.
Plant Nutrients	■ Nutrients like nitrates, phosphates and ammonium are let off from agricultural and urban fertilizers, sewage and manure. Excess of nutrients cause Eutrophication and affect the ecosystem.
Animal Manure and Plant residues	■ Lead to increased algal blooms and microorganism population. This increases oxygen demand of water, affecting aquatic ecosystems. This is introduced into water due to sewage, agricultural run-off, paper-mills, food processing etc.
Thermal and Radiation Pollution	■ Power plants – thermal and nuclear, chemical and other industries use lot of water for cooling purposes and the used hot water is discharged into rivers, streams or oceans. ■ Discharge of hot water may increase the temperature of the receiving water by 10 to 15 °C above the ambient water temperature. This is thermal pollution. ■ Increase in water temperature decreases dissolved oxygen in water which adversely affects aquatic life. ■ Unlike terrestrial organisms, aquatic organisms are adapted to a uniform steady temperature of environment. Sudden rise in temperature kills fishes and other aquatic animals.

Dissolved Oxygen (DO) – Biological Oxygen Demand (BOD) – Chemical Oxygen Demand (COD)		
DO	**BOD**	**COD**
■ DO content of water is important for the survival of aquatic organisms. Factors like surface turbulence, photosynthetic activity, O_2 consumption by organisms and decomposition of organic/ inorganic matter determine the amount of DO present in water. ■ The higher amounts of waste increase the rates of decomposition and O_2 consumption, thereby decreases the DO content of water.	The demand for O_2 is directly related to increasing input of organic wastes and is expressed as biological oxygen demand (BOD) of water. ■ BOD is the amount of dissolved oxygen needed by bacteria for decomposing the organic wastes present in water. It is expressed in milligrams of oxygen per litre of water. ■ The higher value of BOD indicates low DO content of water. Since BOD is limited and specific to biodegradable materials. Therefore, it is not a reliable method of measuring pollution load in water.	Chemical Oxygen Demand (COD) is a slightly better mode used to measure pollution load in water. ■ COD measures the amount of oxygen in parts per million required to oxidize organic (biodegradable and non-biodegradable) and oxidizable inorganic compounds in the water sample. ■ It is not specific like BOD.

Groundwater Contaminants and Their Effects	
Nitrates	■ Excess nitrate in drinking water reacts with hemoglobin to form non-functional methaemoglobin, and impairs oxygen transport. This condition is called **methaemoglobinemia** or **blue baby syndrome**. ■ Methaemoglobin cannot bind oxygen, unlike oxyhaemoglobin. ■ High level of nitrates may form carcinogens and can accelerate eutrophication in surface waters.
Pathogens	■ Poor hygiene of wells may cause pathogenic contamination. Water seepage from solid waste dumps and municipal drains may also cause pathogenic contamination.
Trace metals	■ Includes lead, mercury, cadmium, copper, chromium and nickel. These metals can be toxic and carcinogenic
Arsenic	■ Seepage of industrial and mine discharges, fly ash ponds of thermal power plants can lead to metals in groundwater. ■ In India and Bangladesh [Ganges Delta], millions of people are exposed to groundwater contaminated with high levels of arsenic. ■ Chronic exposure to arsenic causes **black foot disease**. It also causes diarrhoea, peripheral neuritis, hyperkeratosis and also lung and skin cancer.
Organic compounds	■ Seepage of agricultural runoff loaded with organic compounds like pesticides may cause pesticide pollution of ground water.
Fluoride	■ Excess fluoride in drinking water causes neuromuscular disorders, gastro-intestinal problems, teeth deformity (dental fluorosis), hardening of bones and stiff and painful joints (skeletal fluorosis). ■ Pain in bones and joint and outward bending of legs from the knees (**Knock-Knee syndrome**) can be caused by excess fluoride.

Measures to Address Water Pollution

- **Riparian buffers:** It is a vegetated area (a "buffer strip") near a stream, usually forested, which shade and partially protect a stream from the impact of adjacent land uses. It plays a key role in increasing water quality in associated streams, rivers, and lakes, thus providing environmental benefits.
- **Treatment** of sewage water and the industrial effluents before releasing it into water bodies. Hot water should be cooled before release from the power plants.
- Excessive use of fertilizers and pesticides should be avoided. Organic farming and efficient use of animal residues as fertilizers can replace chemical fertilizers.
- **Water hyacinth** (an aquatic weed, invasive species) also called 'Terror of Bengal', can purify water by taking some toxic materials and a number of heavy metals from water.
- Oil spills in water can be cleaned with the help of bregoli— a by-product of paper industry resembling saw dust, oil zapper, microorganisms.
- Eucalyptus trees absorb all surplus wastewater rapidly and release pure water vapor into the atmosphere. However, they have been found to be responsible for depleting groundwater levels.

Soil Pollution

- Soil pollution is defined as the 'addition of substances to the soil, which adversely affect physical, chemical and biological properties of soil and reduces its productivity.

In Situ Bioremediation	Ex Situ Bioremediation
■ **Bioventing:** Supply of air and nutrients through wells to contaminated soil to stimulate the growth of indigenous bacteria. It is used for simple hydrocarbons and can be used where the contamination is deep under the surface. ■ **Biosparging:** Injection of air under pressure below the water table to increase groundwater oxygen concentrations and enhance the rate of biological degradation of contaminants by naturally occurring bacteria. ■ **Bioaugmentation:** Microorganisms are imported to a contaminated site to enhance degradation process. ■ Using **bioremediation** techniques, TERI has developed a mixture of bacteria called 'Oilzapper and Oilivorous-S' which degrades the pollutants of oil-contaminated sites, leaving behind no harmful residues.	■ **Land farming:** Contaminated soil is excavated and spread over a prepared bed and periodically tilled until pollutants are degraded to stimulate indigenous biodegradative microorganisms and facilitate their aerobic degradation of contaminants. ■ **Biopiles:** Hybrid of land farming and composting. Essentially, engineered cells are constructed as aerated composted piles. Typically used for treatment of surface contamination with petroleum hydrocarbons. ■ **Bioreactors:** Involves the processing of contaminated solid material (soil, sediment, sludge) or water through an engineered containment system. ■ **Composting:** Composting is nature's process of recycling decomposed organic materials into a rich soil known as compost. ■ **Phytoremediation** is use of plants to remove contaminants from soil and water. Natural phytoremediation is carried out by mangroves, estuarine vegetation and other wetland vegetation. ■ **Phytoextraction/phytoaccumulation:** Plants accumulate contaminants into the roots and aboveground shoots or leaves. ■ **Phytotransformation/phytodegradation:** Uptake of organic contaminants from soil, and their transformation to more stable, less toxic, less mobile form. ■ **Phytostabilization:** Plants reduce the mobility and migration of contaminated soil. Leachable constituents are adsorbed and bound into the plant structure. ■ **Rhizodegradation:** Breakdown of contaminants through the activity existing in the rhizosphere (region of soil in the vicinity of plant roots). This activity is due to the presence of proteins and enzymes produced by the plants or by soil organisms such as bacteria, yeast, and fungi. ■ **Rhizofiltration:** Water remediation technique that involves the uptake of contaminants by plant roots. Rhizofiltration is used to reduce contamination in natural wetlands and estuary areas (e.g. Mangroves). ■ **Mycoremediation:** Fungi are used to decontaminate the area. ■ **Mycofiltration:** Using fungal mycelia to filter toxic waste and microorganisms.

RADIOACTIVE POLLUTION

Biological Damage Due to Ionizing Radiations

- The biological damage resulting from ionizing radiations is generally termed as radiation damage.
- Large amounts of radiation can kill cells that can dramatically affect the exposed organism as well as possibly its offspring.
- Affected cells can mutate and result in cancer. A large enough dose of radiation can kill the organism.
- Radiation damage can be divided into two types: (a) somatic damage (also called radiation sickness) and (b) genetic damage.
- Somatic damage refers to damage to cells that are not associated with reproduction.
- Effects of somatic radiation damage include reddening of the skin, loss of hair, ulceration, fibrosis of the lungs, formation of holes in tissue, a reduction of white blood cells, and the induction of cataract in the eyes. This damage can also result in cancer and death.
- Genetic damage refers to damage to cells associated with reproduction. This damage can subsequently cause genetic damage from gene mutation resulting in abnormalities. Genetic damages may be passed on to next generation.

Half-Life Period of Radioactivity

- Each radioactive material has a constant decay rate. Half-life is the time needed for half of its atoms to decay.
- Half-life of a radio nuclide refers to its period of radioactivity. The half-life may vary from a fraction of a second to thousands of years.
- The radio nuclides with long half-time are the chief source of environmental radioactive pollution.

Damage Due to Radiation Particles

- Alpha particles, can be blocked by a piece of paper and human skin.
- Beta particles can penetrate through skin, while can be blocked by some pieces of glass and metal.
- Gamma rays can penetrate easily to human skin and damage cells on its way through, reaching far, and can only be blocked by a very thick, strong, massive piece of concrete.

Barium	Barium is a soft silvery-white metal that is used in computers in the front panel of a CRT, to protect users from radiation	Studies have shown that short-term exposure to barium causes brain swelling, muscle weakness, damage to the heart, liver, and spleen.
Beryllium	Beryllium is commonly found on motherboards and finger clips It is used as a copper-beryllium alloy to strengthen connectors and tiny plugs while maintaining electrical conductivity	Exposure to beryllium can cause lung cancer. Beryllium also causes a skin disease that is characterized by poor wound healing and wart like bumps. Studies have shown that people can develop beryllium disease many years following the last exposure.
Toners	Found in the plastic printer cartridge containing black and color toners.	Inhalation is the primary exposure pathway, and acute exposure may lead to respiratory tract irritation. Carbon black has been classified as a class 2B carcinogen, possibly carcinogenic to humans. Reports indicate that colour toners (cyan, magenta and yellow) contain heavy metals.
Phosphor and Additives	Phosphor is an inorganic chemical compound that is applied as a coat on the interior of the CRT faceplate. The phosphor coating on cathode ray tubes contains heavy metals, such as cadmium, and other rare earth metals, e.g., zinc, vanadium as additives.	These metals and their compounds are very toxic. This is a serious hazard posed for those who dismantle CRTs by hand.

Occupational Health Hazards			
Coal dust	Black lung disease/ pneumoconiosis (CWP) or Anthracosis	**Asbestos**	Asbestosis
Benzene, Chromium, Nitrosamines	Cancers of Lung, Bladder, Skin, Mesothelium, Liver.	**Bauxite fumes containing aluminium and silica particles**	Bauxite fibrosis
Silica	Silicosis	**Iron**	Siderosis
Mica	Pneumoconiosis	**Dust of silica and iron**	Silicosiderosis
Textile industry- cotton dust	Byssinosis/ Brown Lung Disease	**Sugarcane fibre**	Bagossosis
		Hay or grain dust	Farmer's lung

BIODIVERSITY

Biodiversity is the variety of plant and animal life in the world or in a particular habitat.

Measurement of Biodiversity

Biodiversity is measured by two components: species richness, and species evenness.

- **Endemism** is the ecological state of a species being unique to a defined geographic location, such as an island, nation, country or other defined zone, or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere.
- A particular type of animal or plant may be endemic to a zone, a state or a country. The extreme opposite of endemism is cosmopolitan distribution.

Why tropics have greater biological diversity?

- Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.
- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialization and lead to a greater species diversity.
- There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.
- In general, species diversity decreases as we move away from the equator towards the poles. With very few exceptions, tropics (between 23.5° N to 23.5° S) harbour more species than temperate or polar areas.
- **Bioprospecting:** Nations endowed with rich biodiversity explore molecular, genetic and species-level diversity to derive products of economic importance.

Species Types	
Keystone species	It is a species whose addition to or loss from an ecosystem leads to major changes in occurrence of at least one other species. ■ All top predators (Tiger, Lion, Crocodile) are considered as keystone species because they regulate all other animal population indirectly. Hence top predators are given much consideration in conservation. ■ If keystone species is lost, it will result in the degradation of whole ecosystem. e.g. certain plant species (ebony tree, Indian-laurel) exclusively depends upon bats for its pollination. If the bat population is reduced then regeneration of particular plants becomes more difficult. ■ Reintroduction of Wolves (keystone) in Yellowstone Park, USA.
Foundation species	It is a dominant primary producer in an ecosystem both in terms of abundance and influence. Example: kelp in kelp forests and corals in coral reefs.
Flagship species	A flagship species is a species chosen to represent an environmental cause, such as an ecosystem in need of conservation. ■ These species are chosen for their vulnerability, attractiveness or distinctiveness in order to engender support and acknowledgement from the public at large. ■ e.g. Indian tiger, African elephant, Giant panda of China, mountain gorilla of Central Africa, Orangutan of Southeast Asia and the leatherback sea turtle.

Measurement of Biodiversity		
Species richness is the measure of number of species found in a community	Alpha diversity	It refers to the diversity within a particular area or ecosystem, and is usually expressed by the number of species (i.e., species richness) in that ecosystem.
	Beta diversity	It is a comparison of diversity between ecosystems, usually measured as the change in amount of species between the ecosystems.
	Gamma diversity	It is a measure of the overall diversity for the different ecosystems within a region.
Species evenness measures the proportion of species at a given site, e.g. low evenness indicates that a few species dominate the site.	Genetic diversity	It is the total number of genetic characteristics in the genetic makeup of a species. A single species might show high diversity at genetic level [e.g. Man: Chinese, Indian American, African etc.] Genetic diversity allows species to adapt to changing environments. It aims to ensure that some species survive drastic changes and thus carry on desirable genes.
	Species diversity	It is the ratio of one species population over total number of organisms across all species in the given biome. 'Zero' would be infinite diversity, and 'one' represents only one species present. ■ It is a measure of diversity within an ecological community that incorporates both species richness and evenness of species. ■ For eg. Western Ghats have a greater amphibian species diversity than the Eastern Ghats. ■ Species differ from one another, markedly in their genetic makeup and do not inter-breed in nature. Closely-related species however have in common much of their hereditary characteristics.

Services Provided by Biodiversity		
Ecosystem services	**Biological services**	**Social services**
Protection of water resources.	Food and shelter.	Research, education and monitoring.
Soils formation and protection.	Medicinal resources, ornamental.	Recreation and tourism.
Nutrient storage and recycling.	Wood products.	Cultural values.

Ecological diversity

- Ecological diversity refers to the different types of habitats. A habitat is the cumulative factor of the climate, vegetation and geography of a region.
- It includes various biological zones, like lake, desert, coast, estuaries, wetlands, mangroves, coral reefs etc.
- India with its deserts, rain forests, mangroves, coral reefs and alpine meadows has a greater ecosystem diversity than a Scandinavian country like Norway.

Cause for loss of biodiversity

There are four major causes also called the **' The Evil Quartet'**

Key Terms	
Climate Forcing / Radiative Forcing	It is defined as the difference of insolation (sunlight) absorbed by the Earth and energy radiated back to space. Climate forcing factors can be External (Galactic and Orbital Variations, Sunspots etc), Internal (Orogeny, Volcanism, Albedo, Atmospheric Composition, Ocean Circulation, etc.) and Human (Population Growth, Consumption per Person etc) factors.
Polar Amplification	It refers to greater climate change near the pole compared to the rest of the hemisphere or globe in response to a change in global climate forcing, such as the concentration of greenhouse gases (GHGs) or solar radiation output.
Carbon Footprint	It is defined as the total amount of greenhouse gases produced to directly or indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO_2). A person's carbon footprint is the sum of all emissions of CO_2, which were induced by his activities in a given time frame (usually a year). Carbon footprint involves all 6 GHGs recognized by the Kyoto Protocol (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6).
Carbon Offsetting	It means compensating for CO_2 pollution (carbon footprint) by preventing the same amount of pollution from happening somewhere else. More precisely, one carbon offset means compensating for emitting one tonne of CO_2 into the atmosphere by preventing a tonne of CO_2 from entering the atmosphere elsewhere on Earth (for example, by investing in renewable energy) or by removing a tonne of CO_2 that's already up there (by supporting something like tree planting—since trees utilise CO_2 for photosynthesis).
Carbon Sequestration	It is capturing the CO_2 produced by burning fossil fuels and storing it safely away from the atmosphere. Importantly, it is both a natural (photosynthesis) and artificial (geologic sequestration into deep underground rock formations) process in which carbon dioxide can be stored in either liquid or solid form.
Carrying Capacity	In ecological terms, the carrying capacity of an ecosystem is the size of the population that can be supported indefinitely upon the available resources and services.
Teleconnection	It refers to climate anomalies being related to each other at large distances. The most symbolic teleconnection is the one linking sea-level pressure at Tahiti and Darwin, Australia, which defines the Southern Oscillation. The link between El-Nino and the Indian Monsoon is also an example of teleconnection ecosystem

Protected Areas in News	
Context	**About**
The number of Rhinos in Kaziranga NP has increased.	■ Kaziranga National Park, Assam ■ Located at the edge of Eastern Himalayan Biodiversity Hotspot. ■ Associated rivers - the Brahmaputra, Diphlu and Mora Dhansari ■ landscapes - Savannah, Semi-evergreen forests and Subtropical Moist Broadleaf Forests ■ A **UNESCO World Heritage Site and a Tiger Reserve** ■ Recognised as an **Important Bird Area** by Birdlife International. ■ Hosts around 2/3rd of the world's **Great One-horned Rhinoceros** population. ■ Hosts the **Hoolock Gibbon,** the only species of Ape found in India
Manas National Park forms a part of the Transboundary National Park being established at the tri-junction of India, Nepal and Bhutan.	■ Manas National Park, Assam ■ A **UNESCO World Heritage site**, a Wildlife Sanctuary, a **Tiger Reserve**, an **Elephant Reserve,** and a **Biosphere Reserve** ■ The river Manas (a tributary of Brahmaputra) passes through it ■ It is dominated by grassland and forest biomes.
'Lonely Planet' magazine has declared Pench and Kanha National Parks to be the most 'Beautiful National Parks in Asia.	■ Pench National Park, Madhya Pradesh ■ Near **Satpura ranges** ■ Mainly consists of **Dry Deciduous Forests** ■ A Tiger Reserve as well ■ Important wildlife - tiger, leopards, sloth bear, etc. ■ Found mention in **Ain-E-Akbari,** has been a setting of Rudyard Kipling's **Jungle Book.** ■ **Kanha National Park, Madhya Pradesh**

Researchers from Kerala have discovered a new species of eel-loach named *'Pangio bhujia'* in Kozhikode	■ Pangio bhujia ■ It has several unique characters including the absence of dorsal fin ■ It is the **first** species of eel-loach in the world that has been discovered to be living in subterranean environments ■ Eel-loaches are generally found in fast-flowing streams in the south and south-east Asia
A National Green Tribunal (NGT) bench has directed the Central government to prepare a time-bound action plan for the protection of Great Indian Bustard	■ **Great Indian Bustard** *(Ardeotis nigriceps)* ■ **IUCN Status:** Critically Endangered ■ Restricted to isolated pockets in Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Madhya Pradesh and Rajasthan (shared with Pakistan). ■ Listed in **Schedule I of the Wildlife (Protection) Act, 1972**; in the **CMS Convention;** and in **Appendix I of CITES**. ■ One of the species for the recovery program under the **Integrated Development of Wildlife Habitats** of the Ministry of Environment and Forests ■ Feed on grass seeds, insects, and sometimes small rodents and reptiles ■ Rajasthan initiated **Project Great Indian Bustard** in 2013
Researchers sighted a species of Tarantula-Peacock Parachute Spider for the first time beyond its known habitat in the Eastern Ghats.	■ **Peacock Parachute Spider** (*Poecilotheria metallica)* ■ **IUCN Status**: Critically Endangered ■ A biological pest controller ■ Its known habitat is near Nandyal in Andhra Pradesh and was spotted in a cave in Pakkamalai Reserve Forests in Tamil Nadu
Tamil Nadu has officially declared **Tamil Yeoman** as the **state butterfly**. Tamil Nadu became **the fifth Indian state** *to* declare its state butterfly. **Maharashtra** was the first state to officially declare **Blue Mormon** (*Papilio polymnestor*) as its state butterfly.	■ **Tamil Yeoman** (*Cirrochroa thais*) ■ Locally known as Tamil Maravan, which means '**Tamilian Warrior**' ■ Belongs to the family of brush-footed butterflies or the Nymphalid ■ It is **endemic** to Western Ghats ■ Butterflies act as bio-indicators as they are sensitive to any environmental change
Researchers have discovered *Dracaena cambodiana* in Assam's West Karbi Anglong district. This is the first time that a dragon tree species has been reported from India.	■ Dracaena Cambodiana ■ An important medicinal plant as well as an ornamental tree ■ This plant yields **dragon's blood** - a bright red resin. It is a precious traditional medicine in China.
Team of researchers, from the Indian Institute of Science (IISc), Bengaluru have discovered *Proahaetulla antiqua.*	■ Proahaetulla antiqua ■ A new vine snake species ■ Discovered in the **Agasthyamalai hills** in protected habitats of Kalakkad Mundanthurai Tiger Reserve (Tamil Nadu) and Shendurney Wildlife Sanctuary (Kerala)
A rare snail species called 'Scaly-Foot Snail' found only on the Indian Ocean floor near Madagascar has become the **first** species to be officially declared endangered.	■ **Scaly foot snail** *(Chrysomallon squamiferum)* ■ **IUCN Status:** Endangered ■ Also known as **Sea Pangolin** ■ Inhabits the hydrothermal vent fields of the Indian Ocean ■ The first marine species to be officially assessed as endangered due to potential threat of deep-sea mining
Odisha has renewed its effort to revive the population of gharials in their natural habitat by releasing 5 reptiles, fitted with radio transmitters, into **Satkosia gorge** of Mahanadi.	■ **Gharial** *(Gavialis gangeticus)* ■ **IUCN Status:** Critically Endangered ■ Listed in Schedule I of the Wildlife (Protection) Act, 1972 and in Appendix I of CITES ■ Native to sandy freshwater river banks in the plains of the northern part of the Indian subcontinent.

Previous Years' UPSC Questions on Ecology & Environment (2019-10)

1. Which one of the following National Parks lies completely in the temperate alpine zone?
   (a) Manas National Park
   (b) Namdapha National Park
   (c) Neora Valley National Park
   (d) Valley of Flowers National Park

2. Consider the following statements:
   1. Asiatic lion is naturally found in India only.
   2. Double-humped camel is naturally found in India only.
   3. One-horned rhinoceros is naturally found in India only.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 2 only
   (c) 1 and 3 only (d) 1, 2 and 3

3. In the context of which one of the following are the terms 'pyrolysis and plasma gasification' mentioned?
   (a) Extraction of rare earth elements
   (b) Natural gas extraction technologies
   (c) Hydrogen fuel-based automobiles
   (d) Waste-to-energy technologies

4. Which of the following are in Agasthyamala Biosphere Reserve?
   (a) Neyyar, Peppara and Shendurney Wildlife Sanctuaries; and Kalakad Mundanthurai Tiger Reserve
   (b) Mudumalai, Sathyamangalam and Wayanad Wildlife Sanctuaries; and Silent Valley National Park
   (c) Kaundinya, Gundla Brahmeswaram and Papikonda Wildlife Sanctuaries; and Mukurthi National Park
   (d) Kawal and Sri Venkateswara Wildlife Sanctuaries; and Nagarjunasagar-Srisailam Tiger Reserve

5. Consider the following statements:
   1. Some species of turtles are herbivores.
   2. Some species of fish are herbivores.
   3. Some species of marine mammals are herbivores.
   4. Some species of snakes are viviparous.

   Which of the statements given above are correct?
   (a) 1 and 3 only
   (b) 2, 3 and 4 only
   (c) 2 and 4 only
   (d) 1, 2, 3 and 4

6. Consider the following pairs:

	Wildlife		Naturally found in
1.	Blue-finned Mahseer	:	Cauvery River
2.	Irrawaddy Dolphin	:	Chambal River
3.	Rusty-spotted Cat	:	Eastern Ghats

   Which of the pairs given above are correctly matched?
   (a) 1 and 2 only
   (b) 2 and 3 only
   (c) 1 and 3 only
   (d) 1, 2 and 3

7. Recently, there was a growing awareness in our country about the importance of Himalayan nettle (*Girardinia diversifolia*) because it is found to be a sustainable source of
   (a) anti-malarial drug
   (b) biodiesel
   (c) pulp for paper industry
   (d) textile fibre

8. Consider the following statements:
   1. Under Ramsar Convention, it is mandatory on the part of the Government of India to protect and conserve all the wetlands in the territory of India.
   2. The Wetlands (Conservation and Management) Rules, 2010 were framed by the Government of India based on the recommendations of Ramsar Convention.
   3. The Wetlands (Conservation and management) Rules, 2010 also encompass the drainage area or catchment regions of the wetlands as determined by the authority.

   Which of the statements given above is/are correct?
   (a) 1 and 2 only (b) 2 and 3 only
   (c) 3 only (d) 1, 2 and 3

9. Consider the following statements:
   1. Agricultural soils release nitrogen oxides into environment.
   2. Cattle release ammonia into environment.
   3. Poultry industry releases reactive nitrogen compounds into environment.

   Which of the statements given above is/are correct?
   (a) 1 and 3 only
   (b) 2 and 3 only
   (c) 2 only
   (d) 1, 2 and 3

10. Consider the following statements:

    The Environment Protection Act, 1986 empowers the Government of India to
    1. state the requirement of public participation in the process of environmental protection, and the procedure and manner in which it is sought
    2. lay down the standards for emission or discharge of environment pollutants from various sources

33. Which one of the following is the national aquatic animal of India?
    (a) Saltwater crocodile (b) Olive ridley turtle
    (c) Gangetic dolphin (d) Gharial

34. Which one of the following is associated with the issue of control and phasing out of the use of ozone-depleting substances?
    (a) Bretton Woods Conference
    (b) Montreal Protocol
    (c) Kyoto Protocol
    (d) Nagoya Protocol

35. Which of the following statements regarding 'Green Climate Fund' is/are correct?
    1. It is intended to assist the developing countries in adaptation and mitigation practices to counter climate change.
    2. It is founded under the aegis of UNEP, OECD, Asian Development Bank and World Bank.

    Select the correct answer using the code given below.
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2

36. BioCarbon Fund Initiative for Sustainable Forest Landscapes' is managed by the
    (a) Asian Development Bank
    (b) International Monetary Fund
    (c) United Nations Environment Programme
    (d) World Bank

37. The Genetic Engineering Appraisal Committee is constituted under the
    (a) Food Safety and Standards Act, 2006
    (b) Geographical Indications of Goods (Registration and Protection) Act, 1999
    (c) Environment (Protection) Act, 1986
    (d) Wildlife (Protection) Act, 1972

38. Consider the following statements regarding 'Earth Hour':
    1. It is an initiative of UNEP and UNESCO.
    2. It is a movement in which the participants switch off the lights for one hour on a certain day every year.
    3. It is a movement to raise the awareness about the climate change and the need to save the planet.

    Which of the statements given above is/are correct
    (a) 1 and 3 only (b) 2 only
    (c) 2 and 3 only (d) 1, 2 and 3

39. With reference to Bombay Natural History Society (BNHS), consider the following statements:
    1. It is an autonomous organization under the Ministry of Environment and Forests.
    2. It strives to conserve nature through action-based research, education and public awareness.
    3. It organizes and conducts nature trails and camps for the general public.

    Which of the statements given above is/are correct?
    (a) 1 and 3 only (b) 2 only
    (c) 2 and 3 only (d) 1, 2 and 3

40. With reference to a conservation organization called 'Wetlands International', which of the following statements is / are correct?
    1. It is an intergovernmental organization formed by the countries which are signatories to Ramsar Convention.
    2. It works at the field level to develop and mobilize knowledge, and use the practical experience to advocate for better policies.

    Select the correct answer using the code given below.
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2

41. Which of the following adds/add carbon dioxide to the carbon cycle on the planet Earth?
    1. Volcanic action
    2. Respiration
    3. Photosynthesis
    4. Decay of organic matter

    Select the correct answer using the code given below.
    (a) 1 and 3 only (b) 2 only
    (c) 1, 2 and 4 only (d) 1, 2, 3 and 4

42. With reference to Eco-Sensitive Zones', which of the following statements is/are correct?
    1. Eco-Sensitive Zones are the areas that are declared under the Wildlife (Protection) Act, 1972.
    2. The purpose of the declaration of Eco-Sensitive Zones is to prohibit all kinds of human activities in those zones except agriculture.

    Select the correct answer using the code given below.
    (a) 1 only (b) 2 only
    (c) Both 1 and 2 (d) Neither 1 nor 2

43. Consider the following statements:
    1. Animal Welfare Board of India is established under the Environment (Protection) Act, 1986.
    2. National Tiger Conservation Authority is a statutory body.
    3. National Ganga River Basin Authority is chaired by the Prime Minister.

    Which of the statements given above is/are correct?
    (a) 1 only (b) 2 and 3 only
    (c) 2 only (d) 1, 2 and 3

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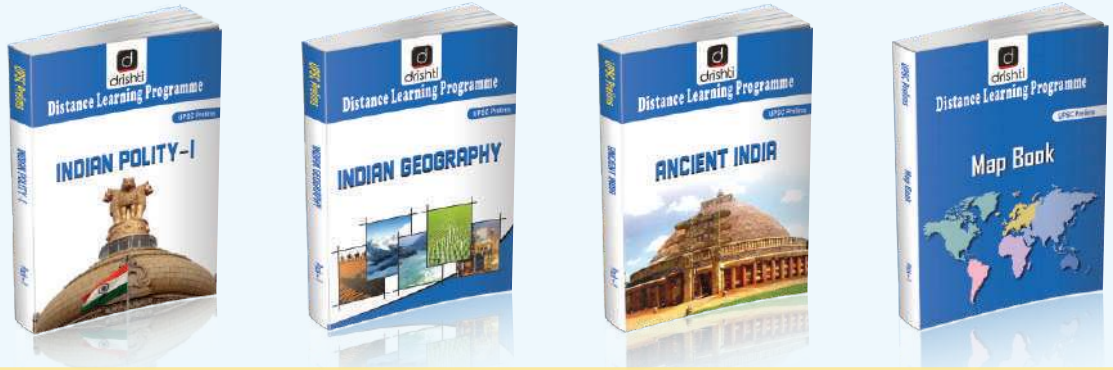

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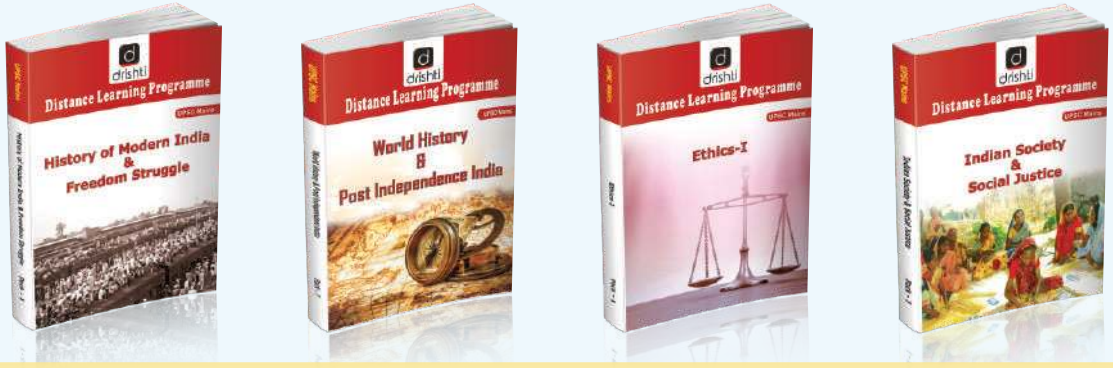

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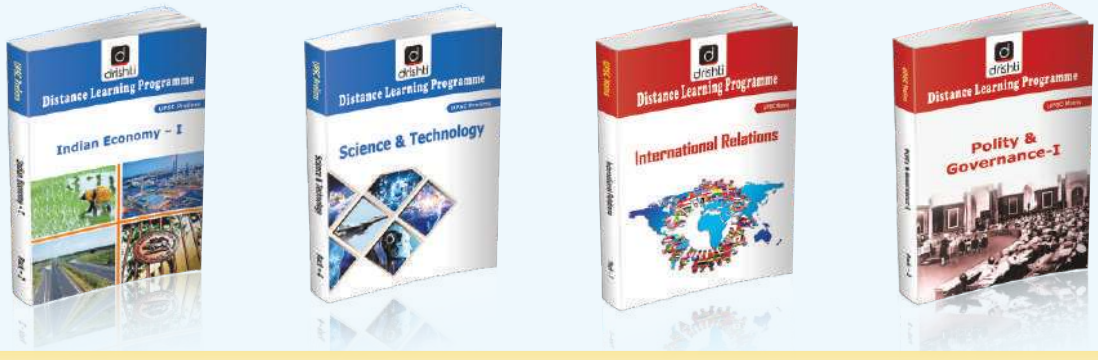

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