MODULE 1 - Scope of Environmental Management –

An environment includes all the living and nonliving things that affect an organism. It's where an organism lives and how it interacts with the world around it.

1. **What is Environment?**
   The sum total of all surroundings of a living organism, including natural forces and other living things which provide conditions for development & growth as well as of danger & damagers.

What it is: An EMS is like a rulebook for a company to help them protect the environment.
How it works:
Organized Plan: It gives companies a step-by-step plan on how to be nicer to the environment.
Everyone Helps: The whole company, from the boss to the workers, has a part to play in the plan.
Goals and Training: It sets clear goals for what the company wants to improve and teaches the workers how to do it.

2. **Environment Management System-**
   - It refers to the management of an organization's environmental programs in a comprehensive, systematic, planned and documented manner. It includes the organisational structure.
   - Planning and resources for developing, implementing and maintaining policy for environmental protection.

Why it's important: An EMS helps companies:
Make less pollution
Follow environmental laws
Take care of the planet for the future

3. **Introduction**
   - The science of Environment studies is a multi-disciplinary science.
   - It is the science of physical phenomena in the environment.
   - It is a broad field of study that includes also the **natural** environment, **built** environment and the **sets of relation** between them.
   - Our survival in this planet Earth depends on the proper management of environment.
   - Every living being are interdependent directly or indirectly.

   - The climatic condition depends on the air, temperature. Everyone is now feeling the change of climate due to the rise in air temperature of the Earth.
   - More presence of CO_2 is resulting in **Ozone Layer depletion** and **Acid Rain.**
   - Due to enormous increase in population and stress on environmental factors like air, water & soil, it is now urgently needed to frame guidelines & rules for the management of environment in a proper way.
   - A good management of environment can only bring a sustainable life to all on Earth.

4. **Concept of Environmental Management-**
   - Its an attempt to **control human impact** on and interaction with the environment in order to preserve natural resources.
   - Environmental Management focuses on the improvement of human welfare for present and future generations.
   - Administrative functions that develop, implement, and monitor the **environment policy** of an organization.
   - Environmental Management not only implies a mere management of environment but is essentially the management of various activities with intolerable constraints imposed by the environment itself and with full consideration of physical factors.

different aspects of environmental management:

1. Controlling Human Impact:
Environmental management aims to minimize the negative impact humans have on the environment. This includes activities like pollution, resource depletion, and habitat destruction.
By managing human interaction with the environment, we can preserve natural resources for future generations.

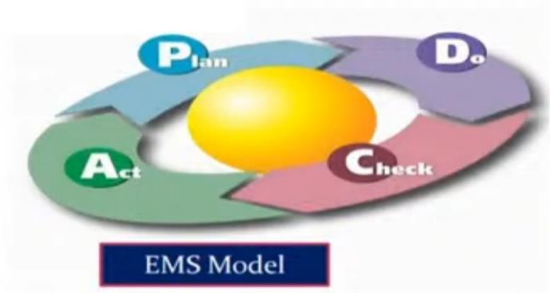
2. Improving Human Well-being:
Environmental management isn't just about protecting the environment; it's also about improving human well-being.
A healthy environment provides us with clean air, water, and food, essential for good health and quality of life.
Sustainable practices that protect the environment also contribute to long-term economic prosperity and social stability.

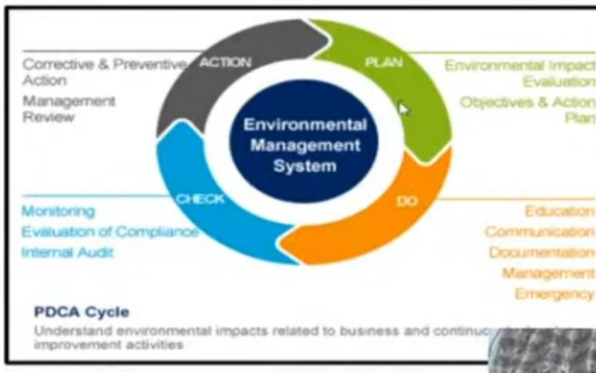
3. Administrative Functions:
Organizations like businesses and government agencies often implement environmental management systems (EMS).
These systems involve various administrative functions, including:
Developing environmental policies that outline the organization's commitment to environmental protection.
Implementing programs to achieve the goals outlined in the policies.
Monitoring performance and making adjustments as needed.

4. Managing Within Constraints:
Effective environmental management recognizes the limitations imposed by the environment itself. We need to be mindful of the carrying capacity of ecosystems and the resources available.
This involves managing human activities within these physical constraints to ensure the environment's long-term sustainability.

By understanding these different aspects, we can appreciate how environmental management plays a crucial role in creating a harmonious balance between human needs and environmental health.

Environmental Management





Characteristics of EM:

Environmental Management:

- Supports sustainable development
- Demands the multi-disciplinary approach. It deals with a world affected by humans.
- Has to integrate different development viewpoints.
- Seeks to integrate natural and social science.
- Can extend from short-term to long-term and from local to global level.

The Plan-Do-Check-Act (PDCA) cycle is a foundational concept of Environmental Management Systems (EMS). It provides a continuous improvement framework for organizations to effectively manage their environmental impacts. Here's a breakdown of the PDCA cycle in the context of an EMS:

1. Plan:
Define environmental policy: Establish clear commitments and principles regarding environmental protection.
Set environmental objectives and targets: Define specific, measurable, achievable, relevant, and time-bound (SMART) goals for environmental performance improvement.
Develop action plans: Outline specific actions and activities to achieve the set objectives and targets.

2. Do:
Implement the action plans developed in the planning phase.
Allocate necessary resources, including personnel, training, and equipment.
Monitor and document the implementation process to ensure adherence to the plan.

3. Check:
Monitor and measure the environmental performance against the set objectives and targets.
Analyze the collected data to identify any discrepancies or areas for improvement.
Conduct internal audits to assess the effectiveness of the EMS implementation.

4. Act:
Take corrective actions to address any identified gaps or non-conformities.
Continuously improve the EMS based on the results of the check phase.
Review and update environmental policies, objectives, and targets as needed.

By continuously iterating through the PDCA cycle, organizations can systematically improve their environmental performance, reduce their environmental footprint, and contribute to a more sustainable future.

characteristics of Environmental Management (EM):

Supports Sustainable Development: EM aims to balance human needs with environmental protection for the long term. This ensures we meet current needs without compromising the ability of future generations to meet their own.
Multi-disciplinary Approach: EM requires expertise from various disciplines, including natural and social sciences, engineering, economics, and law. This allows for a holistic understanding of environmental challenges and the development of effective solutions.
Deals with a Human-affected World: EM acknowledges the significant impact humans have on the environment. It aims to mitigate negative impacts and find ways to live sustainably within the planet's carrying capacity.
Integration of Development Viewpoints: EM recognizes the diverse perspectives surrounding environmental issues. It seeks to balance economic development, social equity, and environmental protection through inclusive decision-making.
Integration of Natural and Social Science: EM bridges the gap between understanding the natural world (natural science) and the human factors influencing environmental issues (social science). This allows for evidence-based solutions that consider both the environment and societal needs.
Scalability: EM can be applied at various scales, from managing the environmental footprint of a single organization to tackling global environmental challenges. It promotes long-term planning (considering future generations) and adaptability to address issues at both the local and global level.
By understanding these characteristics, we can appreciate how environmental management plays a crucial role in creating a more sustainable future for all.

Significance

- Environmental Management is an approach which integrates Ecology, Policy making, Planning and Social development. Its main objectives are as follows:
- To prevent and solve environmental problems.
- To establish limits
- To develop research institutions and monitoring systems.
- To warn threats and identify opportunities.
- To suggest measures for resource conservation.
- To develop a strategy for the improvement of quality.
- To suggest long-term and short-term policies for sustainable development.

Some Other Definitions of EM

- "The process of allocating natural and artificial resources so as to make optimum use of the environment in satisfying basic human needs, at the minimum, and more, if possible, on a sustainable basis". - (Jolly, 1978.)
- Throughout the world, particularly in developing countries, there is an urgent need for the management of total environment. In the first instance environmental management must do three things:
- Identify goals
- Establish whether these can be met &
- Develop & implement means to do what it deems possible.

Two Schemes of EM

- The Eco-Management and Audit scheme(EMAS) – established by the European commission in 1993.
- It enables organization to assess, manage & continuously improve their environmental performance.
- The scheme is globally applicable and open to all types of private and public organizations.
- Currently more than 4,600 organizations & more than 7,900 sites are EMAS registered.

General Scheme for Environmental Management

- STEP I: Identification of objectives and define problems
- STEP II: Determination of appropriate action plan
- STEP III: Implementation & progress evaluation
- STEP IV: Monitoring & adjust management
- STEP V: Future environmental management and planning

Two Schemes of Environmental Management

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Established by the European Commission in 1993.
Helps organizations improve their environmental performance through assessment, management, and continuous improvement.
Applicable to all types of private and public organizations worldwide.
Over 4,600 registered organizations and 7,900 registered sites.
ISO 14001:

The most widely recognized international standard for Environmental Management Systems (EMS).
Provides a structured framework for organizations to manage their environmental responsibilities.
Focuses on setting environmental goals, regularly measuring performance, and consistently improving practices.
Similarities between EMAS and ISO 14001:

Both aim to improve an organization's environmental footprint.
Both require a systematic approach, including setting goals, implementing plans, and regularly measuring performance.
Both encourage continuous improvement.
Key Differences

EMAS:
More stringent requirements, especially for public reporting of environmental performance.
Emphasizes transparency and open communication with stakeholders.
ISO 14001:
More flexibility in its implementation.
Better suited for organizations early in their environmental management journey.
Choosing the Right Scheme

Organizations select the scheme based on their needs, goals, and priorities. Those seeking maximum credibility and public accountability might find EMAS more fitting, while those focused on establishing an efficient and adaptable EMS may be drawn to ISO 14001.

Trends in Environmental Management

- Impact Assessment and Planning (IAP) Assessing environmental and social impacts prior to setting up operations and obtaining environmental approval from the authorities is almost mandatory in most project categories. IAP assessments may be required not only for newly constructed facilities, but also for new operations that will be housed in an existing building
- Environmental Liability and Clean-up Foreign investment has resulted in heightened scrutiny of current and historic environmental liabilities associated with property transactions in India.

Environmental Initiatives in India

- The EAP (Environmental Action Programme) was formulated in 1993 with the objective of improving environmental services and integrating environmental considerations into development programmes.
- For the protection of environment and to control pollution several measures have been undertaken both by government and NGOs.

Key Features of Environmental Management

Focus on Impact Assessment and Planning: Before starting projects, environmental management requires careful evaluation of potential impacts on the environment and social well-being. Having a thorough plan ensures steps are taken to minimize negative effects.

Environmental Liability and Clean-up: Environmental management often addresses historical pollution and contamination. This involves assessing responsibility and implementing strategies for restoring damaged areas.

Here's Some Context on Why These Features Are Important

Responsible Development: Good environmental management means considering how our actions will affect the environment before we start. This reduces the risk of harmful pollution or resource depletion.

Protecting Future Generations: Environmental management takes a long-term view. We don't just deal with the problems of today, we aim to ensure the planet is healthy for future generations.

Legal Compliance: There are laws in most places designed to protect the environment. A good environmental management plan helps businesses and organizations stay on the right side of the law and avoid fines or penalties.

Environmental Initiatives in India

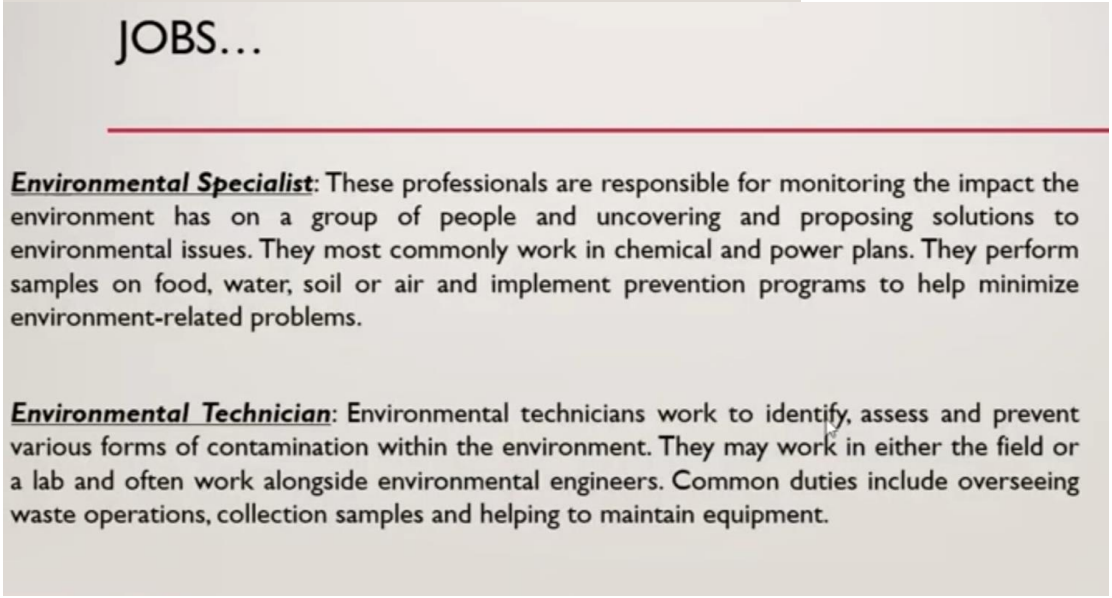
- National Council for Environmental Policy and Planning was set up in 1972 which was later evolved into Ministry of Environment and Forests (MoEF) in 1985.
- MoEF and the pollution control boards (CPCB i.e. Central Pollution Control Board and SPCBs i.e. State Pollution Control Boards) together form the regulatory and administrative core of the sector.
- The Policy Statement for Abatement of Pollution and the National Conservation Strategy and Policy Statement on Environment and Development were brought out by the MoEF in 1992.

decrease

Environmental Initiatives in India

- Even before independence, some laws have been enacted for the protection of environment. In Indian Penal Code of 1860, Articles 268, 290, 291, 426, 430, 431 and 432 are related with environment. Similarly, Article 277 was related with water pollution and 278 with Air pollution.
- National Environmental policy, 2006 It the first initiative in strategy-formulation for environmental protection in a comprehensive manner. It undertakes a diagnosis of the causative factors of land degradation with a view to flagging the remedial measures required in this direction. It recognizes that the relevant fiscal, tariffs and sectoral policies need to take explicit account of their unintentional impacts on land degradation.

Detectives of the Environment: They investigate and find problems that might harm the environment.
Problem-Solvers: They come up with plans to fix environmental issues and make things better for the planet.
Guardians of the Rules: They check that everyone follows environmental laws to keep things safe.
Environmental Teachers: They help people understand why the environment is important and how to protect it.



An environmental technician is a crucial member of the environmental field, working on the hands-on side of environmental protection and management. They play a vital role in collecting data, analyzing samples, and implementing solutions to environmental challenges.

Here's a breakdown of an environmental technician's main responsibilities:

1. Data Collection and Sample Analysis:

Environmental technicians gather data through various methods, including:
Fieldwork: This involves collecting air, water, and soil samples from various environmental settings.
Laboratory work: They analyze collected samples in laboratories using specialized equipment to identify pollutants and assess environmental quality.
This data helps identify environmental issues, monitor progress towards sustainability goals, and ensure compliance with environmental regulations.
2. Implementation and Support:

Environmental technicians assist in implementing environmental protection measures, such as:
Installing and maintaining pollution control equipment
Conducting environmental site assessments
Participating in restoration projects for damaged ecosystems
They provide technical support to environmental scientists, engineers, and other specialists.

3. Reporting and Documentation:

Environmental technicians document their work and findings through detailed reports and maintain accurate records.
This information is crucial for decision-making, regulatory compliance, and sharing results with stakeholders.
4. Additional Responsibilities:

Depending on the specific role and organization, environmental technicians may also:
Conduct environmental training programs for employees
Assist in public outreach and awareness campaigns
Monitor and maintain environmental databases and information systems
Overall, environmental technicians play a vital role in supporting the work of environmental professionals, contributing to a cleaner and healthier environment for all.

- ***Environmental Scientist***: The goal of an environmental scientist is to improve and protect the health of both humans and the environment.

- Ecologist

An ecologist is a scientist who studies the relationships between living organisms and their environment. They are like detectives who investigate the intricate connections between plants, animals, and the world around them.

- ***Environmental Manager***: An environmental manager is a professional who is responsible for overseeing an organization's compliance with environmental regulations to reduce the company's overall carbon footprint and waste output. Common areas that they analyze include clean water, pollution, air quality and waste as it relates to an organization.

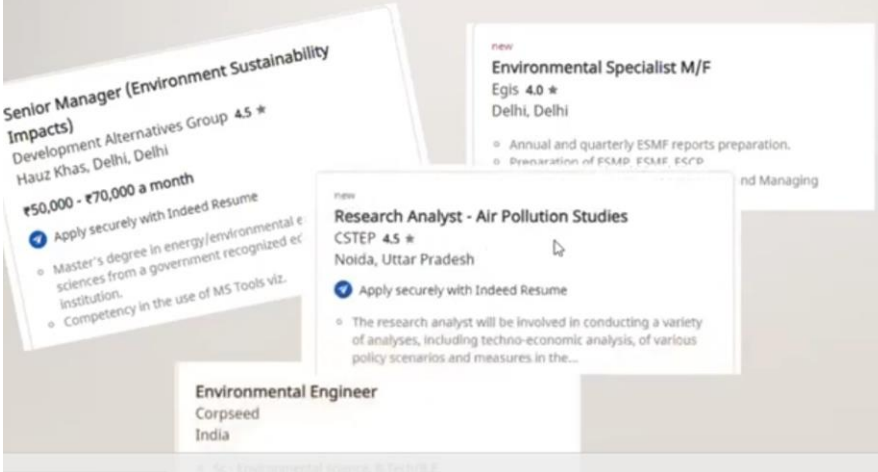
- Environmental Science Teacher

- ***Marine Biologist***: A marine biologist is a scientist who focuses on researching life within the ocean. They may also study life in other saltwater areas such as wetlands. They typically observe and collect data, perform experiments and study marine animals and life.

  - ***Environmental Chemist***: Environmental chemists are responsible for collecting and testing soil, air and water samples to determine their quality and how they affect the environment. They may write reports on their findings to share with others. These professionals aim to identify and prevent environmental threats that would affect people, plants and animals.

  - ***Wildlife biologist***: identifying new species

INDIAN JOBS SEARCH AND VACANCIES



- ***Microbiologist***: Microbiologists typically spend most of their time in a lab performing studies on microorganisms and how they live and thrive in the environment. They may study viruses, fungi, bacteria and other microorganisms and analyze the effects these have on our environment.

- ***Environmental Consultant***: Environmental consultants offer expert advice to clients in regards to how to manage environmental issues and reduce a company's overall carbon footprint. They may measure a client's current levels of environmental contamination and devise systems for how to eliminate future environmental damage

- ***Environmental Biologist***
- ***Environmental Engineer***: These professionals are responsible for designing systems that promote environmental protection. Common projects an environmental engineer may work on include systems to convert waste to energy and water reclamation. They may also ensure that various facilities maintain permits and standard operating procedures as they relate to the environment.
- ***Environmental Health Officer***: Environmental health officers work both in the public and private sectors to help maintain proper environmental standards. They may monitor and enforce various environmental and public health standards such as safety at work, pollution control and injury prevention.
- ***Water Quality Scientist*** : Water quality scientists test and analyze water taken from surface water, groundwater and drinking water. They provide solutions for maintaining and improving water quality and report any water quality issues such as pollution. They typically work for the government, non-profit environmental agencies and commercial businesses.

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Energy scenerio in India - mod 1 -EM sem 8

DEFINITION OF ENERGY

- Energy is the capacity to do work. Or in a simpler words, the influence required to perform any action.
- Energy is a quantitative property which must be transformed from one form of energy into another forms.
- This property gives rise to a new law which is called as law of conservation of energy.

The consumption of energy is directly proportional to the progress of mankind . Is this true or Not ?

With every growing population ,the living standard of humanity , industrialization of the developing countries, the global demand of energy is expected to increase in the upcoming years.

India has one of the fastest and largest growing economies in the world . India ranked fifth in the world in total energy consumption and needs to accelerate the development of the sector to meet its growth aspiration.

There is a very high demand of energy, which is currently satisfied mainly by coal, foreign oil, petroleum ,which apart from being non-renewable, therefore a non permanent solution to the energy crisis ; it is also harmful for the environment.

INTRODUCTION TO COVENTIONAL AND NONCONVENTIONAL ENERGY SOURCES

- The energy which is derived from the resources that can be regenerated and do not deplete over the time is known as renewable energy. It is a clean energy which would not damage the quality of life.
- Fossils fuels too are theoretically renewable but on a very long time – scale and if continued to be exploited at present rates then these resources may deplete in the near future.
- Therefore, in reality, renewable energy is energy from a source that is replaced rapidly by a natural process and is not subjected to depletion in a human time scale.

Conventional energy sources are traditional sources that have been used for many years and are generally well-established technologies. They are often finite, meaning they will eventually run out, and they can also have negative environmental impacts. Here are some examples of conventional energy sources: Fossil fuels, Nuclear energy, Hydropower

Non-conventional energy sources, also known as renewable energy sources, are those that are naturally replenished on a human timescale. They are becoming increasingly important as we look for ways to reduce our reliance on fossil fuels and combat climate change. Solar energy, Wind energy, Geothermal energy: Heat from the Earth's core can be used to generate electricity or heat buildings.Biomass energy: Biomass is organic matter that can be burned to produce electricity or heat, such as wood, crops, and manure.Tidal energy: The energy of tides can be harnessed to generate electricity using tidal turbines.

ENERGY SCENARIO IN INDIA

- Coal and petroleum are the most widely used non-renewable energy resource for energy generation in present scenario.
- At present coal alone accounts for about 70% of India's electricity supply but is not environment friendly.
- The uncontrolled emission of CO_2 leads to global climate change which is the main culprit behind conventional non-renewable energy resource. The developing world community is struggling with scarcity of power.
- Most of the power is derived from non – renewable conventional energy resources which are decreasing day by day.

culprit is a person responsible for doing the wrongful act

SOURCES OF ENERGY

- There are mainly two types of energy resources namely :-
- Conventional sources :- These are also called as non renewable sources of energy means it cannot be renewed if once get used because it takes millions of years for their renewal. They are also known as exhaustible sources of energy . For example:- coal , petroleum, natural gas etc.
- Non conventional sources :- These are also called renewable sources of energy means it can be renewed after every use because it is present in abundant amount in our planet. It is also known as inexhaustible sources of energy. Solar , wind , biomass, tidal etc .

CONVENTIONAL SOURCES OF ENERGY

- FOSSIL FUELS:- Increasing industrialisation has led to a better quality of life all over the world. It has also caused the global demand for energy to grow at a tremendous rate.
- The growing demand for energy was largely met by the fossil fuels – coal and petroleum. Our technologies were also developed for using these energy sources. But these fuels were formed over millions of years ago and there are only limited reserves.
- The pollution caused by burning fossil fuels can be somewhat reduced by increasing the efficiency of the combustion process and using various techniques to reduce the escape of harmful gases and ashes into the surroundings

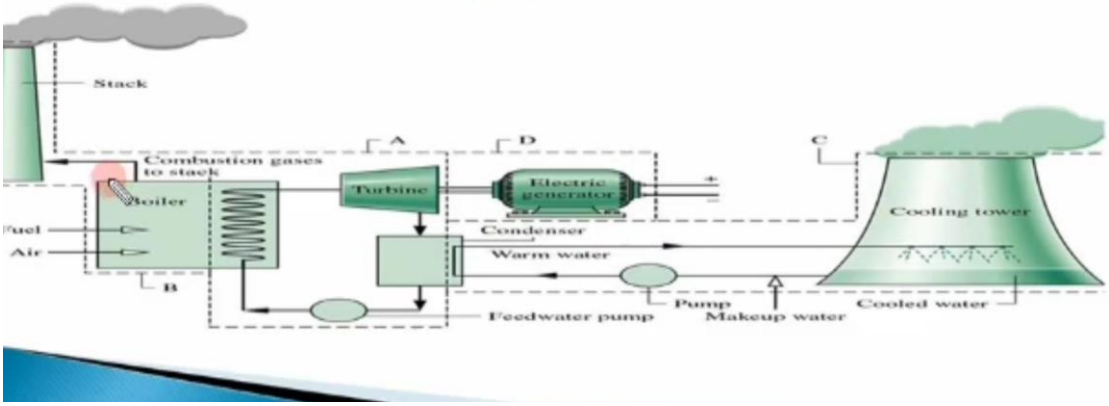
sources of energy, so we need to conserve them. If we were to continue consuming these sources at such alarming rates, we would soon run out of energy.

THERMAL POWER PLANT

- Large amount of fossil fuels are burnt every day in power stations to heat up water to produce steam which further runs the turbine to generate electricity.
- The transmission of electricity is more efficient than transporting coal or petroleum over the same distance.
- Therefore, many thermal power plants are set up near coal or oil fields. The term thermal power plant is used since fuel is burnt to produce heat energy which is converted into electrical energy.

A thermal power station is a type of power station in which heat energy is converted to electrical energy.

General layout thermal power plant



HYDRO POWER PLANTS

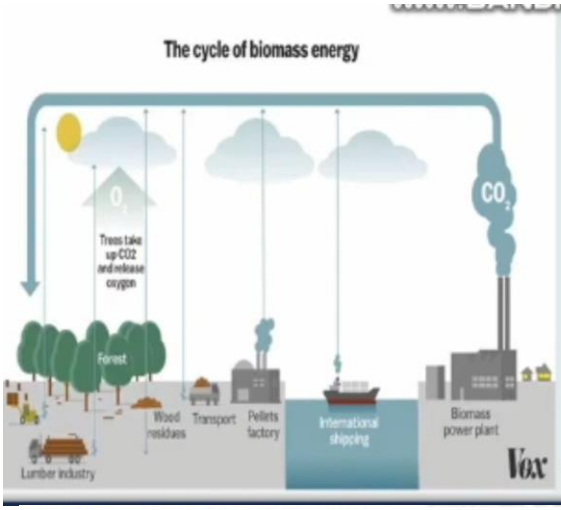
- Another traditional source of energy was the kinetic energy of flowing water or the potential energy of water at a height.
- Hydro power plants convert the potential energy of falling water into electricity. Since there are very few water-falls which could be used as a source of potential energy, Hydro power plants are associated with dams.
- In order to produce hydel electricity, high-rise dams are constructed on the river to obstruct the flow of water and thereby collect water in larger reservoirs.
- But, constructions of big dams have certai problems associated with it. The dams can be constructed only in a limited number of places, preferably in hilly terrains. Large areas of agricultural land and human habitation are to be sacrificed as they get submerged.

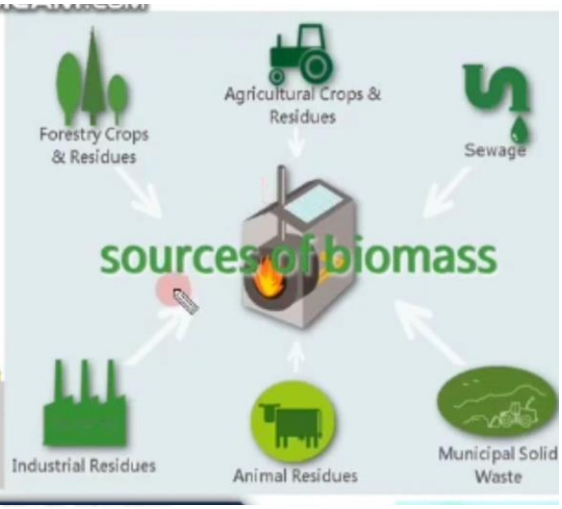
IMPROVEMENTS IN THE TECHNOLOGY OF USE OF CONVENTIONAL SOURCES OF ENERGY

BIOMASS

- Bio-gas is an excellent fuel as it contains up to 75% methane. It burns without smoke, leaves no residue like ash in wood, charcoal and coal burning. Its heating capacity is high.
- Since these fuels are plant and animal products, the source of these fuels is said to be bio-mass. These fuels, however, do not produce much heat on burning and a lot of smoke is given out when they are burnt.
- Bio-gas is also used for lighting. The slurry left behind is removed periodically and used as excellent manure, rich in nitrogen and phosphorous.
- The large-scale utilisation of bio waste and sewage material provides safe and efficient method.

Biomass is a renewable energy source derived from organic matter, meaning it comes from living organisms or recently living organisms. It's a broad category that encompasses various materials, including:
Plant materials: Wood, crops, and agricultural residues like straw and stalks.
Biomass plant materials
Animal waste: Manure from livestock operations.
Municipal solid waste: Food scraps, yard waste, and paper products discarded from homes and businesses.
Algae: Microscopic aquatic organisms that can be grown in special facilities.
Biomass can be converted into different forms of energy through various processes:
Direct combustion: Burning biomass in a boiler to produce heat, which can then be used for electricity generation, space heating, or industrial processes.
Biomass direct combustion
Thermochemical conversion: Processes like gasification and pyrolysis convert biomass into gaseous or liquid fuels that can be used in existing power plants or transportation systems.
Biomass thermochemical conversion
Biochemical conversion: This method uses microorganisms like bacteria or enzymes to break down organic matter and produce biogas (methane) or ethanol. Biogas can be used for electricity generation or heating, while ethanol can be used as a transportation fuel.



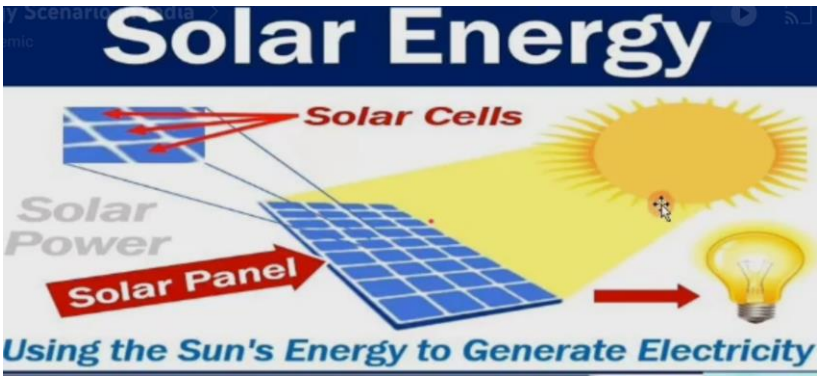


WIND ENERGY

- Today, wind energy is also used to generate electricity. A windmill essentially consists of a structure similar to a large electric fan that is erected at some height on a rigid support.
- To generate electricity, the rotatory motion of the windmill is used to turn the turbine of the electric generator. The output of a single windmill is quite small and cannot be used for commercial purposes.
- Wind energy is an environment-friendly and efficient source of renewable energy. It requires no recurring expenses for the production of electricity.
- But there are many limitations in harnessing wind energy. Firstly, wind energy farms can be established only at those places where wind blows for the greater part of a year.

NON CONVENTIONAL SOURCES OF ENERGY

- With technological progress, our demand for energy increases day by day. Our life-styles are also changing, we use machines to do more and more of our tasks.
- As our demand for energy increases, we need to look for more and more sources of energy. We could develop the technology to use the available or known sources of energy more efficiently and also look to new sources of energy.
- Our basic requirements are also increasing as industrialisation improves our living standards.



OCEAN THERMAL ENERGY

- The water at the surface of the sea or ocean is heated by the Sun while the water in deeper sections is relatively cold. This difference in temperature is exploited to obtain energy in ocean-thermal-energy conversion plants.
- These plants can operate if the temperature difference between the water at the surface and water at depths up to 2 km is 293 K (20°C) or more. The warm surface-water is used to boil a volatile liquid like ammonia.
- The vapours of the liquid are then used to run the turbine of generator. The cold water from the depth of the ocean is pumped up and condense vapour again to liquid.

CONCLUSIONS

- Exploiting any source of energy disturbs the environment in some way or the other.
- In any given situation, the source we would choose depends on factors such as the ease of extracting energy from that source, the economics of extracting energy from the source, the efficiency of the technology available and the environmental damage that will be caused by using that source.
- In some cases, the actual operation of a device like the solar cell may be pollution-free, but the assembly of the device would have caused some environmental damage.
- Research continues in these areas to produce longer lasting devices that will cause less damage throughout their life.

Sustainable Development & Goals in mod 1

What is meant by a sustainable development?

What is sustainable development? Sustainable development is **development that meets the needs of the present without compromising the ability of future generations to meet their own needs**.

The two examples of sustainable development are: 1.**Solar energy: Harnessing the solar energy to reduce pollution in the environment**. 2.Crop Rotation : Planting different types of crops on the same land on a rotational basis for improving soil fertility.06-Jan-2021

The concept of sustainable development is named after the Brundtland report, which reported sustainable consumption in developed countries. Sustainable development is based on three fundamental pillars: **social, economic and environmental**

Sustainable development is indeed built upon three fundamental pillars: social, economic, and environmental. These pillars are interconnected and interdependent, meaning they cannot truly be achieved in isolation. Addressing one pillar while neglecting the others hinders the overall goal of long-term sustainability.

Here's a breakdown of each pillar and its significance:

1. Social pillar: Focuses on the well-being of people and promotes equality, justice, and human rights. It encompasses elements like:
* Access to education and healthcare
* Decent work and living standards
* Gender equality and social inclusion
* Cultural diversity and social cohesion

2. Economic pillar: Aims for sustainable economic growth that meets the needs of present and future generations. This includes:
* Efficient use of resources and minimizing environmental impact
* Fair distribution of wealth and opportunities
* Innovation and technological advancements for sustainable development
* Economic stability and resilience

3. Environmental pillar: Emphasizes the protection of the natural environment for present and future generations. It involves:
* Conservation of biodiversity and ecosystem services
* Pollution control and waste management
* Addressing climate change and its impacts
* Sustainable use of natural resources

Sustainable development is referred to as **the idea that human beings should sustain by meeting their basic needs, while also making sure that the future generations are able to meet their basic needs.**

The four pillars of sustainability

Human sustainability is focusing on nurturing and developing the human component of an organization and society at large. Human sustainability examples include things such as access to food, water, healthcare, education, justice, fair working conditions, development of skills, and respecting humanrights in general .

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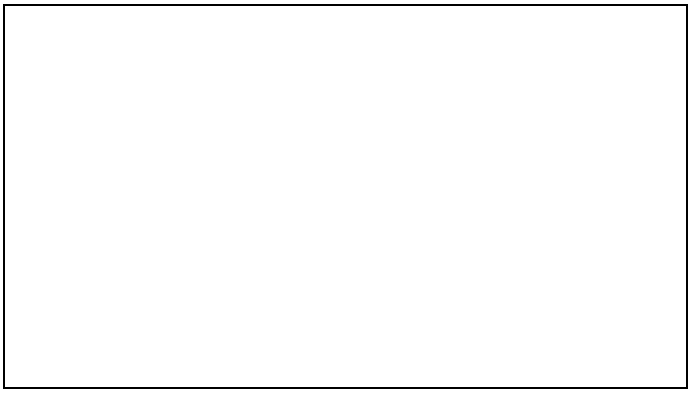
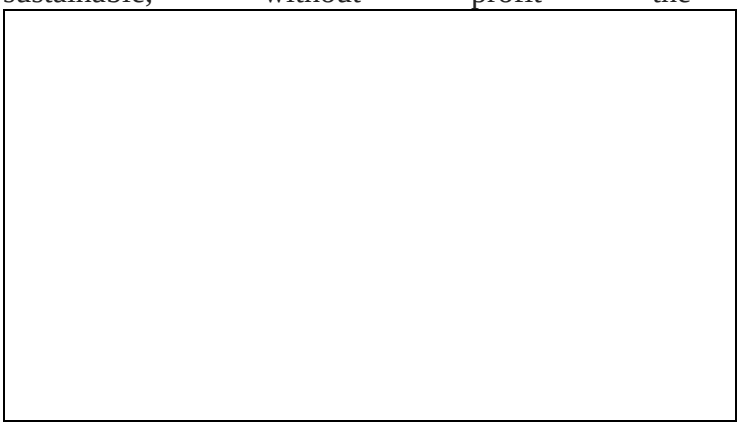
Social sustainability- aims at ensuring the well-being, cohesion, equality, and development of society by creating inclusive infrastructure thanks to sustainable urban design, as well as products, and services that can benefit the community at large

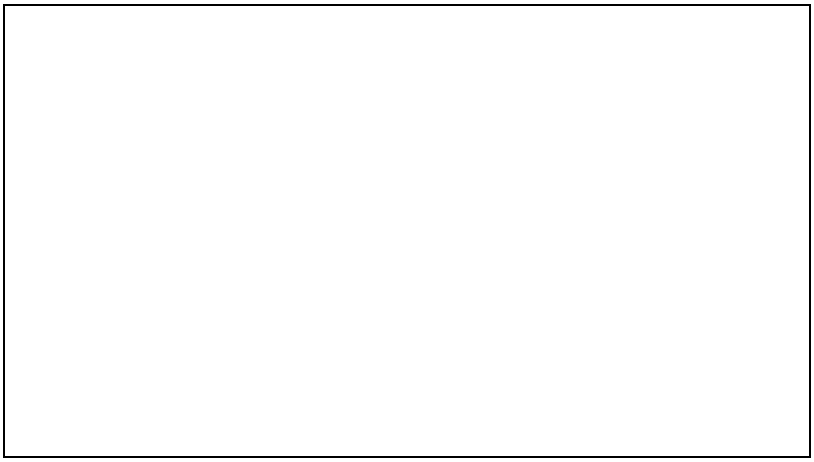


Economic sustainability - means that a business needs to be growing and profitable to be sustainable, without profit the organization would not



Environmental sustainability aims at improving human wellbeing and long-term sustainability by preserving the environment and more rational use of natural resources.

Ecological sustainability is the last of the four pillars of sustainability and it promotes a business model that doesn't do any harm to the environment and society, while at the same time achieving economic growth.



Government Policies to Achieve Sustainable Development Goals

The government has formulated policies to achieve Sustainable Development Goals (SDG) to mitigate the effect of Climate Change and build Sustainable cities and communities. The information

was provided by the Minister of State for Environment, Forest & Climate Change, Ashwini Kumar Choubey in a written reply to the Rajya Sabha. The Government is implementing National Action Plan on Climate Change (NAPCC)

National Action Plan on Climate Change (NAPCC)

The National Action Plan on Climate Change (NAPCC) is an initiative of the Government for addressing, combating & adapting to climate change. It comprises of eight core Missions in specific areas of solar energy, enhanced energy efficiency, sustainable habitat, water, sustaining Himalayan ecosystems, Green India, sustainable agriculture, and strategic knowledge for climate change.

States and UTs are also a part of the initiative. 33 States and Union Territories have prepared a State Action Plan on Climate Change (SAPCC) aligning with the objectives of NAPCC.

National Clean Air Programme (NCAP)

The National Clean Air Programme (NCAP) is a national-level strategy to reduce air pollution levels across the country. Under it, the City Specific Clean Air Action Plans have been prepared and rolled out for implementation in 132 non-attainment and million-plus cities. These action plans focus on city-specific short/ medium/long-term actions to control air pollution from sources such as vehicular emission, road dust, burning of biomass/ crop/ garbage/ Municipal Solid Waste, landfills, construction activities, and industrial emission.

Further, some of the other flagship schemes/missions or programmes to implement SDG 11 by other ministries include Swachh Bharat Mission – Urban (SBM-U), Atal Mission for rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission (SCM), Pradhan Mantri Awas Yojana – Urban (PMAY-U) and Metro Rail Projects.

National Cyclone Risk Mitigation Project (NCRMP)

The National Cyclone Risk Mitigation Project (NCRMP), an initiative of the Government, aims to undertake suitable structural and non-structural measures to mitigate the effects of cyclones in the coastal states and UTs of India. The National Disaster Management Authority (NDMA) under the Ministry of Home Affairs (MHA) implements the Project in coordination with the participating State Governments and the National Institute for Disaster Management (NIDM).

NCRMP has been implemented across eight coastal States with four Main Components; i) Early Warning Dissemination System; ii) Cyclone Risk Mitigation Infrastructure; iii) Technical Assistance for Capacity and iv) Project Management and Monitoring, in two phases i.e. (Phase-I: Andhra Pradesh &Odisha); (Phase-II: Goa, Gujarat, Karnataka, Kerala, Maharashtra & West Bengal). Works on Phase-I were completed in December 2018 and Phase-II is scheduled to be completed by September 2022.

The Net Zero Commitment

India achieved a 24% reduction in emission intensity of its GDP between 2005 and 2016. India will achieve net-zero carbon emissions by 2070. This is the commitment India has made at COP26. To

achieve the goal, the country is taking several initiatives. This includes the recent complete ban on single-use plastics. Furthermore, despite having no binding obligation under the United Nations Framework Convention on Climate Change (UNFCCC), India announced its voluntary goal to reduce the emission intensity of its GDP by 20-25% by 2020 in comparison to the 2005 level.

The government also supports the 10-Year Framework Programme on Sustainable Consumption and Production, for which the Ministry had published a draft notification of regulation on Extended Producer Responsibility (EPR) for Waste Tyre for receiving comments from public and 'Guidelines on the EPR for Plastic Packaging' under Plastic Waste Management Rules, 2016 has been notified.

The government has formulated policies to achieve Sustainable Development Goals (SDG) to mitigate the effect of Climate Change and build Sustainable cities and communities. The information was provided by the Minister of State for Environment, Forest & Climate Change, Ashwini Kumar Choubey in a written reply to the Rajya Sabha. The Government is implementing National Action Plan on Climate Change (NAPCC) which provides an overarching policy framework for all climate actions, he further added.

The Sustainable Development Goals (SDG) Report 2022 describes the 2030 Agenda as "painting a particularly grim picture." The report demonstrates "how the agenda is being significantly threatened" by a number of interconnected crises that are undoing years of SDG achievement and trapping millions in hunger and poverty. If the SDGs are to be saved and the 2030 deadline is to be met, the report urges "immediate action."

Sustainable development- Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN).

The United Nations Document “Transforming Our World: The 2030 Agenda for Sustainable Development”.

This agenda contains 17 goals and 169 targets.

The SDG Report is made by the UN Department of Economic and Social Affairs in collaboration with the UN Statistical System

Global progress made towards achieving SDG’s

For the second year in a row, the world is no longer making progress on the SDGs. A global plan to finance the SDGs is urgently needed.

The 2022 SDG Index is topped by Finland, followed by three Nordic countries –Denmark, Sweden and Norway.

East and South Asia is the region that progressed most on the SDGs since their adoption in 2015.

Bangladesh and Cambodia are the two countries that progressed most on the SDGs since 2015.

By contrast Venezuela has declined the most on the SDG Index since their adoption in 2015.

SDG 1 (No Poverty): Between 657 and 676 million people are currently projected to live in extreme poverty in 2022, compared to the pre-pandemic projection of 581 million.

SDG 2 (Zero Hunger): About 1 in 10 people are suffering from hunger worldwide, with 161 million additional people having slid into chronic hunger in 2020 alone.

Ukraine crisis triggered food shortages for the world’s poorest people.

SDG 3 (Good Health and Well being): The COVID-19 pandemic is threatening decades of progress in global health, decreasing global life expectancy and basic immunisation coverage. The pandemic also increased the prevalence of anxiety and depression among people.

Infected more than 500 million people worldwide leading to 15 million deaths.

SDG 4 (Quality Education): 147 million children have missed over half of in-person instruction in 2020-2021, and 24 million learners may never return to school.

Entrenched inequities in education have only worsened during the pandemic.

SDG 5 (Gender Equality): Women accounted for 39% of total employment in 2019 but 45% of global employment losses in 2020. Many women are increasingly burdened with unpaid care work. Domestic violence has also intensified.

It would take another 40 years for men and women to be represented equally in national political leadership.Women’s share in national parliaments increase from 22.4% in 2015 to 26.2% in 2022.

More than 1 in 4 women have been subjected to intimate partner violence (641 million) at least once in their lifetime.

SDG 6 (Clear Water and Sanitation): Meeting drinking water, sanitation, and hygiene targets by 2030 requires a 4-fold increase in the pace of progress.

The world’s water-related ecosystems are being degraded at an alarming rate.

Over the past 300 years, over 85% of the planet’s wetlands have been lost.

At current rates, in 2030 1.6 billion people will lack safely managed drinking water.

For at least 3 billion people the quality of the water they depend on is unknown due to a lack of monitoring.

SDG 7 (Affordable and Clean Energy): Progress on electrification has slowed, with 679 million projected to have no electricity access in 2030.

Progress in energy efficiency needs to speed up to achieve global climate goals.

SDG 8 (Decent work and Economic Growth): 1 in 10 children are engaged in child labor worldwide – a total of 160 million in 2020.

Worker productivity has rebounded, but not in LDCs.

Global economic recovery is further set back by the Ukraine crisis.

Annual growth rate of Global real GDP per capita 2.1% (2022) and 2.5 %(2023).

SDG 9 (Industry, Innovation and Infrastructure): Global manufacturing has rebounded from the pandemic but least developed countries (LDCs) are left behind.

Higher-technology industries are far more resilient in crises than their lower-tech counterparts.

1 in 3 manufacturing jobs are negatively affected by crisis.

Small scale industry lack access to financial support for recovery.Only 1 in 3 small manufacturers are benefiting from a loan or line of credit.

SDG 10 (Reduced Inequalities): The pandemic has intensified income inequalities between countries and people.

Number of refugees outside their country of origin increased by 44% between 2015 and 2021.

The deadliest year since 2017 for migrants.

SDG 11 (Sustainable Cities and Communities): Leaving no one behind will require an intensified focus on 1 billion slum dwellers.

Number of countries with local disaster risk reduction strategies nearly doubled between 2015 and 2021.

In sub-Saharan Africa, less than 1/3 of city dwellers have convenient access to public transportation.

As cities grow, municipal solid waste problems mounting

SDG 12 (Responsible Consumption and Production): 13.3% of the world's food is lost after harvesting and before reaching retail markets, and 17% of total food is wasted at the consumer level.

Our reliance on natural resources is increasing rising over 65% globally from 2000 to 2019.

Vast majority of the world's electronic waste is not being safely managed.

SDG 13 (Climate Action): Energy-related carbon dioxide (CO_2) emissions increased 6% in 2021 reaching their highest level ever, taking down gains due to the COVID-19.

Rising global temperatures continue unabated, leading to more extreme weather

Climate finance falls short of $100 billion yearly commitment

Sea level will rise 30-60 cm by 2100,drought estimated to displace 700 million people by 2030.

Medium- to large-scale disasters will increase 40% from 2015 to 2030.

SDG 14 (Life Below Water): In 2021, more than 17 million metric tons of plastic entered the ocean – a number projected to double or triple by 2040.

Increasing acidification is threatening marine life and limiting the ocean's capacity to moderate climate change.

90% of the world's fishers are employed in small-scale fisheries who need accelerated support due to the our ocean pandemic.

SDG 15 (Life on Land): The report found that 23 countries in Sub-Saharan Africa have also shown 'stagnant progress' under the goal. The proportion of forests fell from 31.9% of total land area in 2000 to 31.2% in 2020, representing a net loss of almost 100 million hectares.

Almost 90% of global deforestation is due to agricultural expansion.

Around 40000 species are documented to be at risk of extinction over the coming decades.

Nearly half of freshwater, terrestrial and mountain key biodiversity area are protected.

SDG 16 (Peace, Justice and Strong Institutions): While the global homicide rate declined 5.2% between 2015-2020, a quarter of the global population lives in conflict-affected countries.

A record 100 million people had been forcefully displaced worldwide

Corruption is found in every region, almost 1 in 6 businesses have received bribe requests from public officials.

SDG 17 (Partnership for Goals): Net official direct assistance (ODA) reached a new high of USD 177.6 billion, largely due to COVID-19-related aid, but ODA for SDG data declined by more than 18% (2020).

Rising debt burdens threaten developing countries' pandemic recovery.

Some areas of progress as per the SDG Report, 2022

SDG 6: The proportion of the global population using safely managed drinking water services increased to 74% in 2020.

SDG 15: Many countries are sustainably managing their forests, protecting sites critical to biodiversity, and enacting national conservation legislation and policies.

SDG 17: There has been progress in implementing frameworks for the sustainable use of genetic resources and associated traditional knowledge, especially the Nagoya Protocol to the Convention on Biological Diversity.

It provides a transparent legal framework for the implementation of fair and

Equitable sharing of benefits arising from the utilisation of genetic resources.

India's progress towards SDG's

India has slipped spots from last year's 117 to rank 121 on the 17 Sustainable Development Goals adopted as a part of the 2030 agenda by 192 United Nations member states

India's recent overall Sustainable Development Goals (SDG) score was 66 out of 100.

Comparing with South Asian Nations:With the latest rankings, India is now behind all south Asian nations except Pakistan.

The south Asian countries ahead of India are Bhutan ranked 75, Sri Lanka at 87, Nepal at 96 and Bangladesh at 109.

India's rank dropped primarily because of major challenges in 11 SDGs including zero hunger, good health and wellbeing, gender equality and sustainable cities and communities.

India also performed poorly in dealing with quality education and life on land aspect

The previous year, India had suffered on the fronts of ending hunger and achieving food security, achieving gender equality and building resilient infrastructure, promoting inclusive and sustainable industrialisation and fostering innovation

Jharkhand and Bihar are the least prepared to meet the SDGs by the target year 2030. Kerala ranked first, followed by Tamil Nadu and Himachal Pradesh in the second position. (SDG India)

Reasons behind poor performance on the SDGs

COVID-19: The pandemic put a severe brake on the progress. It pushed the countries to impose lockdowns that brought all progressive work towards SDG attainment to a standstill.

Climate Change: As per SDG 2022 report, global temperatures have been rising unabated. The world is facing a major climate catastrophe due to increased heatwaves, drought and apocalyptic wildfires and floods which are affecting billions of people around the globe

Geopolitical Conflicts: The Russia-Ukraine crisis has caused food, fuel and fertilizer prices to skyrocket. It also disturbed global trade supplies and caused the financial markets to tumble

Data Gaps: The Report also notes that despite some progress, serious data gaps exist in SDG monitoring. This includes data in terms of geographic coverage, timeliness and level of disaggregation.

End armed conflicts and embark on a path of diplomacy and peace.

India’s progress towards achieving SDGs is both encouraging and challenging.

India should continue its efforts toward achieving SDGs with the given resources and involving civil societies and people.

Module 2 - EM / sem 8
Global Warming , Acid rain , ozone depletion , hazardeous wastes, endangered life species , loss of bio divercity , Industrial man made disasters , Atomic biomedical hazards.

What is global warming?

A: Since the Industrial Revolution, the global annual temperature has increased in total by a little more than 1 degree Celsius, or about 2 degrees Fahrenheit. Between 1880— accurate record keeping began,1980, it rose on average by 0.07 degrees Celsius every 10 years. Since 1981, however, the rate of increase has more than doubled: For the last 40 years, we've seen the global annual temperature rise by 0.18 degrees Celsius, or 0.32 degrees Fahrenheit, per decade.

Now climate scientists have concluded that we must limit global warming to 1.5 degrees Celsius by 2040 if we are to avoid a future in which everyday life around the world is marked by its worst, most devastating effects: the extreme droughts, wildfires, floods, tropical storms, and other disasters that we refer to collectively as climate change.

Q: **What causes global warming?**

A: Global warming occurs when carbon dioxide (CO2) and other air pollutants collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally this radiation would escape into space, but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapor, and synthetic fluorinated gases—are known as greenhouse gases, and their impact is called **the greenhouse effect**.

our **current era of global warming is directly attributable to human activity**—specifically to our burning of fossil fuels such as coal, oil, gasoline, and natural gas, which results in the greenhouse effect.

In the United States, the largest source of greenhouse gases is transportation (29 percent), followed closely by electricity production (28 percent) and industrial activity (22 percent).

Impacts of global warming - Extreme heat waves have caused tens of thousands of deaths around the world in recent years. And in an alarming sign of events to come, Antarctica has lost nearly four trillion metric tons of ice since the 1990s. The rate of loss could speed up if we keep burning fossil fuels at our current pace, some experts say, causing sea levels to rise several meters in the next 50 to 150 years and wreaking havoc on coastal communities worldwide.

Q: What are the other effects of global warming?

Disappearing glaciers, early snowmelt, and severe droughts will cause more dramatic water shortages , wildfires
Rising sea levels will lead to even more coastal flooding on the Eastern Seaboard, especially in Florida, and in other areas such as the Gulf of Mexico.
Forests, farms, and cities will face troublesome **new pests, heat wave**s, heavy downpours, and increased flooding. All of these can damage or destroy agriculture and fisheries.
Disruption of habitats such as coral reefs and alpine meadows could drive many plant and animal species to extinction.

Allergies, asthma, and infectious disease outbreaks will become more common.

What is Acid Rain?

Acid Rain, as the name suggests, can be said as the precipitation of acid in the form of rain in the simplest manner. When atmospheric pollutants like oxides of nitrogen and sulphur react with rainwater and come down with the rain, then this results in Acid Rain.

Causes of Acid Rain

The causes of acid rain are **Sulphur and Nitrogen particles which get mixed with the wet components of rain**. Sulphur and Nitrogen particles which get mixed with water are found in two ways either man-made i.e as the emissions that are given out from industries or by natural causes like lightning strike in the atmosphere releasing nitrogen oxides and volcanic eruptions releasing sulphur oxide.

the word acid rain was invented in 1852 by Scottish chemist Robert Angus Smith. Smith decided on the word while studying rainwater chemistry near industrial towns in England and Scotland

Acid rain is essentially a by-product of human activities which emit oxides of nitrogen and sulphur in the atmosphere. Example – the burning of fossil fuels, unethical waste emission disposal techniques.

Sulphur dioxide and nitrogen dioxide undergo oxidation, and then they react with water resulting in the formation of sulphuric acid and nitric acid, respectively. The following reaction will clarify the acid formation reaction:

$$2SO_2\ (g) + O_2\ (g) + 2H_2O\ (l) \rightarrow 2H_2SO_4\ (aq)$$
$$4NO_2\ (g) + O_2\ (g) + 2H_2O\ (l) \rightarrow 4HNO_3\ (aq)$$

Effects of Acid Rain

Acid rain is very harmful to agriculture, plants, and animals. It washes away all nutrients which are required for the growth and survival of plants. Acid rain affects agriculture by the way it alters the composition of the soil.

It causes respiratory issues in animals and humans.

When acid rain falls down and flows into the rivers and ponds it affects the aquatic ecosystem. It alters the chemical composition of the water, to a form which is actually harmful to the aquatic ecosystem to survive and causes water pollution.

Acid rain also causes the corrosion of water pipes, which further results in leaching of heavy metals such as iron, lead and copper into drinking water.

It damages the buildings and monuments made up of stones and metals.

Real-Life Examples

Taj Mahal, one of the 7 wonders of the world, is largely affected by acid rain. The city of Agra has many industries which emit the oxides of sulphur and nitrogen in the atmosphere. People continue to use low-quality coal and firewood as a domestic fuel, adding to this problem. Acid rain has the following reaction with the marble (calcium carbonate):

$$CaCO_3(s) + H_2SO_4(l) \rightarrow CaSO_4(s) + H_2O(l) + CO_2(g)$$

What is an Ozone Layer?

The ozone layer is mainly found in the lower portion of the earth's atmosphere. It has the potential to absorb around 97-99% of the harmful ultraviolet radiations coming from the sun that can damage life on earth. If the ozone layer was absent, millions of people would develop skin diseases and may have weakened immune systems.

However, scientists have discovered a hole in the ozone layer over Antarctica. This has focussed their concern on various environmental issues and steps to control them. The main reasons for the ozone hole are chlorofluorocarbons, carbon tetrachloride, methyl bromide and hydrochlorofluorocarbons.

What is meant by ozone depletion?

Ozone depletion is **the destruction of ozone in the stratosphere, where it shields the earth from harmful ultraviolet radiation**. Its destruction is caused by chemical reactions in which oxides of hydrogen, nitrogen, chlorine and bromine act as catalysts.
Ozone layer depletion **increases the amount of UVB that reach the Earth's surface**. Laboratory and epidemiological studies demonstrate that UVB causes non-melanoma skin cancer and plays a major role in malignant melanoma development.

Effects Of Ozone Layer Depletion

Effects on Human Health - Humans will be directly exposed to the harmful ultraviolet radiation of the sun due to the depletion of the ozone layer. This might result in serious health issues among humans, such as skin diseases, cancer, sunburns, cataract, quick ageing and weak immune system.

Effects on Animals -Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

Effects on the Environment -Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.

Effects on Marine Life -Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed, the organisms present in the food chain are also affected.

Ozone Layer Depletion - Solutions to the Depletion of the Ozone Layer. ...

Minimize The Use of Vehicles. ...
Use Eco-friendly Cleaning Products. ...
Use Of Nitrous Oxide Should Be Prohibited. ...
Pesticides Should Not Be Used. ...
Ozone-Depleting Products Should Be Avoided. ...
Renewable Sources of Energy. ...
Reuse And Recycle.

Hazardeous wastes - Hazardous wastes are **those that may contain toxic substances generated from industrial, hospital, some types of household wastes**. These wastes could be corrosive, inflammable, explosive, or react when exposed to other materials.

What Are the 7 Categories of Hazardous Waste

Spent Solvent Wastes.

Dioxin-Bearing Wastes.

Wood Preserving Wastes.

Electroplating and Other Metal Finishing Wastes.

Petroleum Refinery Wastewater Treatment Sludges.

Chlorinated Aliphatic Hydrocarbons Production.

Multisource Leachate.

Types of waste that are commonly hazardous include **cleaning solvents, spent acids and bases, metal finishing wastes, painting wastes, sludges from air and water pollution control units, and many other discarded materials.**

Common hazardous substances

acids. caustic substances. ..disinfectants….glues. …heavy metals, including mercury, lead, cadmium and aluminium. …paint…pesticides.

petroleum products

Ways to Dispose of Hazardous Waste

Incineration or other treatment. There are a variety of ways to treat hazardous waste: ...

#1: Underground disposal. ...

#2: Landfill disposal. ...

#3: Ocean dumping. ...

Hazardous Waste Disposal Alternative: Recycling. ...

Systematic & Thorough Industrial Waste Management.

Endangered life species - 10 of the world's most endangered animals

Javan Rhinos. ...Amur Leopard. ...Sunda Island Tiger. ...Tapanuli Orangutan. ...Yangtze Finless Porpoise. ...Black Rhinos. ...African Forest Elephant.

Endangered species are the **organisms whose number have reduced drastically and if not conserved will become extinct**. The two examples of endangered species are Amur tiger, red panda and Asiatic elephant.

15 Actions to Protect Endangered Species

1) Learn about endangered species in your area. Teach your friends and family about the wonderful wildlife, birds, fish and plants that live near you. visit endangered.fws.gov

2) Create a backyard wildlife habitat. Put bird feeders and other wildlife attractants, such as bird houses and baths.

3) Establish a pollinator garden with native vegetation in your yard. Native plants provide food and shelter for native wildlife. Attracting native insects like bees and butterflies can help pollinate your plants.

4) Minimize use of herbicides and pesticides.

5) Reduce your use of water in your home and garden so that animals that live in or near water can have a better chance of survival. Don't dump paint, oil or antifreeze or other chemicals,

6) Place decals on windows to deter bird collisions. Millions of birds die every year because of collisions with windows.

7) Slow down when driving. Many animals live in developed areas and this means they must navigate a landscape full of human hazards.

8) Recycle and buy sustainable products. Buy recycled paper and sustainable products l

9) Don't litter/otherwise destroy sensitive habitats, which may be home to native/visiting species that are endangered or threatened.

10) Organize or participate in a "clean up" campaign of an important habitat in your area.

11) Never purchase products made from endangered species like ivory, coral and tortoise shell. Buy exotic plants and animals only from reputable stores.

12) Report any harassment of threatened and endangered species. You can find a list of state wildlife departments at http://www.fws.gov/offices/statelinks.html

13) Visit a national wildlife refuge, park or other open space. These protected lands provide habitat to many native wildlife, birds, fish and plants. Get involved by volunteering at your local park or wildlife refuge.

14) Be Vocal. Write a letter to your local newspaper urging support of important species protection measures. E-mail support the Endangered Species Act.

15) Join others (and organize) in the annual Stop Extinction Challenge. Organized by Endangered Species Coalition (usually in August).

Loss of bio-divercity- Biodiversity loss refers to **the decline or disappearance of biological diversity**, understood as the variety of living things that inhabit the planet, its different levels of biological organisation and their respective genetic variability, as well as the natural patterns present in ecosystems.

five major causes of loss in biodiversity are: Biodiversity loss is caused by five primary drivers: habitat loss, invasive species, overexploitation (extreme hunting and fishing pressure), pollution, climate change associated with global warming. In each case, human beings and their activities play direct roles.

How to prevent biodivercity loss - Support local and regional projects aimed at tackling biodiversity loss. Buying fewer products and making sure the products you do buy minimise the impact on biodiversity. Investing in ways that promote biodiversity. Reducing waste of consumer goods: food, clothes, electrical appliances, etc

How does biodiversity protect us - Biodiversity makes the earth habitable. Biodiverse ecosystems provide nature-based solutions that buffer us from natural disasters such as floods and storms, filter our water and regenerate our soils.

Industrial Disasters

Fire: This is the most frequent hazard. ...

Explosion: Explosions is the result of a shock wave. ...

Chemical release: Sudden release of toxic vapours has the potential to cause death and severe injuries several kilometres from the release point.

Man-made disasters are the consequence of technological or human hazards. These hazards can include stampedes, fires, transport accidents, industrial accidents, oil spills, terrorist attacks, nuclear explosions/nuclear radiation.

Such man-made disasters are **crime, arson, civil disorder, terrorism, war, biological/chemical threat, cyber-attacks**, etc.

Bhopal.Gas tragedy - example of Industrial Disaster 0 The single worst industrial accident in history occurred on **December 3, 1984, when some 45 tons of the dangerous gas methyl isocyanate escaped from the Union Carbide plant in Bhopal, India**It killed an estimated 15,000 to 20,000 people. At the time, it was the worst industrial accident in history.

Effects of Industrial Disasters, - Toxic Waste, and Community Impact focuses on hazardous and toxic wastes releases, industrial disasters, the consequent contamination of communities and the environment, and the subsequent social impacts, including **adverse health effects, deaths and property destruction, psychosocial problems, an**

Tips to Prevent Industrial Accidents

Obey Safety Requirements. One of the main causes of injuries and accidents on the job is failure to comply with safety regulations. ...

Communicate. ...

Provide/Get Proper Training. ...

Keep Machinery & Equipment in Working Order. ...

Don't Take Shortcuts.

Biomedical Hazards - Health risks. Health-care waste contains **potentially harmful microorganisms that can infect hospital patients, health workers and the general public**. Other potential hazards may include drug-resistant microorganisms which spread from health facilities into the environment

Sharps – Sharps objects like needles, scalpels, broken glass, and razors. Pathological Waste – Body parts of humans or animals, including tissues, fluids, or blood. Pharmaceutical Waste – Unused drugs, medicine, or creams that are expiring.

What is Biomedical Waste?

Biomedical waste is any waste containing infectious or potentially infectious materials. These wastes are generated during the diagnosis, treatment, and immunization of humans and animals.

Biomedical wastes can be in both solid and liquid forms. Examples of biomedical wastes include:

Waste sharps such as needles, lancets, syringes, scalpels, and broken glass

Human tissues or identifiable body parts (as a result of amputation)

Animal tissues and waste from veterinary hospitals

Used bandage, dressings, gloves, and other medical supplies

Liquid waste from infected areas

Laboratory wastes

Biomedical wastes are distinct from regular garbage and require particular disposal and treatment.

Types of Biomedical Waste

The World Health Organization (WHO) has categorized biomedical waste into eight categories. They are:

Infectious Waste – Any biomedical waste that is infectious or contaminated.
Sharps – Sharps objects like needles, scalpels, broken glass, and razors.
Pathological Waste – Body parts of humans or animals, including tissues, fluids, or blood.
Pharmaceutical Waste – Unused drugs, medicine, or creams that are expiring.
Genotoxic Waste – Toxic drugs and hazardous toxic waste
Radioactive Waste – Any waste containing potentially radioactive materials
Chemical Waste – Liquid waste from machines, batteries, and disinfectants is chemical.
General/Other Waste – All other non-hazardous waste.

Further, the **Central Pollution Control Board (CPBC)** has designated separate colour-coded bins to dispose of biomedical wastes as per their nature.

Yellow Bin: For anatomical waste, chemical waste, soiled waste, chemotherapy waste, discarded linen and medicines, and laboratory waste.
Red Bin: For contaminated plastic wastes
Blue Bin: For glass waste and metallic implants
Black Bin: For hazardous and other waste

The wastes in each of the bins have different treatment and disposal methods.

Effects of Biomedical Waste

Exposure to hazardous biomedical waste can cause disease or injury to human health. HIV, hepatitis B, and C are the three most commonly spread viruses worldwide due to improper treatment of medical wastes. They are transmitted through injuries from contaminated syringes and needles.

Doctors, nurses, and sanitation workers are amongst the most vulnerable to the harmful effects of biomedical waste.

At a time of rapid emergence of new strains of the novel coronavirus, the importance of appropriate treatment of medical wastes cannot be more emphasized. The various technologies that can be used for treatment include:

Incineration , Chemical Disinfection , Wet Thermal Treatment

Microwave Irradiation , Land Disposal ,Inertization

Biomedical Waste in the Indian Context

The outbreak of COVID-19 has caused an unmanageable growth of biomedical waste.

The Central Pollution Control Board (CPBC) has issued guidelines on biomedical waste disposal. As per the guidelines, the biomedical wastes are collected in yellow bags. The bags are then taken to Common Biomedical Waste Treatment Facility (CBWTF) or a waste-to-energy plant. There they are incinerated, autoclaved, or burnt to produce energy.

Currently, there are around 200 authorized common biomedical waste treatment and disposal facilities in 28 states of India for the safe disposal of biomedical waste.

Atomic Hazards - The principal initial effects are **blast and radiation**. Blast causes damage to lungs, ruptures eardrums, collapses structures and causes immediate death or injury. Thermal Radiation is the heat and light radiation, which a nuclear explosion's fireball emits producing extensive fires, skin burns, and flash blindness.

What are nuclear hazards give example?

Examples include **lethal effects to individuals, large radioactivity release to the environment, or reactor core melt**."The prime example of a "major nuclear accident" is one in which a reactor core is damaged and significant amounts of radiation are released, such as in the Chernobyl Disaster in 1986.

In the history of civil nuclear energy, there have only been two major accidents where a large amount of radioactive material was emitted: at **Chernobyl (1986), which has resulted in 46 deaths so far, and at Fukushima Daiichi (2011), which resulted in no casualties**.

The incident was rated as a Level 3 on the International Nuclear Event Scale, INES. **May 1992 Tube leak causes a radioactive release of 12 Curies of radioactivity from Tarapur Atomic Power Station** (17). January 1992 Four tons of heavy water spilt at RAPS

CH 3 - Ecology/ sem 8 / EM / Dr. Asawari D

All living organism, whether plant or animal or human being is surrounded by the environment, on which it derive its needs for its survival.

Each living component interacts with non –living components for their basic requirements form different ecosystem.

Definition

Ecology is the study of interactions among organism or group of organisms with their environment. The environment consists of both biotic components (living organisms) and abiotic components (non – living organisms). or Ecology is the study of ecosystems.

Ecosystem is the basic functional unit of ecology. The term ecosystem is coined form a Greek word meaning study of home.

TYPES OF ECOSYSTEM- Natural ecosystem

Natural ecosystems operate themselves under natural conditions.

Based on habitat types, it can be further classified into three types.

1. Terrestrial ecosystem

This ecosystem is related to land. Example - Grassland ecosystem, forest ecosystem, desert ecosystem, etc.,

2. Aquatic ecosystem

This ecosystem is related to water. It is further sub classified into two types based on salt content. •Fresh water ecosystem

(i)Running water ecosystems.

Examples

Rivers, Streams -(b) Standing water ecosystems

Examples Pond, lake

(ii) Marine ecosystem -Example : Seas and sea shores

Man – made (or) Artificial ecosystems

Artificial ecosystem is operated (or) maintained by man himself.

Example -Croplands, gardens

STRUCTURE (or) COMPONENTS OF AN ECOSYSTEM

The term structure refers to the various components. So the structure of an ecosystem explains the relationship between the abiotic (non –living) and the biotic (living) components.

An ecosystem has two major components

•Biotic (living) components

•Abiotic (non living) components

Biotic components

The living organisms (or) living members in an

ecosystem collectively form its community called biotic components (or) biotic community.

Examples

•Plants (producers),
•animals (consumers),
•microorganisms (decomposers).

Members of components of an ecosystem (or)

Classification biotic components

The members of biotic components of an ecosystem are grouped in to three based on how they get food.

•Producer (plants)
•Consumer (Animals)
•Decomposers (Micro-organisms)

Procedures (Autotrophs)

Procedures synthesize their food themselves through photosynthesis

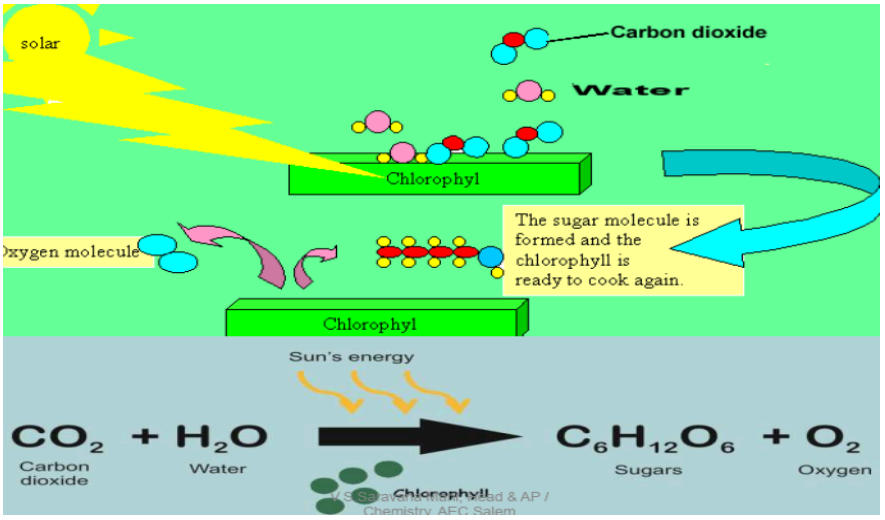
Example : All green plants, trees.

Photosynthesis

The green pigments called chlorophyll, present in the leaves of plants, converts CO2 and H2O in the presence of sunlight into carbohydrates.

6CO 2 + 12H2O ----> C6H12O6 + 6O2+6H2O

This process is called photosynthesis



Consumers (heterotrophs)

Examples

Plant eating species -Insects, rabbit, goat, deer, cow, etc.,

Classification of consumers

Consumers are further classified as

(i) **Primary consumers** (Herbivores) (Plant eaters) Primary consumers are also called herbivores, they directly depend on the plants for their food. So they are called plant eaters.

Examples : Insects, rat, goat, deer, cow, horse, etc.,

Secondary consumers (primary carnivores) (meat eater)

Secondary consumers are primary carnivores, they feed on primary consumers. They directly depend on the herbivores for their food.

Example

Frog, cat, snakes, foxes, etc.,

(iii) Tertiary consumers (Secondary carnivores) (Meat-eaters) Tertiary consumers are secondary carnivores, they feed on secondary consumers. They depend on the primary carnivores for their food.

Examples -Tigers, lions, etc.,

Decomposers

Examples

Microorganisms like bacteria and fungi. Decomposers attack the dead bodies of producers and consumers and decompose them into simpler compounds. During the decomposition inorganic nutrients are released.

The inorganic nutrients together with other organic substances are then utilized by the procedures for the synthesis of their own food.

Abiotic (non-living) components

The non-living components (physical and chemical) of ecosystem collectively form a community called abiotic components (or) abiotic community.

Examples -Climate, soil, water l air, energy, nutrients, etc.,

1. Physical components

They include the energy, climate, raw materials and living space that the biological community needs. They are useful for the growth and maintenance of its member.

Examples -Air, water, soil, sunlight, etc.,

2. Chemical Components -They are the sources of essential nutrients

Examples

- Organic substances : Protein, lipids, carbohydrates, etc.,
- Inorganic substances: All micro (Al, Co, Zu, Cu) and macro elements (C,H, O, P, N, P, K) and few other elements.

FUNCTION OF AN ECOSYSTEM

To understand clearly the nature of ecosystem its functioning should be thoroughly understood. The function of an ecosystem is to allow flow of energy and cycling of nutrients. **FOOD CHAINS**

Definition

"There sequence of eating and being eaten in an ecosystem is known as food chain" (or)

"Transfer of food energy from the plants through a series of organisms is known as food chain"

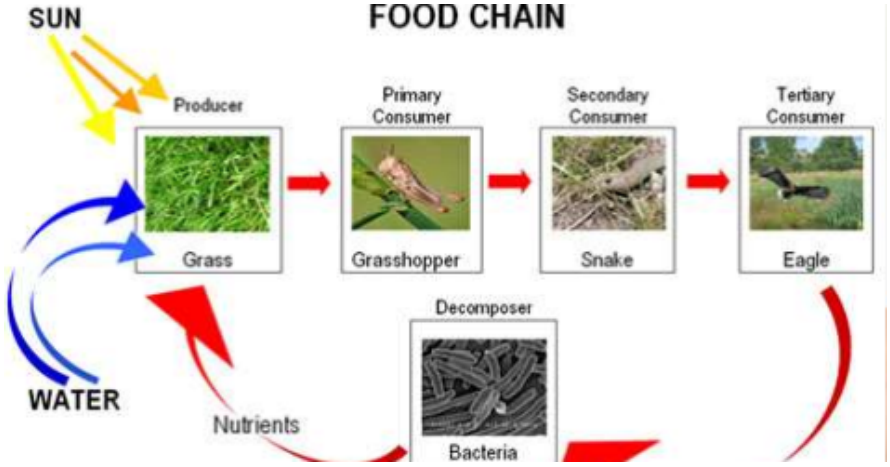
When the organisms die, they are all decomposed by microorganism (bacteria and fungi) into nutrients that can again be used by the plants. At each and every transfer, nearly 80-90% of the potential energy gets lost as heat. A food chain always starts with plant life and ends with animal.

Herbivores

Animal that eat only plants are called herbivores.

Carnivores

Animals that eat other animals are called carnivores.



Food chain in a pond

Food chain in a forest

FOOD WEB

Definition

The interlocking pattern of various food chains in an ecosystem is known as food web. In a food web many food chains are interconnected, where different types of organisms are connected at different tropic levels, so that there is a number of opportunities of eating and being eaten at each tropic level

Example

Grass may be eaten by insects, rats, deer's, etc., these may be eaten by carnivores (snake, tiger).

Thus there is a interlocking of various food chains called food webs

Difference between food chains and food web

In a linear food chains if one species gets affected (or) becomes extinct, then the species in the subsequent tropic levels are also affected. But, in a food web, if one species gets affected, it doest not affect other tropic levels so seriously.

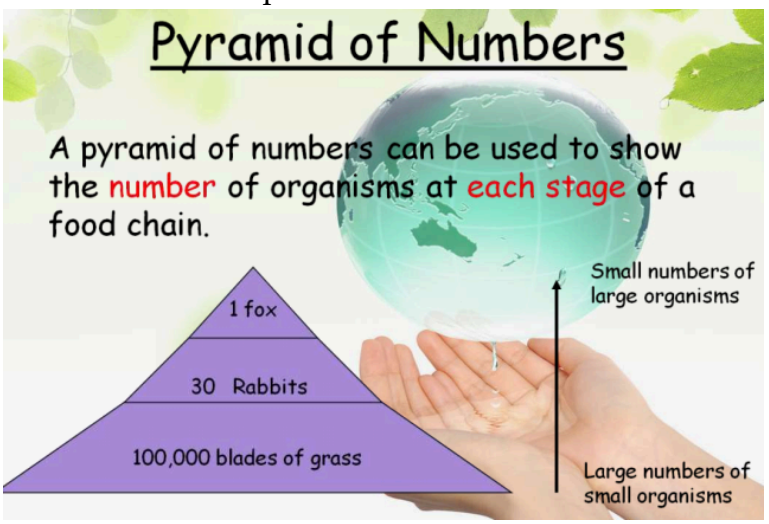
There are number of options available at each tropic level.

ECOLOGICAL PYRAMIDS

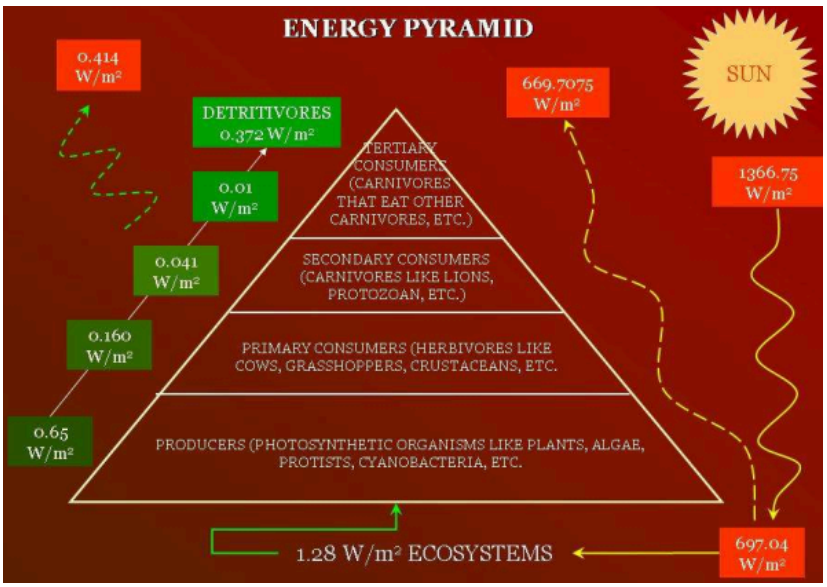
Definition

"Graphical representation of structure and function of tropic levels of an ecosystem, starting with producers at the bottom and each successive tropic levels forming the apex is known as an ecological pyramids."

In food chain starting from the producers to the consumers there is a regular decrease in the properties (ie.,, biomass and number of the organisms). Since some energy is lost as heat in each tropic levels, it becomes progressively smaller near the top.



Pyramid of energy.



3. Pyramid of biomass.