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- 1.1 Rain water harvesting can be described as collection of rainwater in order to prevent water runoff. It helps conserving water which can be used further.
- 1.2 The main purpose of watershed management is to conserve water & water resources & use it wisely. It helps recharging the groundwater & water is used in an efficient manner.
- 1.3 Drip irrigation system is known to be the most water efficient irrigation system. In this water is applied to the roots in precise quantity with slow pace. It involves minimum water wastages.
- 1.4 India has a vast coastline of 7500 kms. Most of it vulnerable to various disasters such as Tropical Cyclones, Tsunamis, Storm surge etc.
- 1.5 NDRF stands for National Disaster ^{Response} Relief Force. Its main role is to respond quickly to any natural or man-made disaster. It is responsible for prompt rescue operations anywhere in the country.
- 1.6 Resource mapping is an important part of disaster management as it involves identificat-ion & categorization of resources to be used during a disaster to mitigate it.
- 1.7 Disaster management can be described as the planning, organising & taking action to prevent a disaster & mitigation during a disaster.

1.9 Remote sensing is the technology that is used to observe an object or phenomenon without touching it physically. It is done by sensing the radiations ~~emitted~~ emitted by any object, with the help of sensors.

1.10 Electromagnetic spectrum a set of different radiations that are arranged according to their wavelength & frequencies. These radiations are gamma rays, X-rays, Ultra-violet rays, visible light, Infrared rays, Microwave rays, Radio waves, etc.

1.11 NavIC or Navigation in Indian Constellation is also known as Indian Regional National Satellite System (IRNSS) is an Indian navigation satellite system. It is developed to provide positional data like USA's GPS. It has a set of 7 satellites & its operational range is 1500kms.

1.13 Three types of satellites - (i) Geostationary satellites, (ii) Polar satellites, (iii) Sun-synchronous satellites.

1.14 Components of GIS - Software, hardware, Methods, people/personnel handling it, and data.

1.15 Remote sensing works on the principle of emitted radiations which are sensed or captured by the sensors involved in Remote Sensing technology. These sensors then signal back these in form of images to the receiver stationed on earth.

2.1 Efficiency. Irrigation system involves use of efficient irrigation methods to increase the water-use efficiency so that there is minimum or no water wastage. Water use efficiency is the ratio of water applied to the crop to the transpiration done by the crop plant. Water use efficiency can be increased by use of irrigation methods such as chip irrigation, sprinkle irrigation etc. In these irrigation system water is applied in a slow pace & in required quantity only. It reduces water logging, & water runoff, & leaching of soil. The government of India promotes these methods of irrigation through schemes like PM Kisan Sanchai Yojna, which has a component of "Har Khet ko Pani" & "Per drop more crop."

2.2 According to Water Quality Index India is one of the top ground water stressed countries. As per Economic survey 2020-22 states like Punjab, Haryana, etc have exhausted more than 100% of their ground water table. Ground water management is one of the top priorities of government of India. ~~At low~~ Groundwater management involves, conservation of ground water table, aquifers, rain water harvesting, & mindful use of groundwater, scientific irrigation practices, etc. The government has a dedicated ministry, 'Ministry of Jal Shakti' for water conservation. It has set up 'Central Ground Water Authority' under Environment Protection Act, 1986 which is responsible for ground water management. Schemes like 'Atal Bihari Vajpayee' ~~are~~ there for the same.

2.3 Factors influencing water quality -

- The content of dissolved oxygen in the water.
- Fertilizers & pesticides (mixed with water runoff)
- Toxic wastes from industries
- Presence of decayed organic materials
- Eutrophication
- Presence of minerals such as Fluorine, Arsenic, uranium etc in excess quantity.
- Mixing of air pollutants such as NO₂, SO₂ etc with rainwater runoff.
- Sedimentation of silt in the rivers due to floods in flood affected areas.

2.4 Man-made disasters or anthropogenic disasters are the destructions caused by human activities. These disasters are -

- Industrial or Chemical disasters → Example - Bhopal Gas Tragedy (1984)
- Nuclear Disaster → Example - Chernobyl Nuclear Disaster (1986)
- Others → Urban fires, armed conflicts, etc

The occurrence of man-made disasters is increasing day by day because of :-

- Rapid urbanization & industrialization
- Race to become more advanced & powerful
- Assertion of power
- Mindless exploitation of resources, etc

2.5 National Disaster Response Force or NDRF is the top notch force designed & trained to perform rescue operations during a disaster. It is formed under the Disaster Management Act, 2005. It comes under 'Ministry of Home Affairs'. It is not a separate force but the ~~best~~ personnels are recruited from the various central armed police forces (CAPF) such as CISF, BSF, CRPF, SSF, ITBP, etc. This force is trained to act promptly during a disaster & perform tasks like rescuing & transporting the victims, supplying food & other essentials, etc. NDRF has performed at par so far in handling disasters.

2.6 Preventive & administrative measures of disaster -

Before disaster → Keeping early warning detection system at place.

- Use of IRNSS to analyse the disaster prone areas.
- Training of local community
- Building disaster resilient infrastructure
- Desiltation of rivers in flood prone areas.
- Resource mapping using GIS & GPS

During Disaster → Transportation of people to safe place.

- Arrangement of supplies such as food, medicines, etc.
- Arrangement of makeshift camps.

After Disaster → Rehabilitation & relocation

- Livelihood restoration.

2.7 Education on disasters & emergencies is important & necessary because -

- It makes people aware about the potential hazards & their impact.
- It helps them understand the disaster & its different kinds.
- It focuses on training them ~~to~~ & makes them disaster responsive.
- It enables people tackling the situation if the administrative aid gets delay.
- It empowers people as they are taking part in decision making & implementation.
- It is an important tool for capacity building.

2.8. GPS was developed by America in 1980s for military purposes. It is used to detect & identify the position of an object far away. It works through the use of 24 satellites. The satellites capture the image & position of an targeted object & signal back to the receiver stations on earth.

Application → It is used in military operations to identify locations.

- Now, it is used in travelling, used by airplanes, etc
- ~~It is used~~ In navigation of naval ships.
- In monitoring objects or personal movements.

2.9 Application of GIS -

- Analysing land use pattern.
- Regional & population planning.
- Surveying for various projects.
- Identification of locations.
- In travel & tourism.
- Minerals & resource mapping.
- Waste management.
- Urban planning & infrastructure development.
- In precision agriculture.
- Soil health analysis.
- Military operations, etc.

2.10 Electromagnetic spectrum is distribution or arrangement of electromagnetic waves according to their wavelength & frequencies.

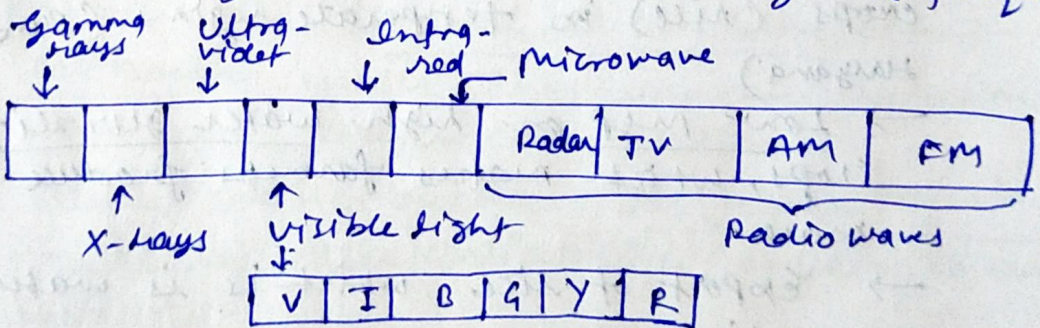


Figure - Electromagnetic spectrum

These rays are arranged on the basis of the substance they interact with, the energy levels of their photons, their wavelength & frequencies. Electromagnetic spectrum has a vital use as it describes the characteristics & use of various electromagnetic rays.

3.1 According to World Quality Water Index, India ranks 120 out of 122 countries in the world in water resources utilization. India ranks 13th in the list of most water stressed countries in the world.

There are various concerns related to water resources of India. These are -

⇒ Unscientific agriculture → Excessive use of ground water has led to 100% ground water table exhaustion in ~~some~~ ^{most} states & more than 100% in states of Punjab, Haryana.

Reasons → Not following the demand of the particular agro-climatic zones. For example - growing tropical water intensive crops (rice) in temperate regions. (Punjab, Haryana)

→ Low MSP on high water guzzling crops, which makes farmers produce them more.

→ Export of rice which is a water guzzling crop.

→ Not using drip or sprinkle irrigation methods, which led to excess runoff.

⇒ Ground water pollution → due to excess use of fertilizers & pesticides.

→ Conditions of algal blooms & eutrophication.

→ Percolation of industrial waste

⇒ Unscientific Urban Planning — Metro cities such as Mumbai faces flooding of drainage every monsoon. A major portion of the city Chennai is situated on marsh, which leads to water logging conditions.

⇒ Drought Monsoon dependence — The variation in monsoon leads to drought in some places & (Chennai, Rajasthan etc) & floods in some places (Assam) simultaneously.

However, to deal with these issues government has been focusing on water management. Various steps have been taken from by the govt, these are —

- Formation of 'Central Water Board' under 'Ministry of Jalshakti' to deal with all the water management issues.
- Formation of 'Central Water Management Authority' under 'Environment Protection Act, 1986' for water conservation.
- Various schemes such as 'Jal Jeevan Mission' to ensure tap water availability (by 2024) to every household.
- 'PM Krishi Sinchai Yojna' for efficient irrigation. It has component like 'Harkhet Ko Pani' & 'Per drop more crop' for water conservation.
- 'Natal Bhujal Yojna' for ground water management.

Thus, it can be seen that various steps have been taken by the govt in order to conserve water. And The effective implementation of these will ensure the water management.

3.2 Earthquake can be defined as shaking or trembling of earth surface because of sudden release of energy in the lithosphere. These earthquakes or release of energy travels in the form of waves, which is called seismic waves.

These earthquakes mainly occur along the tectonic plate boundaries. These are caused by the collision of plate boundaries, such as these reasons are Himalayan region (Eurasian-Indian plate boundary), Andaman-Nicobar Islands (Indian-Australian-Pacific plate boundary), San-Andreas fault zone (etc California plate & Pacific plate - Transverse plate boundary)

In India, to study the impact of the seismic activities & for their better prevention & handling the whole country is divided into various seismic zones. These zones are from zone II to zone V according to their seismicity potential.

① Zone II - Low seismicity potential.

It ranges around 6-7 on Modified Mercalli (MM) scale. These areas are North-Central part, Telangana - Andhra, some parts of Odisha & Lakshadweep islands.

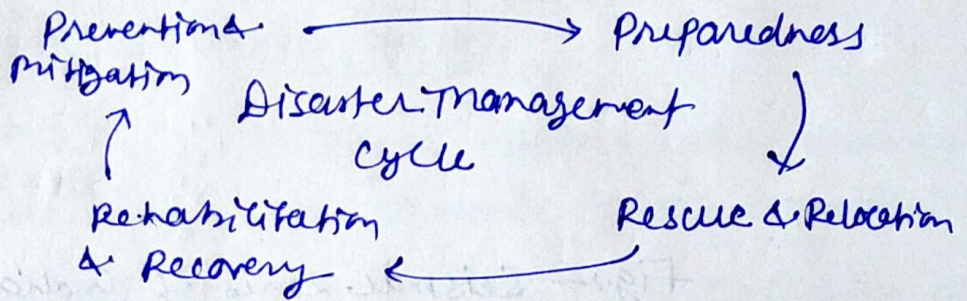


Fig:- Seismic zones of India

- ① Zone II → It has low to moderate seismic potential. Around 7 on MM scale. This includes areas of Koyana dam (Koyana Nagar) in Maharashtra, some parts of Trop & Chattisgarh, Western Ghats etc.
- ② Zone III → It has moderate high seismicity potential that is around 8 on MM scale. This includes the areas of Gujarat (Kathiwar), Indo-gangetic plains, most parts of Western Himalayas, etc.
- ③ Zone IV → It has highest seismicity potential of around 9 or more than 9 on MM scale. This includes the areas of Kashmir, Jammu & Kashmir, Uttarakhand, Northern Bihar, North-Eastern states (Eastern Himalayas), Andaman & Nicobar Island group.

The seismic zone mapping helps monitoring the seismic zones in order to ~~prompt~~ act promptly during an earthquake disaster.

3.3 Disaster management can be defined as handling of a disaster before it has occurred & during its occurrence. It involves planning, organising, strategising & taking actions.



There are various types of disasters which can be categorised as -

① Natural disasters

→ Climatic disasters - Floods, droughts, heat waves, cold waves, forest fires etc

→ Geological - Landslides, glacier melt, cloud burst, etc

→ Biological - Pandemics & epidemics, Pest attack, locust attack, virus outbreaks,

② Man-made disasters

→ Industrial & chemical disaster - Gas leak (Bhopal gas disaster), oil spill etc

→ Nuclear disaster - Nuclear radiation release (Chernobyl disaster)

→ Others - Urban fires, Bridge collapse, etc

Mitigation & Prevention

Before disaster → Installation of early warning system in place

- Training of community people
- Disaster education & awareness
- Desiltation of rivers in flood prone areas
- Monitored construction in coastal zones & hilly areas.

During disaster → Rescue & transportation of victims

- Arrangement of makeshift camps
- Arrangement of food, medicines, doctors etc.

After disaster → Rehabilitation & recovery

- Re-employment & livelihood restoration
- Reconstruction & lost properties.

Other than this, Government of India has taken various steps to strengthen disaster management. These are -

- Signatory to Sendai Framework on disaster management.
- Enactment of Disaster Management Act, 2005
- Establishment of National Disaster Management Authority (Under NDMA, 2005) at national level headed by Prime Minister, State Disaster Management Authority at state level headed by CMs, District Disaster Management Authority headed by District Magistrate & Local level authorities.

India is endeavouring to develop a robust disaster management system to tackle it more effectively.

3.4 Remote sensing can be defined as the technology to observe an object or phenomenon without touching it physically.

Remote sensing technology works on the principle of radiations emitted by the target objects. These radiations are then captured or detected by the sensors of remote sensing satellites & are signaled back to the receiver stations located on earth.

The components of Remote sensing involve -

- ① The platform in which it is placed.
- ② The sensors
- ③ The Energy source
- ④ Radiation emitted by the object
- ⑤ Recording of the energy by the sensors
- ⑥ Transmission & Reception
- ⑦ Processing, interpretation & analysis
- ⑧ Application.

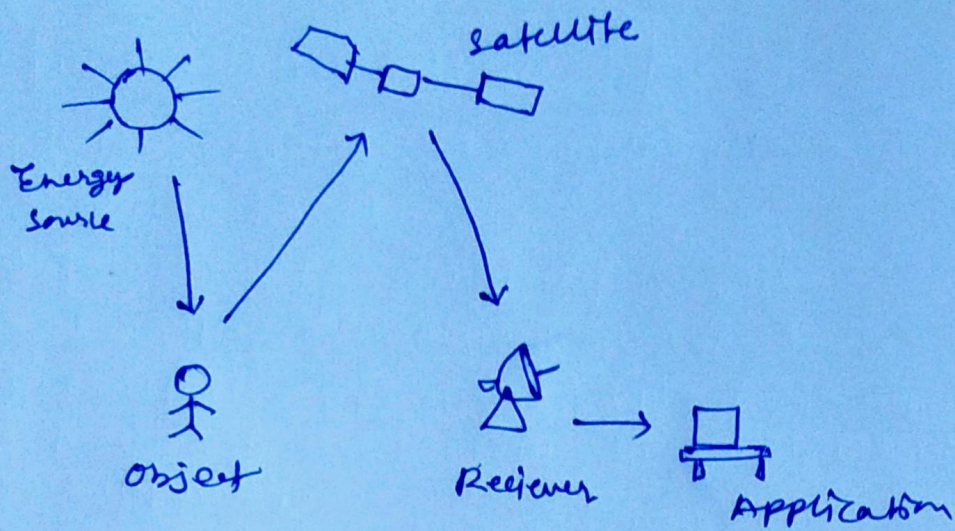


Figure - Components of Remote Sensing

Applications of Remote Sensing -

- In land use & land pattern mapping
- Weather forecast (Megha Tropiques satellite)
- Resource localization (ResourceSat satellite)
- Monitoring hazard & disaster prone regions.
- Predicting natural hazards - such as forest fires, cyclones etc
- In precision agriculture - soil health, moisture determination etc
- Analysing land for population planning & infrastructure development, etc

Remote sensing has a vital importance in human life for making it more efficient & advanced.