INTER-RELATIONSHIP BETWEEN DISASTER AND DEVELOPMENT

Differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation-IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources. **Emerging approaches in Disaster Management - Three stages** Pre-disaster Stage (preparedness), Emergency Stage, Post Disaster stage - Rehabilitation

5.1. Inter-Relationship between Disasters and Development:

Introduction:

- Development requires institutional and structural transformations of societies to speed up economic growth reduce levels of inequality and eliminate absolute poverty.
- Over time, the effects of disasters can seriously degrade a country's long-term potential for sustained development and cause governments to largely modify their economic development priorities and programs.
- At the same time, disasters often provide opportunities for development. They can improve the atmosphere in favor of change and create a rationale to establish development programs such as job training, housing construction and land reform.
- However, poor management of the relief and rehabilitation responses may have severe negative implications for development for years to come, and may even increase vulnerability to future hazards.

- Four basic themes indicating inter-relationships between disasters and development are as follows:
  i. Disasters destroyed development programmes and years of development initiatives. This also gives an opportunity for infrastructure improvements e.g. transport and utility systems to be rebuilt when a flood destroys them.
  ii. Rebuilding after a disaster provides significant opportunities to initiate development programs. A self-help housing program to rebuild housing destroyed by an earthquake teaches new skills, strengthens community pride and leadership.
  iii. Development programs can increase an area's susceptibility to disasters e.g. probability of technological disaster may increase in an industrialized area. Therefore, the Environment Impact Assessment is mandatory.
  iv. Sustainable Development programs can be designed to decrease the susceptibility to disasters and their negative consequences. Housing projects constructed under building codes designed to withstand high winds result in less destruction during the next tropical storm.
- Decision-makers who ignore these relationships between disasters and development do damage to the people who place their trust in them.
- Increasingly, around the world, forward thinking Government agencies with the support of United Nations and Non-Governmental Organization (NGO) officials are assessing development projects in the context of disaster mitigation and are designing disaster recovery programs with long-term development needs in mind.

5.1.1. Role of development in disaster management:

Development of a culture is an essential component of an integrated approach to disaster reduction.

- **Development Planning-** There is a need to integrate development plans and regulations with disaster-mitigation.
- The construction of roads, railways lines, bridges, etc., should be according to the topography and geology of that area in terms of risk and vulnerability.
- All development projects (engineering and non-engineering) including irrigation and industrial projects should be targeted towards disaster-mitigation.

- In order to move towards safer development, development projects should be sensitive towards disaster mitigation.
- The design of development projects and the process of development should take the aspect of disaster reduction and mitigation within its ambit; otherwise, the development ceases to be sustainable and eventually causes more hardship and loss to the nation.

5.2. Development projects:

5.2.1. Dams and their impact:

Dams are built worldwide to store water for irrigation, flood control, and to generate electricity. Until now some 800,000 dams have been constructed worldwide. However, many negative effects of large hydroelectric dams have come to light, slowing the progression of future dams.

Advantages of Dams:

i. Clean, efficient, and reliable form of energy.
ii. Does not emit any direct pollutants or greenhouse gases.
iii. While the initial cost is high, they are very inexpensive to operate.
iv. Electricity generated by hydro-electric power plants is the cheapest electricity generated.
v. Dams prevent floods.
vi. Dams store water for irrigation in summer seasons and dry months. Many desert areas can now farm due to dams and canals that supply water.
vii. Dams supply water for local drinking needs.
viii. Allows for fish farming.

Negative Impact of Dams:

The negative effects of dams have been mentioned as follows:

i. **Negative impacts on catchments:** Mostly with the construction of dams, the catchment areas experience a pressure since they are the remaining forests. Most forest areas are submerged under the dam. These catchments then get degraded. Local life around these catchments suffers adversely in such cases due to these dams.

ii. **Deteriorating effects on lands and environment:** While building dams, a lot of soil, stones and sand is required as the construction materials for the dams. This calls for mining and digging in the project site which directly disturbs the nearby wildlife and vegetation. This even causes a lot of dust pollution because of extensive digging and land replacement.

iii. **Backwater build-up:** Backwater build-up happens when a flowing river is interrupted by a dam reservoir. A kind of back pressure is generated that gives rise to backwater. This directly affects the upstream ecology in negative ways and causes a great damage to property.

iv. **Negative effects on aquatic ecosystems:** While building dams, river is usually directed elsewhere through a tunnel. The major aquatic life is directly affected by this. Some species that is low on tolerance can become extinct as a result of this direction change.

v. **Causes Water-logging and salinity in water:** The Canals built during the dams' construction are the biggest reason responsible for water-logging. In case of improper lining of these canals, water may sweep out of them and affect the nearby lands in a negative way. Drainage system, if not correctly ensured, can really disturb the local lifestyle and destroy valuable lands and their quality.

vi. **Deforestation on a high scale:** To build dams, it is often required to clear huge areas of land to make space for so many required elements. Many nearby forests need to be cut down and this happens on a really large scale. Cutting down natural forests affects wild animals as well the cutting of so many trees cause a havoc on the overall environment.

vii. **Soil erosion and air pollution:** Due to the deforestation on a large scale, soil erosion is common to take place which not only

degrades the land but also adds to the air pollution. Dust particles immediately see a hike in the atmosphere, making it unfit to breathe in. This affects the animals residing nearby those forests and even the people living there. This becomes the biggest reason for trivial respiratory diseases.

Solution to these Problems:

Negative effects on flora, fauna, and the local population can be reduced by the following methods:

- Fish passages should be created to aid in the migration of the fish.
- New dam sites should be chosen with the environmental impacts in mind.
- Local people should be led into confidence and must be suitably re-settled.
- Proper compensation as per the market rate should be given.
- Religious monuments of historic significance should be shifted.
- Endangered species can be relocated.
- If the political will to change and do a good job is there a dam can be constructed in a way to minimize its effects on people and the environment.

5.3. Embankments and their Impacts:

- Embankment a ridge built with earth or rock to contain flood water or to construct a road, railway, and canal.
- Embankments vary in nature and function under a variety of situations.
- It may or may not have an impervious/ impermeable core.

Purpose:

- Embankments are designed to control or prevent flooding, flood control embankment is one of several types of embankments on the floodplains.
- An embankment built to prevent flooding of low-lying land is also called a levee or dyke constructed along a riverbank and at some distance from the river to retain floodwater.
- Safer from flooding, the channel now has an increased carrying capacity so it is less likely to burst
- Earthen embankments provide habitats for riverbed animals e.g kingfishers, voles and otters

- Can be used as a path or pedestrians beside the river.
- Concrete embankments are effective at stopping bank erosion.
- Earth embankments provide habitat for plants and animals,

Disadvantages:

- They deprive people of river access for fishing and boating
- They have a higher maintenance cost as they are prone to erosion
- If breached/ violated, water will stay on the embankments, destroying the animal habitats

List of major dams in india:

Dams	Reservoir	State	River	Hight (M)	Length (M)	Capacity (MW)
Tihri Dam		Uttarakhand	Bhagirathi	260	575	2400
Koyna Dam	Shivajisagar Lake	Maharastra	Koyna	103	807	1960
Srisailam Dam	Srisailam reservoir	Telangana/ Andhra	Krishna	145	512	1670
Nathpa Jhakri		Himachal Pradesh	Sutlej	62.5	185	1500
Sardar Sarovar		Gujarat	Narmada	163	1210	1450
Bhakra Dam	Govindsagar Lake	Punjab	Sutlej	226	520	1325
Indira Sagar Dam	Indira Sagar	Mahdya Pradesh	Narmada	92	653	1000
Nagarjuna Sagar	Nagarjuna Sagar	Telangana/ Andhra	Krishna	124	1550	965
Idukki Dam		Kerala	Periyar	169	366	780
Hirakund Dam		Odisha	Mahanadi	61	4800	347

http://www.quickgs.com/major-dams-of-india/

Difference between Dam and Embankment:

	Dam	Embankment
Location	Vertical to river direction	Parallel to river at safe distance
Main function	Creating reservoir during upstream	Force a river to flow in its own direction
Best place for construction	Along with the narrow width of a river	Downstream of a river or river bank near a city.

	Dam	Embankment
Construction materials	Soil, masonry, concrete etc.	Generally: sand
Service time	Lifetime	Only during flood
Effect on river bed	Sediment occurs, river bed gets filled	River bed erosion occurs due to increase of water current.
Effect on flood	Can cause flood during upstream	Reduce flood affect
Effect on water flow in river	Decrease river flow velocity	Increase river flow velocity (also during flood)
Maintenance	Always	Maintenance is required especially before and after flood
Length	Equal to river width	Couple of kilometers to hundreds of kilometers depending on necessity.

protection chemicals in agricultural operations can affect water resources and ecosystems.

- Transportation infrastructure (e.g., roads and airports) is another type of land use that affects water resources through road runoff and alterations to components of the hydrological cycle.
- As population and human aspirations increase, land becomes an increasingly limited resource, calling for land-use planning.
- Land-use planning is important to mitigate the negative effects of land use and to enhance the efficient use of resources with minimal impact on future generations.
- Land-use planning is defined as a systematic assessment of land and water potential, alternatives for land use, and the economic and social conditions required to select and adopt the best land-use options. The main objective of this planning process is to allocate land uses to meet the needs of people while safeguarding future resources.
- Land-use planning aims at achieving a balance among these goals through the use of information on trade-offs, appropriate technology, and consensus-based decision-making.
- Effective land-use planning often involves local communities, scientific information on land resources, appropriate technologies, and integrated evaluation of resource use.

5.4.1 The Master plan of land use:

It includes analysis, recommendations, and proposals for population, economy, housing, transportation, community facilities, & land use. It is the basis for all infrastructure requirements.

Objectives:

- To promote efficient utilization, acquisition & disposition of land and ensure the highest and best use of land.
- To direct, harmonize and influence discussions and activities of the private and public sectors relative to the use and management of lands
- To reconcile land use conflicts and proposals between and among individuals, private and government entities relative to the present and future need for the land.
- To promote desirable patterns of land uses to prevent wasteful development

- To minimize the cost of public infrastructure and utilities and other social services to preserve areas of ecological, aesthetic, historical and cultural significance

Functions of the master plan:

- To guide development of a city is an orderly manner so as to improve the quality of life of the people
- Organize and coordinate the complex relationships between urban land uses
- Chart a course for growth and change, be responsive to change and maintain its validity over time and space, and be subject to continual review

5.4.3. Principles of Land-Use Planning:

- Evaluate and record unique features.
- Preserve unique cultural or historical features.
- Conserve open space and environmental features.
- Calculate additional charges for altering land.
- Plan for mixed uses in close proximity
- Plan variety of transportation options
- Set limits and managed growth patterns.
- Encourage development in areas of existing infrastructure.

5.4.4. Concepts of land use

i. **Reversible uses:** when the inherent features and characteristics of the land have not been considerably altered or modified such that the soil horizon, landform, and structure remain intact so that the land can be reverted to its former use or original condition.

ii. **Irreversible uses:** when land is subject to applications which brought about changes, alteration or modifications so much so that it prevents the original use or it is physically impossible to restore the land to its previous state or condition.

iii. **Multiple land uses:** Combining different land uses, whether reversible or irreversible, in an orderly and desirable pattern because:

- Land is finite and supply is finite
- Demand is ever increasing
- Competition is there. Land may have more than one use and uses can be combined in different ways.

iv. **Compatible and incompatible land uses:** Some land uses are innately incompatible while others are completely compatible. Compatible uses can coexist harmoniously and effectively in an orderly management.

v. **Comprehensive land use planning:** A document embodying specific proposals for guiding, regulating growth and development of a city or municipality.

vi. Best use of the land:

- The use of land which generates the maximum profit without negative consequences especially on the environment
- Land should be used in such a manner consistent with its natural qualities to maximize its productivity and also adhere to the principles of sustainable development.
- Utilizing land in a manner that is beneficial to both man and environment.

5.4.5. Levels and Process:

- Planning can be at various levels: local, town, district, state, regional, national, and international. A two-way link between these levels is important for successful planning.
- A "bottom-up" type of planning starts at the local level and links to the next higher level with active local participation.
- Local acceptability of the plan is a critical element of a successful plan.

A typical planning process involves the following steps:

- Establishing goals and a baseline;
- Inventorying and organizing resources;
- Analyzing problems;
- Establishing priorities and alternatives;
- Checking for land suitability;
- Evaluating alternatives and choosing the best option;
- Developing a land-use plan;
- Consulting and implementing the plan; and
- Revising the plan.

It is important that local people and stakeholders be involved in all steps of the planning process to make it a successful plan. This will also ensure local acceptability and effective use of local information.

5.4.6. The Future of Land-Use Planning:

Land-use planning is becoming complex and multidisciplinary as planners face multiple problems that need to be addressed within a single planning framework. Such problems include nonpoint-source pollution, water allocation, urbanization, ecosystem deterioration, global warming, poverty and unemployment, deforestation, desertification, farmland deterioration, and low economic growth. Watershed-scale planning is gaining popularity among communities and agencies so that biological, physical, and socioeconomic components of the landscape system can be integrated into the planning framework.

5.5. Climate Mitigation and Adaptation:

- Adaptation may also be defined an understanding of how individuals, groups and natural systems can prepare for and respond to changes in climate or their environment.
- Climate mitigation is any action taken to permanently eliminate or reduce the long-term risk and hazards of climate change to human life, property.
- The International Panel on Climate Change (IPCC) defines mitigation as: "An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases."
- Climate adaptation refers to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.
- The IPCC defines adaptation as the, "adjustment in natural or human systems to a new or changing environment".
- Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
- Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

5.5.1. Mitigation Strategies:

Climate change involves complex interactions between climatic, environmental, economic, political, institutional, social, and technological processes. It cannot be addressed or comprehended in isolation of

5.6. Indigenous knowledge:

- Local and indigenous knowledge refers to the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For rural and indigenous peoples, local knowledge informs decision-making about fundamental aspects of day-to-day life.
- This knowledge is integral to a cultural complex that also encompasses language, systems of classification, resource use practices, social interactions, ritual and spirituality.
- These unique ways of knowing are important feature of the world's cultural diversity, and provide a foundation for locally-appropriate sustainable development
- The term 'indigenous knowledge' is used to describe the knowledge systems developed by a community as opposed to the scientific knowledge that is generally referred to as 'modern' knowledge. Indigenous knowledge is the basis for local-level decision-making in many rural communities.
- Indigenous knowledge is the local knowledge that is unique to a culture or society. Other names for it include: 'local knowledge', 'folk knowledge', 'people's knowledge', 'traditional wisdom' or 'traditional science'.
- This knowledge is passed from generation to generation, usually by word of mouth and cultural rituals, and has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that sustain societies in many parts of the world.
- Indigenous people have a broad knowledge of how to live sustainably. However, formal education systems have disrupted the practical everyday life aspects of indigenous knowledge and ways of learning, replacing them with abstract knowledge and academic ways of learning. Today, there is a grave risk that much indigenous knowledge is being lost and, along with it, valuable knowledge about ways of living sustainably.

5.6.1. Objectives

- To appreciate indigenous (स्वदेशी) perspectives on ways of living together and using resources sustainably;
- To appreciate the role of indigenous knowledge and traditional ways of learning in maintaining the sustainability of a community;

- To understand the role of 'modern' education in undermining indigenous knowledge and ways of teaching and learning; and
- To identify opportunities for integrating relevant aspects of indigenous knowledge and approaches to teaching and learning into the school curriculum.

5.6.2. Types of Indigenous knowledge:

- resource management knowledge and the tools
- techniques, practices and rules related to pastoralism
- agriculture, agro-forestry, water management and the gathering of wild food
- classification systems for plants, animals, soils, water and weather
- empirical knowledge about flora, fauna and inanimate resources and their practical uses
- the worldview or way the local group perceives its relationship to the natural world

5.6.3. Relevance of Indigenous knowledge in Disaster Management:

- **Technological:** Indigenous technology is seen in almost every part of the world. Technology is used almost in every aspect of the life. These traditional practices are seen to be more effective for the community than scientific practices. Like in some cases, most of the communities have intimate knowledge about the quality of soil, plants and seeds that are resistant to drought o flood. Farmers who work in the unimportant lands practice mixed cropping, intercropping techniques which reduces risk of poor harvest. Also at many places, houses are constructed on raised platform so that they remain above flood levels. Technologies can be seen to be used while constructing earthquake resistance building or houses as well.
- **Economic:** Communities have developed their indigenous economic strategies to deal with the disasters. Usually vulnerable households try to store up grains, foods and cash which they can draw on in difficult times. In the case of food shortage, natural or wild foods from the forests are used such as roots, berries etc.
- **Social:** This basically includes relationship networks, mutual assist and self help groups. Sharing of foods, materials during the crisis can be seen in many communities. Also, people's joint participation to rebuilt or reconstruct the damaged infrastructures can be seen after the disaster event.

5.7. Role of Information technology in Disaster Management:

Components of Information Technology Used in Disaster Management :

1. **Awareness program-** To combat disaster, awareness of the risk population about the possible disaster and its combat -strategies is utmost important. It can be done in various ways. If target population are mostly common illiterate people, audio visual aid like Video conferencing, tale- communication even with the experts who are not available at field level can play a great role in educating people to mitigate disaster like situation.
2. **Radio & television-** The most traditional electronic media used for disaster warning and a widespread effect to the people. The effectiveness of this media in the developing countries and rural environments where the tele-density is relatively low and there it can be used to spread the warning quickly to a broad population. A study on this media revealed that the effectiveness of radio and television with a easy understandable language of warning can reduce the potential death toll of catastrophic, cyclonic and tidal bore. But only drawback of this system is that at night this media are generally switched off.

3. **Telephone/Mobile-** The landlines and Mobile phones has an important role in warning the communities at stake for an incoming danger of a disaster. A phone call with warning saved many lives in South Asian Countries in 2004 Tsunami mainly at coastal region. However there are two drawbacks to warn the people through telephone are :

   i. Installation of telephone in the rural areas in all India still is not satisfactory even if there is an exponential use of mobile phone in recent past has mainly bounded in urban areas - particularly in rural and coastal areas the communities are mainly fisherman communities still think that mobile phone is a luxury.

   ii. The other drawback is congestion of phone lines before and during the disaster resulting incomplete phone calls at vital period.

4. **Short Message Service.(S M S)-** The SMS is allowable in most of the mobile phone and permits sending of short messages amount the mobile phone an even land line. In case of failure of network the SMS can work on a different band and can be sent or received even when phone lines are congested. During 2005 Hurricane Katrina disaster in USA, many residence of affected coastal areas were unable to contact relatives and friends through telephone but they could be able to communicate to each other through SMS.

   Other communication technologies are used like Cell broadcasting, satellite radio, internet or e-mail, amateur and community radio, etc. to warn the people at stake in case of a impending disaster.

5. **Auto- ALERT through Siren/Emergency bell:** People in villages who ate not exposed to mobile phones etc can be brought under the auto alert systems of sirens or emergency bells which starts on its own whenever any alert message is detected. They can be installed at offices of local administrations or police stations in the locality.

5.7.2. GIS and Remote Sensing in Disaster Management:

GIS (Geographical Information System) can be defined as a system of hardware and software used for storage, retrieval, mapping and analysis of geographic data. GIS can be used for scientific investigation, resource management and development planning.

Remote Sensing is a measurement of acquisition of information about a phenomenon by a recording device and gathered information about the environment without physical or intimate contact with the object or phenomena.

By utilizing GIS agencies involved in response can share information through data bases on computer generation maps in one location. For disaster management, workers have to access a number of department managers with their unique data and unique maps which in case of a disasters do not allow time to gather these resources.

GIS provides the mechanism to centralize and visual display critical information during an emergency.

GIS based spaced technology solutions have become an integral part of disaster management in developed as well as developing countries.

However incase of failure of GIS system in affected area by thunderstorm or flood like natural disaster, Disaster Management group has to take on physically though data of GIS in pre-failure state can be used to a great extent by the group depending on their expertise and post-failure scenario of GIS.

The use of GIS in different phases can be illustrated as follows:

i. Planning
ii. Mitigation
iii. Preparedness
iv. Response

i. Planning- Emergency management in case of a disaster begins with locating and identifying potential emergency problems. The use of GIS can become the backbone of emergency management as it provides a mechanism to centralize and visually display critical information during an emergency. Using a GIS official's can be triggered the bull's eye of the hazards and evaluation of the consequences of potential emergencies or disasters can easily be made. When a disaster like earthquake faults, fire hazards, flood zones, etc are viewed with other map data such as buildings, residential areas, rivers and waterways, streets, pipelines, power lines, etc an official can formulate mitigation, preparedness and possible recovery needs with the help of the information derived from remote sensing and satellite imagery play an important role in disaster management and crisis period. Before an effective emergency management program implementation thorough analysis and planning must be done.

GIS facilitates the process by allowing planners to view appropriate combinations of different data to computer generated maps.

ii. Mitigation- Mitigation is the activity that actually eliminates or reduces the probability of a disaster by taking preventive measures (e.g. legislation that require stringent building code in earthquake prone area or in case of a flood zones). Mitigation may include the implementation of strict legislation considering the magnitude of an earthquake, characteristics of soil and other geological data, landslide data, vegetation, topography, weather, etc in different areas and take proper action to avoid or to reduce the effects of unavoidable disaster. A GIS can identify certain soil types in an adjacent to an earthquake impact zone whereas bridges and overpass are at risk and GIS can identify the path of a flood based on topographic features or spread of a coastal oil spill based on current and winds. The habited property and human life at risk can easily be identified and targeted for protective actions. Thus based on GIS data safe Zones of habitation can be mapped and accordingly people can be guided properly to choose the safe places.

iii. Preparedness- In the preparedness face the Governments developed plans to save lives and minimize the disaster damage. GIS can accurately support better response planning in areas such as determining evacuation routes or locating vulnerable infrastructures and vital lifelines, etc. it also supports logistical planning to be able to provide relief supplies by displaying previously available information on roads, bridges, airports, railways, etc. apart from these activities such as evacuee camp planning can also be done by GIS. GIS can display real time monitoring for emergency early warning. Remote weather stations can provide current weather indexes based on locations and surrounding areas, wind direction, temperature and relative humidity, etc. Wind information is vital in predicting an early report the movement of chemical cloud release or anticipating the direction of wild fire spread upon.

iv. Response- Response are the activities followed by any a disaster. These activities are designed to provide emergency assistance for victims (e.g. search and rescue emergency shelter, medical care, mass feeding, etc). GIS can provide one of the primary components for Computer aided dispatch (CAD) system. Emergency response units based at fixed locations can be selected and routed for emergency response. The quickest response units can be selected, routed and dispatched to the emergency zone. Depending on the emergency a