INTRODUCTION TO DISASTER MANAGEMENT

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CHAPTER 1

INTRODUCTION OF DISASTER MANAGEMENT

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ABSTRACT:

Natural and man-made disasters both have the potential to result in major human casualties, damage to critical infrastructure, and the interruption of vital services. Effective disaster management is essential to reducing the effects of catastrophic occurrences and safeguarding community wellbeing. An overview of disaster management, its significance, and the major components of its execution are given in this introduction. Disaster management is defined in the introduction as a multidisciplinary strategy for preventing, reacting to, recovering from, and lessening the consequences of catastrophes. It highlights the need of using both preventive and reactive tactics in catastrophe management. The importance of many stakeholders, including governmental and non-governmental bodies as well as the general public, is emphasized to provide thorough disaster management.The introduction also discusses the many forms of catastrophes, such as man-made disasters like terrorist attacks and industrial mishaps, as well as natural disasters like earthquakes, floods, hurricanes, and wildfires. It talks about the traits and unpredictable nature of catastrophic occurrences, highlighting the need for effective disaster management plans to increase resilience and decrease susceptibility. The introduction also lists the essential components of efficient disaster management, such as long-term mitigation strategies, emergency readiness and response, catastrophe recovery, and disaster risk assessment. It underlines the value of taking precautionary measures including early warning systems, evacuation plans, and capacity development as well as the necessity of performing risk assessments to detect possible dangers and vulnerabilities.

KEYWORDS:

Atmosphere, Disaster, Geo Hazards, Management,Natural Resource.

INTRODUCTION

Disaster is a term that the French, Greek, Italian, and other forebears used to describe any unfavorable catastrophe that results from an unfavorable alignment of the stars. A severe occurrence within the Earth's system that causes human casualties, property damage, or the loss of priceless items is referred to as a "Disaster" from the perspective of society. According to science, at least one or more geological phenomena or Earth System processes are present in an active, ongoing, systematic, and cyclical way behind every natural catastrophe that has happened on the surface of the Earth. These 'Geo hazards' are natural occurrences or processes that are dangerous to people, other living things, their property, and the environment. A "natural disaster" occurs whenever a society experiences a significant loss or damage to human life, human property, or environmental health as a result of geo hazards. Because only a small number of hazardous occurrences result in catastrophes, not all geo hazards may produce disasters. For instance, massive landslides or glacier avalanches in uninhabited inner mountain belts or significant flooding in the middle of a forest are all geo hazards, but they are not considered catastrophes until there is no such harm to a person's life or property [1], [2]. However, it is abundantly obvious from geological facts and studies that all-natural catastrophes are the end consequence of continuing, cyclical processes in the Earth System that have been occurring since the creation of our mother Earth, or for the last 4.5 billion years.

Our human society is experiencing calamities more regularly these days. This is a result of our incorrect human interference with nature via a variety of developmental activities that we undertake haphazardly without comprehension of such fundamental Earth System Processes. It would be very beneficial if we understood the Earth System Processes before planning or engaging in any type of disaster management activity, such as disaster vulnerable zonation or hazardous area mapping, disaster prediction, and mitigation, or monitoring such events during a disaster or assessing the damages caused after a disaster. Our disaster management objectives would be met promptly during these catastrophic natural occurrences, and both our life and property would be assuredly protected. It is wonderful to know from a scientific perspective that all geohazards, although destructive, is the outcome of different natural cyclical Earth System Processes.

Geohazards may also be beneficial. Our interferences with such natural processes become harmful to humans when they grow more ruthless and greedy without comprehending nature. For instance, volcanic eruptions are one of the geohazards that, if we live near them, are susceptible to becoming catastrophes. However, the recent spate of similar volcanic eruptions only contributed significantly to the early formation of this gas-filled atmosphere and made the earth's surface fertile with volcanic ash, allowing the plant kingdom to proliferate quickly and further with other inorganic mineral deposits and hot springsgeothermal energy sources. Similar to how fertile paleo floodplains and deltas were created as a result of numerous past dangerous flooding events, high-potential groundwater aquifers were also created. These aquifers have been naturally recharged and discharged for thousands of years, and as a result, hold enormous amounts of safe potable water [3]–[5].

Land, water, minerals, and several other natural resources vital to our survival are a blessing to us. These natural resources were created as a result of several Earth System Processes that, although formerly immensely destructive, may now all be seen as beneficial catastrophes for the advancement of human society. When we learn that dinosaurs became extinct during the Cretaceous period for several natural causes, we can see how accurate this statement is. Now, without comprehending natural geological processes, people have begun to recognize the negative impacts of population growth and the ensuing resource extraction and pollution. Groundwater resources have been quickly and unethically exploited as a result of the expanding human population and the resulting rise in water demand, which has caused the groundwater table to decline.

Thus, the normal natural recharge that has historically occurred in that region during the monsoon is diminished or eliminated. Because of this, the groundwater table has dropped significantly in developing regions, resulting in several "induced natural disasters" such as cracks forming in massive buildings and other heavy structures, land subsidence, desertification, degradation of groundwater quality, etc. The groundwater table is rapidly declining, which is blamed for the uneven hydrostatic pressure under the earth and recent sediments that are causing the land subsidence recorded in Kolkata city. Additionally, this might trigger additional natural catastrophe sequences including earthquakes, seawater incursion, and drought. Additionally, the aggressive surface water and groundwater contamination caused by improperly disposing of both industrial and home wastes into the possible river and land systems irresponsibly without treating them has made the region vulnerable to catastrophe and health risks.

Similar to this, the essential rock recycling processes via the movements of continental and oceanic plates at various speeds and sizes constitute plate tectonics, one of the key fundamental causal elements for big catastrophic catastrophes. As a result of plate tectonics, a new lithospheric plate progressively develops on one side as a constructive component, while on the other side land deformation, collisions, and subduction occur as destructive components. Thorough knowledge of these Earth System Processes enables us to behave prudently when exploiting and using prospective resources, conserve them for future use sustainably, and identify places that are prone to certain calamities and the conditions that could trigger them [6], [7].

DISCUSSION

According to the United Nations, a disaster is a substantial disturbance of a community or society's capacity to operate that has broad effects on people, property, the economy, or the environment and is more severe than what the community or society can handle on its own. catastrophe management is the process by which we "prepare for, respond to, and learn from the effects of major failures" and cope with the human, material, economic, or environmental effects of a catastrophe. Disasters may have human causes, even though nature often causes them. The International Federation of Red Cross and Red Crescent Societies defines a catastrophe as when a risk affects individuals who are already weak. Disaster occurs when risks are combined with hazards, vulnerabilities, and the incapacity to mitigate their potential negative effects. Natural catastrophes and armed warfare have consistently triggered peaks in death and morbidity throughout human history. This study explores the improvements in public health humanitarian assistance over the last 50 years as well as the difficulties in handling natural catastrophes and armed conflict today.

Disaster Categories Natural Disasters:

The International Federation of Red Cross & Red Crescent Societies defines natural disasters as naturally occurring physical phenomena that may have either a quick or sluggish start and have an immediate impact on human health as well as subsequent effects that result in more suffering and death. These catastrophes include:

1. Earthquakes, landslides, tsunamis, and volcanic activity are examples of geophysical events.
2. Water-related (such as avalanches and floods)
3. Extreme temperatures, drought, and wildfires, for example, are climatological
4. Weather-related (such as cyclones, storms, and wave surges)
5. Insect/animal plagues and disease epidemics, for example, are biological.

The United Nations Office for Disaster Risk Reduction classifies natural disasters according to their magnitude or intensity, speed of onset, duration, and area of extent. For example, while earthquakes typically last only a short time and affect a relatively small area, droughts frequently last much longer and frequently affect much larger areas.

Virus Emergencies:

A pandemic is an outbreak of an infectious illness that has spread across a large area. It may damage both human and animal populations, disrupt services, and hurt people's health. It can also refer to the appearance of a sizable number of cases of an infectious disease in a region or population that is typically free from that disease. It may be an unusual or unexpected increase in the number of cases of an infectious disease that already exists in a given region or population. Natural catastrophes or man-made calamities both have the potential to result in pandemic emergencies. These have included the epidemics listed below:

By removing trees from agricultural lands and turning them into multi-story residential areas, building road networks, and creating other infrastructures, we rapidly expand our urban limit using the available land, water, and other earth-born resources. Combining these human efforts has reduced oxygen intake while increasing carbon dioxide output into the atmosphere. The area's temperature and climatic imbalance subsequently rose as a result of this. As a result, frequent rainstorms, flooding, and following drought conditions are caused by the unbalanced climate. Therefore, urbanization should be done effectively to protect the living environment, which incorporates some of the vital tasks, such as:

1) Site appropriateness study before any built-up land development.

2) Make sure there is intense afforestation and improve waste lands for agriculture as alternatives to deforestation and agricultural land conversion.

The installation and proper operation of waste water treatment plants, the provision for the safe disposal of residues and hazardous wastes, the repurposing of treated water, the potential for proper handling of degradable and non-degradable waste, the checking for the availability of adequate and appropriate drainage systems, the installation and maintenance of waste water treatment plants, etc. The setting up and maintenance of rooftop rainwater collection systems, etc. Through these initiatives, we have a great chance of protecting the environment, averting climate-related calamities, and guaranteeing a stable way of life [8]–[10].

Population growth that is unprecedented and ongoing has increased demand for both renewable and non-renewable resources and resulted in the overexploitation of all such natural resources. As a result, in addition to the "induced natural disasters" discussed on the previous page, we also run the risk of experiencing several other catastrophes, including mine collapse, quicksand in quarries, soil erosion, and soil slump due to improper underground mine workings. Therefore, proper action must be taken for the welfare of humans, starting with an understanding of these constantly evolving Earth System Processes in general and the local morphodynamic and tectonic processes in particular, followed by the preparation of appropriate integrated plans to use resources sustainably, conservatively, and to lessen the effects of disasters. Proper integrated planning entails an integrated approach from all angles that combines various datasets from sources, such as preliminary/primary satellite image processing, satellite image interpretation, and mapping that will bring inducing parameter details to understand the Earth System Processes, monitor the situation continuously, and couple the collateral data available from the Government, Quasi-Government, and Non-Governmental Organizations.

The Geographic Information System is a key element of Geomatics technology, which serves as the ultimate platform and boon in gathering, generating, and linking digital spatial and non-spatial databases, developing models by incorporating a variety of online spatial and non-spatial inputs, analyzing them, and creating practical action plan maps that are most helpful for planners and decision-makers for quick and easy access. The other significant and adaptable techniques accessible in geomatics technology include aerial remote sensing, digital photogrammetry, and global positioning system. This study provides information on how to interpret satellite images, create digital databases, analyze data, model, and develop information systems to help readers better understand the rapidly developing and extremely practical nature of geomatics technology in disaster management activities. Decision-makers who fail to take into account the connections between catastrophes and development are failing the people who depend on them. A growing number of progressive government organizations, supported by the United. Officials from many nations and non-governmental organizations (NGOs) are evaluating development initiatives in the context of catastrophe mitigation and creating disaster recovery plans with the demands of long-term development in mind.

Consistent Development:

After decades of development attempts, the idea of sustainable development has arisen. In the past, the industrialized world's growth was centered on the production of raw materials. Before now, economic efficiency and production growth were prioritized. But since there are so many impoverished people in the developing world and because these people don't get any "trickle-down" advantages, attempts have been undertaken to actively improve income distribution. Efficiency and equality were made the dual goals as the development paradigm turned toward equitable growth.

The third main goal of development is now environmental protection. Because of this, the idea of sustainable development has grown to include three key perspectives: economic, social, and environmental. All three facets of sustainable development are in danger from natural disasters. The economic theory of sustainability is based on keeping the stock of capital (or assets) that produces the most that an individual or society may consume over a certain length of time while still being in the same financial condition as at the beginning. Natural resources and the environment's ability to absorb new technologies and natural disasters are considered assets. Thus, the depletion of natural capital is a major factor in the limitation of development. Of course, how resilient societies are to stress and shock also influences how much production is lost as a consequence of natural catastrophes.

From an economic perspective, the spread of catastrophe risk has become worse as a result of the fast-growing interconnection. Globally, the number of persons impacted by catastrophe damage is approximately 1,000 times more than the number of fatalities. Losses might, for instance, spread across the financial markets, through capital flight, the devaluation of the local currency, increased debt, etc. Developing economies are more susceptible to disruption from natural catastrophes because they are subject to the whims of global financial flows. Investment, competent governance, and social stability are essential for economic progress; however, catastrophes provide the exact opposite circumstances. Investments in natural and man-made capital are lost, which generates abrupt withdrawals; post-disaster assistance adds to the financial and administrative strain on the government. Finally, given their effects on the local area and the deaths they cause, catastrophes might be considered to be socially disruptive.

Effects of Human Behavior and Actions:

According to the social perspective on sustainable development, human behavior, and activities affect how vulnerable a population is to natural catastrophes. Thus, attempts to mitigate risks, adaptation in front of perceived danger, and more broadly, enhanced economic growth may all strengthen the resilience of socio-economic systems. Poverty and environmental fragility are mutually reinforcing. Natural catastrophes have the most devastating effects on developing nations.

The social perspective of sustainable development emphasizes the involvement of at-risk populations in developing and putting into action effective methods to minimize vulnerability since the effects of natural catastrophes are disproportionately felt by the poor. The communities must be involved in developing site-specific solutions and evaluating the effectiveness of suggested actions. Together, local governments, businesses, and communities can best carry out catastrophe preparation. Improved local awareness is crucial. It is important to recognize and comprehend how people perceive danger, to improve public consultation and communication channels, and to depend on local resources. The conventional support structure for handling crises has often been undercut by the significant changes that urbanization has brought about. Given the requirement for quick and localized reactions in the face of suddenly occurring disasters, decentralization of decision-making is crucial to the development of organizations for disaster preparation prevention, and mitigation.

Environmental Perspective:

The environmental perspective on sustainable development places a strong emphasis on maintaining the adaptability and dynamic resilience of biological and physical systems. Disasters may be beyond human control, yet human behavior has the potential to influence how likely they are to occur. Rapid shifts in economic and population trends have upset the ecological equilibrium. The danger presented by natural disasters grows when environmental deterioration brought on by human activity is not controlled. The majority of Indian cities are instances of unchecked urban growth, which has resulted in increasing runoff and severe floods. This expansion has also been accompanied by deforestation and the disposal of rubbish into rivers and canals. Many of the same acts that maintain systems' capacity for change adaptation also help them be more resilient to environmental shocks or extremes, such as natural disasters. The relationship between the depletion of natural resources and increasing susceptibility to natural disasters highlights the need of taking preventative action.

Disasters' Impact on Development:

A growing awareness that development has failed in many regions of the globe and that it is development failures that have led to an accumulation of catastrophe risks is part of the reason for the renewed interest in the political and economic dimensions of disasters brought on by natural occurrences. The hard-won fruits of years of growth are quickly undone by disasters. Natural catastrophes are becoming more frequent; since 1996, the frequency of floods, hurricanes, and droughts has increased. Many of them are predictable or reoccurring. About 256 million people were impacted by catastrophes in the years 2005–2006. Affected people are more vulnerable since they have lost their homes, jobs, and other sources of support.

Root reasons are understood: Marginalization, poverty, global warming, and environmental degradation. Disasters are more likely to strike poorer nations. 98% of the catastrophe victims from last year reside in nations with low or middle levels of human development. True catastrophe recovery is time-consuming. The time between crises is often too short to foster resilience and strengthen coping skills. The significance of taking disasters' potential, hazards, and effects into account while designing development programs has to be discussed. When catastrophe planning is included in project development, harm and interruption that may result may be avoided. This debate will deepen our understanding of the connections between development and disasters, widen our perspective on potential interventions, and provide concrete examples of how development planners might weigh the costs and advantages of these kinds of initiatives.

Interruption of Programs:

Disasters halt current projects and redirect resources from their intended use. Development activities may also be severely impacted by interrupting current initiatives to facilitate a transfer of resources from long-term programs to highly visible short-term recovery and emergency response programs. The process of development is also hampered by a catastrophic disaster's subsequent impacts. Inflation, issues with the balance of payments, a rise in government spending, and a decline in monetary reserves are some of these indirect repercussions of direct economic impact. An increase in a country's debt implies that as the cost of debt payment grows, fewer resources are available for investments in profitable ventures. The result is often a reduction in economic growth, delays in development projects, program cancellations, and incentives against new investment.

Influence on the Investment Climate:

Particularly frequent catastrophes have a detrimental effect on the motivation for more investment. To entice investors, a stable and assured environment is required. At the individual level, recurring losses from dangerous situations might deter investment in original ideas. Foreign and local investors will often be highly cautious about promoting entrepreneurial activity in an uncertain environment. The Asian region's developing nations are now under pressure to enhance their investment climate, step up initiatives to innovate and develop skills, and safeguard individuals who are susceptible to catastrophic shocks like health crises, job losses, and natural catastrophes. A significant concern is also posed by the potential for avian flu. Various nations in the area are taking action to control potential breakouts. Even though people involved in poultry production have been badly impacted, the avian flu's effects have not spread to the general economy.

The Non-Formal Sector's Effect:

The non-formal sector is particularly negatively impacted by disasters. Due to the lack of consideration for interruption in this area of the economy, the costs of catastrophes are often underestimated. Although it is not often included in national economic statistics, the non-formal sector may affect a sizeable section of the population in many nations. Because homes are often used as locations for company operations, the non-formal sector is particularly susceptible to housing damage. There will be secondary consequences from missed revenue and jobs if a local company is hampered. This industry's small businesses can be particularly vulnerable to price rises.

Political and Social Consequences:

A single threat may start a chain reaction of catastrophes in many regions of the globe. For instance, a famine brought on by drought may trigger a civil war, which in turn causes a major exodus of people. Flooding is another example, which may compel people to seek shelter across international boundaries, disrupting the balance of demands and resources and diminishing the government's capacity to handle the additional population increase. Civil unrest and turmoil may result from this in the future. Such compound risks and calamities don't have to happen one after another; they might happen at the same time. As a result, individuals may be trapped between opposing forces during a civil war and a severe drought, with little access to resources for food production or outside aid. Complex catastrophes are also becoming increasingly prevalent in a rising number of nations. A complicated catastrophe is essentially a kind of human-caused emergency in which the origin of the situation as well as the support provided to victims are constrained by significant political factors. Civil strife, which causes the political system to collapse, is the political situation that characterizes a complex emergency the most. At least one of three events occurs in such circumstances. The government becomes very skeptical of or disinterested in affected persons who have migrated from non-government to government-controlled regions. The government's capacity to aid its disaster-afflicted citizens becomes severely limited.

In actuality, a large portion of those impacted reside in ungoverned places. These are often the most vulnerable persons who are also the hardest to reach. The tragedy becomes "complex" as a result of the difficulty in providing aid caused by the dispersion or breakdown of governmental power. Agreements with all sides to the conflict are eventually required for solutions to allow aid to be given to recognized civilian noncombatants. These options can include contracts that, in essence, give up basic components of sovereignty in return for humanitarian aid.

CONCLUSION

The introduction also emphasizes the need for effective coordination and communication amongst all parties engaged in disaster management. It stresses the use of geographic information systems (GIS), remote sensing, and predictive modeling as well as other data-driven methodologies to improve disaster response and recovery operations. The ends by highlighting the significance of ongoing learning, assessing, and adapting in catastrophe management. It emphasizes the dynamic character of catastrophes and the need to revise plans and policies in light of knowledge gained from earlier occurrences. This introduction offers a thorough review of catastrophe management, including its importance and major elements. It lays the groundwork for future investigation of certain disaster management issues to foster a better comprehension of the subject and facilitate successful catastrophe risk reduction and response initiatives.

REFERENCES:

[1] Damon P. Coppola, *Introduction to International Disaster Management*. 2021. doi: 10.1016/c2018-0-00377-1.

[2] D. P. Coppola, *Introduction to International Disaster Management: Third Edition*. 2015. doi: 10.1016/C2014-0-00128-1.

[3] A. Kirschenbaum, "Review of Introduction to International Disaster Management," *J. Homel. Secur. Emerg. Manag.*, 2007, doi: 10.2202/1547-7355.1389.

[4] A. Susilawati, F. Efendi, and S. Hadisuyatmana, "Gambaran Kesiapan Tenaga Kesehatan dalam Manajemen Bencana di Puskesmas Wilayah Rawan Bencana," *Indones. J. Community Heal. Nurs.*, 2019, doi: 10.20473/ijchn.v4i1.12395.

[5] D. P. Coppola, *Introduction to International Disaster Management, Second Edition*. 2011. doi: 10.1016/C2009-0-64027-7.

[6] A. K. Doondori and Y. P. M. Paschalia, "Peran Perawat dalam Penanggulangan Bencana," *J. Kesehat. Prim.*, 2021.

[7] D. M. Neal, "Teaching Introduction to Disaster Management: A Comparison of Classroom and Virtual Environments," *Int. J. Mass Emergencies Disasters*, 2004, doi: 10.1177/028072700402200105.

[8] D. P. Coppola, "Risk and vulnerability," in *Introduction to International Disaster Management*, 2020. doi: 10.1016/b978-0-12-817368-8.00003-8.

[9] Z. Li, Q. Huang, and C. T. Emrich, "Introduction to social sensing and big data computing for disaster management," *International Journal of Digital Earth*. 2019. doi: 10.1080/17538947.2019.1670951.

[10] K. Kalavathy, "Enabling A Culture Of Disaster Preparedness: Introduction Of Disaster Management In School Curriculum - A Comparative Study Of Schools In Chennai," *Indian Streams Res. J.*, 2015.

CHAPTER 2

EARTH SYSTEM PROCESSES AND DISASTER EVENT CHAINS

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ABSTRACT:

The earth is a sophisticated system made up of several interrelated processes that affect its dynamic behavior. It is essential to know this Earth system processes to fully appreciate the cascades of catastrophic events that may have a large negative influence on human cultures and the environment. This essay tries to investigate the complex interactions and feedback loops that exist between Earth system processes and the incidence of catastrophes. We begin by delving into the basic Earth system processes, such as air circulation, ocean currents, tectonic plate movements, and the hydrological cycle, that underlie natural occurrences. We learn more about the mechanisms behind diverse geophysical occurrences, such as hurricanes, earthquakes, volcanic eruptions, floods, and droughts, by researching these processes. Next, we look at how various Earth system processes might combine and make catastrophes more likely to occur. For instance, the interaction between warm ocean currents and the atmosphere may promote the growth and intensification of tropical cyclones, which can then result in very destructive hurricanes. Similar to how tectonic plate contacts may start a seismic activity, which leads to earthquakes and ensuing tsunamis. We also look at the idea of disaster chains, which describes how one disastrous event might trigger a slew of related catastrophes. An earthquake, for instance, may cause landslides and dam collapses, which in turn cause flash floods and extensive destruction. To anticipate possible cascading effects and lessen their consequences, understanding these chains is essential for successful disaster management and response preparation.

KEYWORDS:

Atmospheric, Cyclones, Disaster, Management, Disaster Event Chains.

INTRODUCTION

Environmental Processes:

Through four processes, disaster occurrences may be lessened, completely avoided, or warned against. They are 1) comprehending the reasons and their origins, 2) identifying these susceptible areas, 3) pragmatically and precisely preparing for execution, and 4) taking precautions. It is quite easy to follow all 4 stages to manage/mitigate natural catastrophes if the persons concerned are aware of the Earth's System Processes. The creation and activities of Mother Earth are quite intriguing and significant to the map makers, planners, decision-makers, implementers, and monitoring engineers. Let's quickly examine the origins of mother Earth in this chapter as well as her normal, natural, dynamic, and cyclical activities [1].

According to the Nebular Hypothesis, a massive, hot, rotating nebula made up of spiraling clouds of dust and heavier elements such as hydrogen and helium that was ejected by a supernova began to cool and contract as a result of radiation losses, and the shockwave from the nearby supernova. The evolution of gravity is the result of contraction. The nebula began spinning more quickly to maintain angular momentum as a result of cooling and contraction. A bulged Sun with a disc of the nebula around it emerged as a consequence. However, because of the nebula's quick rotation, the centrifugal force there equals the gravitational pull, which caused a strip of the nebula's outer orbit to develop. Similar to how distinct orbital strips of the nebula were created, they were cooled and continuously contracted within.

These strips eventually gathered from collisions and subsequently condensed into spherical planets throughout time. All of the planets were created in this manner around the sun. Our Earth is closer to the Sun than the other outer planets, therefore cooling and condensation took a bit longer on our globe. Because of this, the Earth's Silica, Aluminium, Magnesium, Iron, and Nicol components had enough time to separate and settle into three circular interior layers of the planet depending on their particular gravities. The term "differentiation process" refers to the process of dividing materials into three distinct layers. The Core, Mantle, and Crust are the three layers that resulted from the evolution of our interior Earth. The core is made up of two sub-layers, namely the Inner Core and Outer Cores, and is found in the heart of our planet between 2900 and 6378 kilometers below the surface, under very high pressure and temperature conditions. Iron and nickel combine to produce a strong inner core. The Inner Core's very high-pressure causes "NiFe's" melting point to be far higher than it would otherwise be. Thus, although being at a temperature higher than that at which iron and nickel normally melt, the inner core remains solid. The Inner Core is surrounded by the liquid-like Outer Core, which has a similar makeup [2], [3].

Due to the tremendous temperature and pressure, the iron and magnesium that make up the Mantle, which surrounds the Core and is situated 100 km below the Earth's surface and extends up to a depth of 2900 km, are in a plastic or semi-solid/semi-liquid state. However, the pressure at the Mantle drops to less than half what it was at the Core. Based on the observable density fluctuations discovered by the seismic waves that were recorded and transmitted across the Earth as a result of the powerful prior earthquakes, the Mantle may be further separated into two, namely the Lower Mantle and Upper Mantle. The crust is the extremely thin layer that forms on the Earth's surface above the mantle and resembles an egg's shell. Based on the chemical components and physical characteristics acquired during its creation, it is divided into two types. First, the continental crust, which is composed of silica and aluminum, and second, the oceanic crust, which is composed of silica and magnesium. A little section of the uppermost part of the Upper Mantle and the whole Crust are included in the Crustal plate/Lithosphere, a spherical uppermost layer that may be found up to 100 km below the Earth's surface. In the Upper Mantle, between 100 and 350 km under the Crust, lies the asthenosphere. The mobile basaltic magma is created in this low seismic wave velocity zone, which is also where the volcanic chambers are situated [4].

Plate Tectonics Is An Ongoing Phenomenon On Earth:

'Convection cells' occur within the Earth as a result of the Core's very high temperature and the Crust's extremely low temperature. As a consequence, three different kinds of edges and limits have formed on the Crust's surface. Divergent, convergent, and transform margins are what they are called. It is evident that different combinations of continental and oceanic crusts are creating boundary boundaries across the Earth's surface and that plate tectonic motions are occurring over the asthenosphere. The convection cells underneath them regulate the divergent and convergent edges. A new oceanic crustal strip is created when two neighboring convection currents emerge from the deep, hot core and rise to the cold crustal surface at the diverging border. The Mid-oceanic Ridge is a long, linear vent that originated in the middle of the ocean, where magma slowly emerges as lava, cools quickly from the ocean water above it, and then rises slightly above the surrounding terrain as a ridge. The other two nearby convection cells, which are on each side, migrate toward one another and sink into the Lower Mantle as a complement and result. The crustal plates are being pushed near one another by these convection cells. The two crustal plates eventually clash. 'Convergent margin' refers to the margin where the collision of crustal plates is occurring.

DISCUSSION

Boundaries of Convergent, Divergent, and Transform:

Trenches, folded or volcanic mountain chains, and island arcs are generated on the opposing side of plate collisions. The collision of the Eurasian and Indian plates led to continental-continental convergence, which produced the Himalayan Mountains. The Indian-Australian Oceanic and Eurasian Oceanic plates collided to form the Island Arcs, which include the Andaman and Nicobar Islands. In addition to these divergent and convergent processes, transform margins also emerge when the plates are slid against one another horizontally. The convection cells under the crust, together with the size and stiffness of the plates, govern how quickly continental and oceanic plates move.

As a result of the movement of these plates, tension builds up, which is followed by a rapid release of pressure that causes seismic waves to be generated. Thus, several geohazards are naturally created, and as a result, there is a high likelihood that catastrophes may affect the human-built infrastructure and the inhabited population on these crustal plates in the form of earthquakes, tsunamis, landslides, rock falls, etc. Numerous volcanic events are occurring and have been documented at or closer to the plate edges as a consequence of plate collisions or divergence. The 'Ring of Fire' refers to these boundaries that are situated around volcanic chains [5], [6].

Plate tectonics is the study of how internal convection cells underlie the motions and collisions of crustal and lithosphere plates across the asthenosphere. Overall, the crustal plate is going through a natural process of recycling rock, either via plate tectonism or the Petrological Cycle process, which has been going on since the Earth's creation. Geologists have so begun researching crustal plate motions and deformations. The crustal plates are damaged by compression or expansion stress owing to plate tectonic movements, as previously described. The crustal plates may experience several deformations, including mountain-building, the development of fractures, and faulting, due to the constant buildup of stress conditions brought on by continental-continental collision. The term "earthquake" refers to seismic waves that are produced and propagated at high speeds by shaking the crustal rock mass during abrupt deformation in the form of faulting. The earthquake waves will create a massive calamity by destroying the buildings and features that are in their course of passage.

As a result of the tension that builds up beneath crustal plates as a result of continent collisions, the crust will attempt to respond to the strain by slowly sinking like a crawling worm and swelling up locally. A mountain range might form if one region is continually being raised. Mountain Building Processes are what this is. For instance, the Himalayas, which are currently being compressed by plate tectonic forces, acquire height at a rate ranging from 6 to 12 millimeters every year. Additionally, the whole Indian Plate undergoes spinning, arching, and deepening processes that run counterclockwise to the direction of its movement, i.e. along the East-West axis. If up lift ment occurs, soil erosion and groundwater level decline would be exacerbated. There will be significant deposition of eroded materials along the deep or subsiding regions. Due to normal plate tectonic movements, similar geohazards like seawater intrusion, groundwater pollution, groundwater movement, polluted plume direction change, sea level decline, etc., are also expected forever in various parts of our Earth's surface. As a result, disasters naturally occur as a result of these geohazards. Scientifically known as "Isostasy," this term refers to the natural vertical adjustments of continental crusts depending on their thickness and density that occurred during or after the deformation of the crustal plate caused by plate tectonic activities. As a result, different geomorphic landforms have been created and are categorized according to their elevations and the agents.

Processes and Agents in Geomorphology:

Glacier, Tectonism, Denudation, Aeolian, Fluvial, Coastal, and Marine are the principal and important agents of geomorphological processes that may increase susceptibility to catastrophe, and their simple or multiple combinations are also effectively work upon and altering the Earth's Crust. These geomorphic agents are still at work, causing many catastrophes as they create various landforms. Therefore, it is crucial to understand the geomorphic landforms and their susceptibility to different catastrophes in addition to the resources that are created by geomorphological processes. For instance, the most dangerous characteristics in heavily glaciated locations include glacial avalanches, snowmelt flow, Lahar, and fissures. Fault scarps may be seen on the fault plane and escarpment slopes of Block Mountain, which was formed by the tectonic geomorphic process. These locations are very susceptible to extreme landslides, rock falls, slumps, and soil erosion [7], [8].

Similar to how various susceptible slope characteristics arise as a result of denudational processes, calamities including soil erosion, landslides, rock falls, and rock slumps may happen. Dunes, fast-moving sandstorms, and desertification are all effects of the aeolian geomorphic landforms, which are putting a lot of people at risk. Fluvial geomorphic processes have a variety of negative effects on the environment, including erosion, whirlpool creation, rapid sand production, water stagnation, pollution, and flooding. Again, fast sands, coastal erosion, wavy whirlpools, strong cyclonic storms, and floods are the calamities that might occur due to coastal geomorphic processes. Along with the Earth's self-revolution, axis tilt, and orbital motion around the sun, the combined action of the many aforementioned geomorphic agents will play a highly hazardous role in determining local climates and swiftly altering the pace of geomorphic processes. To put it simply, several calamities occur sequentially, one after the other. The same is covered later in this chapter under the heading "Disaster chains".

Oceanic and Atmospheric Circulations on Earth:

The Atmospheric and Oceanic Circulations, in addition to the various Plate Tectonic movements and geomorphological processes, are thought to be the primary determining factors for the current local climatic variations and, consequently, the climate-related disasters caused by cyclones, hurricanes, typhoons, etc., as well as ocean accidents and the destruction or sinking of passenger ships and cargo ships. There are three different kinds of cells cycling on the Earth's atmosphere to balance the heat variance created by the latitude effect, much like the deep beneath "Convection Cells" that have caused Plate Tectonic motions on the Earth's Crust. The direct solar radiation striking the region between the Tropics and along the Equator causes significant heating during the summer solstice. On the other hand, the strong oblique solar radiations will only provide relatively weak thermal energy to the Polar Regions. The reason is that it takes a lot of time for solar radiation to travel through the atmosphere and reach the poles due to heat energy being lost via reflection, scattering, absorption, and refraction. Cyclones, typhoons, and hurricanes were brought on by the localized severe fluctuations in atmospheric circulations. The same outcomes and mishaps are brought on by marine circulations as well.

The Space Shuttle Endeavour may be seen in the background of the barrier between the Earth's stratosphere and mesosphere in a space shot taken by an astronaut from the

International Space Station. The troposphere, which is an orange-colored layer just above Earth's surface, is where all of the weather and clouds that we generally see and feel are created and confined. The white Stratosphere is located above this layer of orange color, while the blue Mesosphere is located much higher. There is a depiction of the space above the Earth's surface on the right side of the picture. This provides information on the heights, the many layers of the atmosphere, and the numerous natural and human activities taking place above the Earth.

Solar Flares And Variations In The Radiation The Sun Produces:

Due to several geometrical interactions between the Earth and the Sun, the Earth's rotation, and spatial variations in the Earth's atmospheric transparency, there is a chance that the intensity and duration of incoming solar radiation might alter. There will be a noticeable climatic disorder and this might lead to climatic catastrophes due to variations in the intensity and duration of incoming solar radiation onto the Earth's surface [9], [10].

Orbital Revolution Around The Sun And The Universe, And Self-Rotation:

The main causes of the various geometrical connections between the Earth and the Sun are variations in the Earth's orbital parameters, including variations in the tilt of the Earth, differences in the time of aphelion and perihelion, and variations in the shape of the Earth's orbital path. The intensity and duration of the increasing/decreasing variations in solar radiation are significantly impacted by these changes in the geometrical relationships between the Earth and the Sun, which in turn affects the normal climate and becomes one of the major causes of climate change and related disasters. Additionally, the Earth has several records of palaeoclimatic shifts and paleo disasters. Studies on palaeoclimate demonstrate that Polar Reversals, changes in the inclination of the Earth's axis, and changes in the configuration of the Earth's and Sun's orbits are to blame for variations in Perigee and Apogee. Additionally, it is discovered that the Earth's axis spins and experiences precession. It takes 26,000 years for the Earth's axis to precess. Additionally, it is expected that in 12,000 years, the Earth's axis of rotation would align with the star Vega. The Earth's climate is primarily influenced by these facts, which also account for other connected calamities and climatic disasters.

Disaster Recurrences in a Chain:

Due to any of the Earth's dynamic and cyclical natural processes at first, two or more catastrophes may occur one after the other continually as a sequence with or without a set amount of time in between. 'Disaster Chain' is the term used to describe this. For instance, it is important to realize that every monsoon brings about a major chain of disasters in our nation, which is accelerated by heavy rainstorms, flooding, the spread of infectious diseases like cholera and diarrhea, and accidents that are related to these factors. A Chinese perennial river known as Tangjiashan had its regular flow stopped by a landslide brought on by an earthquake in May 2008. The debris that was deposited across this river by a landslide had served as a substantial earthen dam. As a consequence, Quake Lake was created upstream from the site of the landslide. On June 6, 2008, the water level of the earthquake lake rose to a height of 738.71 meters, indicating that the temporary earthen dam's breaking point had been achieved. The additional instances of catastrophe chains are floods caused by river diversion, explosion, and fire incidents owing to broken home gas supply/distribution lines, and earthquake damages followed by these. A lot of the calamities might lead to successively worse disasters, making the terrible conditions much worse in certain places.

Research on Disaster Risk Has Improved:

The fundamental parts of disaster risk research include hazards, disaster, disaster risks, and disaster response. In this section, we discuss the significant scientific advancements in this area, as well as integrated studies.

Disaster Risk Science Hazard Study:

Hazard analysis has long been a key component of catastrophe risk science study. Their main goal is to enhance forecasting capacity and accuracy, which will then increase the efficiency of early warning. They do this by helping us understand the origins and mechanisms by which dangers develop. Seismology, meteorology, geology, hydrology, biology, and geography researchers have carried out extensive, systematic studies on the dynamics, causes, and development processes of many natural disasters. Transdisciplinary, comprehensive studies have also been done on earthquakes, tropic cyclones, landslides, debris flows, floods, diseases and pests, wildfires, droughts, land degradation, and desertification in addition to systematic studies within single disciplinary domains. Hazard studies were considerably sparked by the advent of the IDNDR. The Natural Hazards, Environmental Hazards, Natural Hazards Review, and Natural Hazards and Earth System Sciences publications, among others, were also launched. Numerous works on hazards are also available, including the bilingually published Recent Studies in Geophysical Hazards, Natural Hazards, and the Atlas of Natural Disasters in China.

Recent developments in the field of hazard research include for instance, improved early-warning systems and a deeper knowledge of earthquake occurrence, which has been achieved by linking small earthquakes to large ones. Other examples include how tropical cyclones and storm surges are affected by global warming and the increasing sea level, and how this affects the migration of coastal inhabitants. Early-warning systems have been prompted by the links between climate change and hydro meteorological hazards and their secondary hazards, which mainly focus on the changing frequency and severity of disasters induced by climate change. The relationship between climate change and environmental risks like droughts, wildfires, land degradation, and desertification, focusing in particular on the cryosphere change in higher elevation regions and its corresponding impact on the water supply of oases in arid basins. In addition to this research on a single risk factor, multi-risk factors, risk chains, cascade risks, and risk compounds are receiving more and more attention.

Disaster Study in Disaster Risk Science:

Studies on risks have been complemented by studies on disasters, with the latter's emphasis on the process by which losses develop and the assessment of catastrophe losses and effects. A lot of focus has been placed on the crucial roles that socioeconomic and human variables play in the development of catastrophes as well as how they amplify the consequences of environmental and natural hazards. The development of this area has been supported by journals like Progress in Disaster Science, the Journal of Catastrophology, and Disasters.

The global impact of volcanic eruption, the spatial-temporal distribution of urban heat wave exposure and loss, climate change and flood vulnerability, the socioeconomic impact assessment of climate change, and the harm caused by climate extremes to road infrastructure and transportation are just a few examples of key topics in this field that have been frequently published in the journals mentioned above. This research have considerably advanced disaster risk science and greatly enhanced the methodologies and models available for catastrophe loss assessment, especially for disasters connected to climatic trend impacts and climate change.The Environment as Hazard, Major Natural Disasters in China and the

Mitigation Countermeasures, Disasters by Design, the Atlas of Natural Disaster Systems of China, which is available in a bilingual Chinese and English edition, At Risk: Natural Hazards, People's Vulnerability and Disasters, and Natural Disasters in China, among many other significant books, have all been published in this field. These publications have largely focused on the connections between resource exploitation and natural hazards and disasters from the viewpoint of human activity and have paid close attention to the role of human and socioeconomic factors in the formation of disasters. All of these publications have made significant contributions to the advancement of disaster risk science research.

Disaster Risk Science Risk Study:

To address the pressing demands of risk reduction, research on hazards has extended catastrophe studies, with a focus on disaster risk assessment, simulation, and governance strategies. The focus of risk analysis has been on catastrophe risk modeling and mathematical models. Systematic research on disaster risk has also been published in other journals, including Geomatics, Natural Hazards & Risk, and Jàmbá: Journal of Disaster Risk research. In 2010, the International Journal of Disaster Risk Science was established in China, which officially used the phrase "disaster risk science. Recent improvements in risk analysis include, among others, seismic risk simulation using scenario ensembles and risk reduction, global trends of tropical cyclone risks, socioeconomic and climatic controls on coastal flood risks, climate change, and global flood risk and its reduction, avalanche risk, wild fire risk, and multi-hazard risk. Concerns around networked risk, compound event risk, crop coordinated failure risk, and other dangers have grown.

Integrated Catastrophe Risk Modeling, Hazards, Risks, and Disasters in Society, The Social Roots of Risk: Producing Disasters, Promoting Resilience, the World Atlas of Natural Disaster Risk, and Risk Modeling for Hazards and Disasters, among many others, are just a few of the books published in the risk field. Representative works in the context of China include the Atlas of Natural Disaster Risk of China, Mountainous Disaster Forming Mechanism and Risk Control in Wenchuan Earthquake, Integrated Risk Governance: Science, Technology and Demonstration, Integrated Risk Governance, the Atlas of Environmental Risks Facing China Under Climate Change, Disaster Risk Science, and others. These articles have significantly advanced disaster risk science research in China and around the world, deepened our understanding of disaster risk, especially as it relates to climate change, multiple hazards, disaster chains, and disaster compounds, and support risk mitigation strategies with scientific evidence.

Study of Disaster Response in Disaster Risk Science:

The two pillars of disaster response are prevention, preparedness, emergency response, recovery, and reconstruction, and the combination of prevention, consilience, relief, and integrated disaster risk governance for regional disasters. The response system for individual disaster events consists of prevention, preparedness, emergency response, recovery, and reconstruction.

Several scientific projects have been initiated, several new scholarly journals have been established, and new research outputs in the form of journal articles and books have been produced in response to the United Nations' demand for global hazard mitigation, disaster reduction, and DRR. The Integrated Research on Disaster Risk initiative was introduced by the International Council for Science in 2008. The Integrated Risk Governance core science project was started by the International Human Dimension Program. IRG officially registered for the Future Earth initiative in 2015. Geological Hazard and Control, Disaster Prevention and Management, the Journal of Flood Risk Management, the International Journal of

Disaster Resilience in the Built Environment, and the International Journal of Disaster Risk Reduction are a few typical academic publications in this topic. These publications have given a scholarly discourse on catastrophe response crucial forums. Recent advancements in the study of disaster response, for example, have concentrated on: the importance of readiness in disaster response; optimization of emergency coping resources; emergency relocation and social capital; and so on. Other studies call for effective adaptation to climate change to lower the risk of disasters, particularly increased private sector adaptation, prevention capacity improvement in the wildland-urban interface and coastal regions, protection of the environment and ecosystem services, and modifications in human exposure in quantity and distribution.

CONCLUSION

We learn a lot about the interconnections and fragility of our planet by looking at the processes that make up the Earth system and how they fit into the sequences of catastrophic events. The development of proactive plans for disaster risk reduction, early warning systems, and resilience-building measures may be assisted by this information when emergency management workers, scientists, and policymakers are involved. In conclusion, the incidence and size of catastrophes are significantly shaped by processes inside the Earth system. We may work to reduce the negative effects on both human populations and the environment by appreciating the complex interactions between these processes and the chains of catastrophic occurrences. In addition to contributing to current catastrophe research, this study intends to provide the groundwork for sensible decision-making about disaster risk reduction and management.

REFERENCES:

[1] A. Mignan and Z. Wang, "Exploring the space of possibilities in cascading disasters with catastrophe dynamics," *Int. J. Environ. Res. Public Health*, 2020, doi: 10.3390/ijerph17197317.

[2] M. Jia, Y. Zhang, T. Pan, W. Wu, and F. Su, "Ontology Modeling of Marine Environmental Disaster Chain for Internet Information Extraction: A Case Study on Typhoon Disaster," *J. Geo-Information Sci.*, 2020, doi: 10.12082/dqxxkx.2020.190765.

[3] V. Herrera-Cruz and F. Koudogbo, "TerraSAR-X rapid mapping for flood events," *Proc. Int. Soc. Photogramm. Remote Sens. (Earth Imaging Geospatial Information), Hann. Ger.*, 2009.

[4] G. Zhang, L. I. Sanzhong, A. Guo, and Y. Suo, "West Pacific and North Indian Ocean Seafloor and Their Ocean-Continent Connection Zones: Evolution and Debates," *Acta Geol. Sin. (English Ed.*, 2017, doi: 10.1111/1755-6724.13464.

[5] A. Mitra, *Sensitivity of mangrove ecosystem to changing climate*. 2013. doi: 10.1007/978-81-322-1509-7.

[6] A. Mitra, "Climate Change and Its Impact on Brackish Water Fish and Fishery," in *Sensitivity of Mangrove Ecosystem to Changing Climate*, 2013. doi: 10.1007/978-81-322-1509-7_6.

[7] W. Lestari, "Pengaruh Pelayanan Promosi dab Syariah Terhadap Minat Nasabah Dalam Memilih Asuransi Syariah (Studi pada PT.Asuransi Takaful Keluarga Cabang Palembang)," *J. Chem. Inf. Model.*, 2019.

[8] M. Hermelin, "Responsability of the colombian departments of geology in the process of building environmental culture in universities," in *XIV Congreso Latinoamericano de Geología y XIII Congreso Colombiano de Geología*, 2011.

[9] C. K. Tham, "SensorGrid architecture for distributed event classification," in *Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications*, 2007. doi: 10.1007/3-540-37366-7_5.

[10] A. D. Khuluq and R. Hamida, "Peningkatan Produktivitas dan Rendemen Tebu Melalui Rekayasa Fisiologis Pertunasan," *Paper Knowledge . Toward a Media History of Documents*. 2017.

CHAPTER 3

AN OVERVIEW OF CLASSIFICATION OF DISASTERS

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ABSTRACT:

Disasters can seriously damage infrastructure, the environment, and human lives. The many forms of catastrophes and their distinctive features must be well understood to implement effective disaster management. The goal of this study is to improve our comprehension of disasters and enable better preparation, response, and recovery activities. It does this by providing an overview of the categorization of disasters. The research also examines other criteria for categorizing catastrophes, such as their temporal characteristics and the magnitude of their effects. It is necessary to differentiate between sudden-onset catastrophes, which happen suddenly and without warning, and slow-onset disasters, which take time to develop. For the implementation of suitable response methods and the efficient allocation of resources, it is essential to understand the temporal elements of catastrophes. Disasters may also be categorized according to where they occur, from local or regional occurrences to worldwide catastrophes. To coordinate international efforts and provide assistance where it is most needed, it is helpful to be aware of the geographical dimensions.

KEYWORDS:

Cyclones, Classification of Disasters, Earthquakes, Environment, Human Lives.

INTRODUCTION

The majority of Earth's tragedies are caused by the planet's natural, dynamic, cyclical, and renewing processes. Plate tectonics is one of the significant Earth's natural dynamic processes that was briefly discussed in the preceding chapter. The physical and chemical breakdown of rocks, weathering, and mass wasting of rocks are other obvious natural processes. Once the granite has been weathered, it will naturally be transported to low-lying places by processes including erosion, transportation, and deposition by a variety of forces like wind, glaciers, water, and ocean waves and currents. Numerous essential non-renewable resources for living things, such as rich soil, aquifers, hydrocarbon reserves, etc., are formed as a result of these natural processes [1].

Due to the wide variety of dangers and their varied effects, categorizing catastrophe is a challenging undertaking. This study offers a methodical way of classifying catastrophes according to their source, including technical, natural, and complex situations. Natural catastrophes include climatic events like storms, floods, and droughts as well as geological occurrences like earthquakes, volcanic eruptions, and tsunamis. Industrial accidents, nuclear accidents, and transportation mishaps are examples of technological catastrophes that entail infrastructure breakdowns or accidents. Situations resulting from military wars, social unrest, or humanitarian catastrophes are referred to as complex emergencies. As a consequence, the placers of heavy minerals such as ilmenite, garnet, gold, diamonds, etc. were also created. But along with these natural occurrences come natural catastrophes like landslides, earthquakes, floods, lahars, snow avalanches, etc. The calamities that result from continuous natural processes are hence referred to as natural disasters [2].

On the other hand, the wrong kind of human interference with nature throughout human progress has increased the frequency of natural catastrophes. They fall under the category of Natural Disasters Caused by Humans. This chapter provides a general overview of how catastrophes might be categorized to comprehend their causes and origins, which will help decision-makers choose the most effective mitigation and management strategies. The following are the two crucial factors that should be taken into account when categorizing disasters:

1. The interval between the occurrence and

2. Establishing conditions for the occurrence.

According to how quickly they happen, natural disasters may be divided into two categories: (1) Rapid Occurring Disasters and (2) Slow Occurring Disasters.

Emerging Disasters Quickly:

'Rapid Occurring catastrophes' are defined as catastrophes that might happen quickly and would inflict immediate destruction in the region. Earthquakes, Landslides, Glacial Avalanches, Volcanic eruptions, Asteroid Impact, tsunamis, Dust storms, etc. are a few of the Rapid Occurring Disasters. Even though some of the catastrophes in these cases would completely devastate a region in a matter of seconds, their velocities and points of origin may be used to foresee them in advance. For practically all catastrophes, academics from throughout the world have developed similar disaster prediction skills. The planners should have a preplanned setup with well-trained officials/volunteers and informed people about all these plans in advance to handle these Rapid Occurring Disasters. Many cutting-edge mapping methods for disaster-prone areas are being established employing the most recent developing capabilities offered by geospatial technology. Natural Hazard Vulnerability Maps for the whole nation, as well as mitigation and/or management plans, should have been established well in advance for all of these Rapid Occurring Disasters. The appropriate and previous training of the concerned individuals/officials should come after it. The Government may also put the preventative strategies recommended for various locations into action with the use of the Rapid Occurring Natural Hazard Vulnerability maps. For instance [3].

To prevent landslides, trash and rock hang along hill slopes may be geo textilized, nailed, or removed. Refusing to get permits for large development projects near disaster-prone zones. Preventing excessive groundwater use and ongoing observation of hydrostatic pressure imbalances caused by the groundwater table's rapid decline, which can cause land subsidence, more seismic activity, or seawater intrusion into potable aquifers beneath coastal cities and towns, making them salinized. Active fault planes that run alongside vulnerable and disaster-prone locations are grouted with concrete. Locating secure and substitute locations for upcoming constructions, etc. Additionally, the erected structures and their operational status should be continuously monitored so that Rapid Occurring Natural Disasters may be swiftly managed.

Slow-Moving Catastrophes:

The category of "Slow Occurring Disasters" may be used to describe catastrophes that might take some time to occur. For instance, 'Slow Occurring Disasters' might include things like soil degradation, drought, desertification, coastal erosion, ozone depletion, coral reef decline, unbalanced greenhouse effect, etc. Although each catastrophe in these cases caused a distinct kind of damage, its effects might still be felt over time. However, since catastrophes caused by soil erosion or drought develop extremely gradually and consistently, it is simple to foresee the target locations and potential types of destructions far in advance of their occurrence. As a result, it is crucial to create vulnerability maps relevant to a certain catastrophe along with mitigation strategies based on provoking criteria. The appropriate mitigation structures should have been regularly maintained to ensure that these catastrophes are averted or mitigated. The mitigation strategies may have been executed correctly.

DISCUSSION

Classification of Disasters Using Inducing Parameters:

Various types of natural disasters, such as earthquakes, volcanoes, landslides, tsunamis, floods, land subsidence, heavy rains, drought, forest fires, etc., are caused by the natural destruction component of dynamic and cyclic geosystem processes. The destruction of non-renewable natural resources as a result of human meddling in the Earth's natural processes has been completely ignored throughout the previous two decades. Humans engage in a variety of interfering and nature-destructive actions, including as cutting down trees for building projects, overusing groundwater, and contaminating potential lands, river systems, groundwater aquifers, and seas. As a consequence, we have been dealing with several natural catastrophes that these manmade interventions have caused, including [4]:

1. Due to toe removal, there have been landslides, land slips, and rock falls along ghat road portions.

2. Soil erosion that is severe in a deforested region,

3. Anonymous floods in towns and cities due to improper drainage,

4. In locations with pollution and excessive groundwater use, there is desertification and land subsidence.

5. On the other hand, certain calamities like stampedes, pollution, accidents, etc. are happening due to human mistake alone.

At the conclusion of the Cretaceous era, some 67–66 million years ago, our nation had a quiet volcanic explosion, a natural hazard that may have contributed to the extinction of dinosaurs in India. Additionally, this eruption was responsible for a 2 degree Celsius average decrease in climate change. In the Andaman and Nicobar Islands, the one and only volcano on Barren Island recently erupted from September 2010 to January 2011. However, since the island is uninhabited and bleak, this volcanic eruption occurrence was not classified as a natural catastrophe. On the other hand, on February 6, 2014, the Sinabung volcano had just erupted. The 10 square kilometer fertile plantation region on the down slopes had been consumed by the pyroclastic flows, or the hot lava flow, and 15 people of the hamlet Sukameriah had been killed. An ash plume emanating from a volcanic vent and flow deposits can be seen on the southeast slope of Sinabung's summit in the natural-color satellite picture taken by the Advanced Land Imager on the Earth Observing-1 spacecraft. Even today, this volcano continues to pose a daily danger to the more than 30,000 people of the adjacent settlements. Volcanic eruptions are a byproduct of the Earth's continuing natural Plate Tectonic processes. Some of the forms of Plate Tectonic motions creating such volcanoes include melting of sub ducted crustal plates, development of new oceanic crust along Mid-oceanic ridges under the thick column of sea water, and movement of crustal plates over the hot spot locations on the Earth's surface.

Earthquake:

Similar to the volcanic eruptions brought on by the ongoing natural Plate Tectonic activity on Earth's surface, earthquakes are mostly the outcome of the same cause. The three types of seismic waves known as "Primary, Secondary, and Love waves" are propagated in all directions as a result of the sudden release of pressure caused by plate tectonic movements that continue to build up pressure on the crustal plate until the tolerance limits of the rocks [5]. The locations where the strength of these waves travels is particularly high and the ensuing calamity known as an earthquake will be hardest impacted by the complete collapse of structures. Along with crustal plate breaks, other natural events like volcanic eruptions, massive rock falls or landslides, land subsidence, debris avalanches, and snow avalanches have also caused earthquake waves to be produced. These waves have been observed traveling across the globe at varying intensities. Focus is the area where the deep underground seismic waves first began to spread. The Epi center is a surface location directly above the Focus.

Aerial photograph of the San Andreas Fault and block diagram depicting the rupture of the crust and displacement along the fault line that results in rapidly propagating earthquake waves from the epicenter, which is the point immediately above the origin point at the subsurface, are shown. From this epicenter point, it is possible to compute the distances, the extent of habitation damage, the time required for different seismic waves to travel, and the power dissipation of seismic waves over distance for various earthquake intensities in various locations. Plans are created to prepare for future earthquakes using this knowledge. Therefore, the majority of earthquakes are solely caused by natural processes. However, major development projects on weak zones, where fault planes and lineaments are weaker, have sometimes resulted in earthquakes as well. The topic of "Natural Disasters Induced by Human Interventions" is covered individually in the paragraphs that follow.

Landslide:

A number of natural slope failure mechanisms, including weathering, soil erosion, rainfall, strong winds, earthquakes or mild tremors, a lack of vegetation along hill slopes, and hydrostatic imbalance inside the hill slopes, may result in landslides. Overall, natural landslides may be caused by rainfall, cyclic and regular geomorphic processes, and their agents, such as processes that form mountains. Based on the kind, rate, and direction of the materials involved in the slide, many terms for landslides include soil creep, land/soil slip, translational slip, rock/debris slump, rock/debris fall, etc.

Cyclone:

The English term "Cyclone" is derived from the Greek word "Cyclos," which means "coils of a snake." One of the most significant natural disasters brought on by low pressure developing over the ocean's surface is the cyclone. Due to its low density, the low pressure that developed over the tropics as a result of the warming of the ocean's surface water and the consequent formation of hot, humid air near the surface will begin to rise. In that surface region, a low-pressure surface therefore forms. Little pockets of high-density air from the surrounding region will travel into the low-pressure area to equalize the pressure, where they will then warm up and rise above. Because of the extremely low temperatures that prevail at high altitudes, the hot, moist air cools and condenses to form clouds, which are then moved laterally at certain heights by the Coriolis effect, either clockwise over the northern hemisphere or anti-clockwise over the southern hemisphere. At the center, this movement creates an eye. Cyclone is the name given to it once circulation picks up quickly.

Flood:

Natural rainstorms, intense rain, and cyclonic cloud bursts deliver enormous amounts of surface water as floods and devastate low-lying areas by inundating them and wiping away all the resources and assets along their flow paths. Flash floods, dam failure floods, overland floods, coastal zone floods, estuarine floods, cloud burst floods, snow melt floods, lehar, single event floods, multiple event floods, and seasonal floods are some of the several kinds of floods that may occur. The visible, infrared, and microwave satellite sensors used to image the flooded Earth's surface provide all the information required for mapping flood-sensitive regions, damage assessment, and flood-causing factors. False Color Composite images from the Wide Field Scanner instrument mounted on the Indian Remote Sensing Satellite show the flood-affected regions as blue [6], [7].

Earth Erosion:

Although soil erosion is a slow-moving natural calamity, its damaging effects over time have long been acknowledged. The disastrous effects of soil erosion in terms of fertility loss and loss of soil itself in enormous quantities, land, and forest degradation, surface temperature increase and desertification, reservoir siltation and pollution, loss of storage capacity of reservoirs, damages to the turbine blades of hydro-electric power dams by the eroded soil, and severely impacting agricultural lands and settlement areas where wind activity is dominant by piling up the eroded sand as a result of wind activity In various locations of Tamil Nadu, all these destructions caused by soil erosion may be seen. To map regions of active soil erosion, susceptible areas of soil erosion, and inducing characteristics of soil erosion, geo informatics technology is very helpful.

Tsunami:

The tsunami, or very large sea waves, is one of the most dangerous natural catastrophes that may occur near coastlines. Multiple natural events, including undersea earthquakes brought on by plate tectonic movements, coastal landslides, submarine landslides, submarine volcanic eruptions, and snow avalanches along the shore, all contribute to tsunamis. But indirectly, the abrupt climatic change brought on by human growth might result in glacier avalanches and snowmelt near coasts that are at risk for tsunamis.

Natural Disasters Brought On By Human Activity:

Caused an Earthquake:

We are now aware of earthquakes via the media owing to reservoir-induced seismicity, land subsidence-based earthquakes, incorrect heavy constructions in soft soil locations, and tremors. If human development operations are carried out incorrectly in seismically sensitive places without knowing the current terrain characteristics, earthquakes will be produced. The Koyna dam in Maharashtra state, which was built on vulnerable crisscrossing fault planes and lineaments, is one of the best-known examples of a reservoir-induced earthquake.

Landslide Caused:

Landslides have occurred as a result of the delicate toe removal along hill slopes for ghat road construction. As an example, because of inappropriate human interaction with nature, landslides like as the Marappalam landslide, uphill Ghat road side landslides all throughout Tirumala hills, as well as along Ooty, Kodaikkanal, and Himalayan ghat road sections, have become common catastrophic occurrences.

Created a Flood:

Breeched bunds and induced floods may be caused by inadequate drainage systems, poor maintenance of river bunds, sewer and canal networks, tanks, and reservoirs to prevent siltation, choking, and failure, improper storage and discharge of reservoir water, and encroachment on and blocking of tanks and lakes by agricultural activities and constructions. The temporal Radar SAT data in Nepal vividly shows the flow of flood water that has leaked out from a lake bund on the upstream side, as well as the flooded regions and time of flooding.

Substantial Soil Erosion:

As a result of weathering and transportation mechanisms, soil erosion naturally occurs exclusively in arid elevated places. But human interference with nature, such as clearing trees from plains, slopes, and hill sides, starting fires in forests, building unauthorized infrastructure, and misusing property, is severely causing soil erosion [8].

Assisted Drought:

Naturally, drought may occur in regions with strong solar radiation, such as the tropics, where groundwater is heavily drained via leaky aquifers, leading to deeper groundwater levels, in regions where tectonic emergence causes deeper water levels, etc. However, excessive and incorrect groundwater extraction, obstruction of natural groundwater aquifer recharge, air pollution from human development activities, interference from nature, and the ensuing rise in local area temperature may all contribute to drought.

Specifically Man-made Disasters:

Pollution of the Environment:

Humans' improper residential and industrial waste dumping onto prospective lands and river systems caused catastrophic pollution and the irreversible degradation of critical resources including the air, soil, surface water, and groundwater. Therefore, we must recognize and halt the violent actions that have caused environmental damage.

Atomic mishaps and armed assaults:

Weapons and missiles will be handled for destruction by war troops, terrorist attacks, or defensive operations. Additionally, certain human error-related mishaps, such as nuclear accidents, can cause numerous catastrophes for both people and the environment.

Stampedes:

A stampede may result from inadequate entrance, departure, and crowd-handling routes as well as sudden anxiety brought on by a few incidents among a throng. In India, religious gatherings seem to be when stampedes happen most often. Monitoring and locating the locations where pressure is building up in a dense, moving crowd is crucial to avert stampedes. For instance, the Sabarimala temple region in Kerala has been classified as having risky zones for the occurrence of human stampedes. These places include dead ends, small roads, areas with inadequate infrastructure, no light, no drinking water, and insufficient police presence in crowded areas. Therefore, it is crucial to take into account all of these circumstances, identify the areas that need special attention, and take the appropriate preventative measures as soon as possible before such religious gatherings. To avert a human stampede, it is crucial to develop real-time information and communication amongst emergency departments.

CONCLUSION

The usefulness of disaster categorization in terms of catastrophe risk reduction, emergency preparedness, and response activities. Authorities may direct their preparation measures to particular dangers and vulnerabilities by classifying catastrophes, resulting in a more focused and effective strategy. Researchers can examine trends and patterns in the incidence and effects of disasters thanks to classification, which also makes it easier for knowledge and lessons gained to be shared across other countries. The categorization of disasters provides a useful framework for comprehending the wide variety of dangers and their repercussions, to sum up. We may improve our planning, response, and recovery efforts by grouping catastrophes according to their geographical scope, temporal character, and point of origin. This study offers an introduction to disaster categorization, adding to the continuing conversation about disaster management and promoting a more proactive and knowledgeable approach to lessen the effects of catastrophic occurrences.

REFERENCES:

[1] T. Lukić *et al.*, 'Classification of natural disasters between the legislation and application: Experience of the Republic of Serbia', *Acta Geogr. Slov.*, 2013, doi: 10.3986/AGS53301.

[2] I. M. Shaluf, 'Disaster types', *Disaster Prev. Manag. An Int. J.*, 2007, doi: 10.1108/09653560710837019.

[3] W. Manopiniwes and T. Irohara, 'A review of relief supply chain optimization', *Industrial Engineering and Management Systems*. 2014. doi: 10.7232/iems.2014.13.1.001.

[4] L. K. Siebeneck and T. J. Cova, 'The disaster return-entry process: a discussion of issues, strategies and future research', *Disaster Prev. Manag. An Int. J.*, 2021, doi: 10.1108/DPM-07-2020-0243.

[5] L. Wolfrom and M. Yokoi-Arai, 'Financial instruments for managing disaster risks related to climate change', *OECD J. Financ. Mark. Trends*, 2016, doi: 10.1787/fmt-2015-5jrqdkpxk5d5.

[6] W. Ejaz, A. Ahmed, A. Mushtaq, and M. Ibnkahla, 'Energy-efficient task scheduling and physiological assessment in disaster management using UAV-assisted networks', *Comput. Commun.*, 2020, doi: 10.1016/j.comcom.2020.03.019.

[7] M. D. Vaverková *et al.*, 'Municipal solid waste management under Covid-19: Challenges and recommendations', *Environ. Geotech.*, 2021, doi: 10.1680/jenge.20.00082.

[8] T. Habig, R. Luke, S. Gehlhar, T. Sauerland, and D. Tappe, 'A consolidated understanding of disaster community technologies', in *Proceedings of the International ISCRAM Conference*, 2021.

CHAPTER 4

APPLICATION OF GEOMATICS TECHNOLOGY FOR DISASTER VULNERABLE AREA MAPPING, MITIGATION, DAMAGE ASSESSMENT AND MANAGEMENT

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ABSTRACT:

Disasters pose significant threats to human lives, infrastructure, and ecosystems. The effective management and reduction of disaster risks require accurate mapping, mitigation strategies, damage assessment, and efficient management practices. Geomatics technology, which integrates various remote sensing, geographic information systems (GIS), and global positioning system (GPS) tools, offers valuable solutions for addressing these challenges. This study provides an overview of the application of geomatics technology in disaster-prone areas, focusing on vulnerability mapping, mitigation measures, damage assessment, and comprehensive management. Vulnerability mapping is a crucial step in disaster risk assessment, aiding in the identification of areas that are susceptible to various hazards. Geomatics technology provides a robust framework for collecting and analyzing spatial data, allowing for the integration of diverse datasets such as topography, land cover, population density, and infrastructure distribution. By utilizing remote sensing techniques, GIS, and GPS, geomatics technology enables the identification and characterization of vulnerable areas, contributing to informed decision-making for disaster mitigation and preparedness planning.

KEYWORDS:

Geomatics Technology, Disaster, Mitigation, Management, Vulnerable Area Mapping.

INTRODUCTION

Disaster management encompasses many different elements, including mapping disaster-sensitive areas, analyzing the kind and severity of the causative factors involved, planning for mitigation or prevention, evaluating the disaster's damages, and rehabilitation. Determining the elements that trigger disasters based on manmade actions and natural processes is crucial. Recent studies have sought to define the ratio of the two kinds of inducing characteristics so that more precision, appropriateness, and practicality in planning for mitigation, or even the elimination of an area's susceptibility to catastrophes, may be accomplished. India is vulnerable to several natural catastrophes, including earthquakes, landslides, cyclones, tsunamis, floods, etc. because of its diverse terrain combinations and three main kinds of climate [1].

Aerial and satellite remote sensing, digital image processing, digital cartography, GIS, and GPS are all components of geomatics technology, which has become an effective tool for mapping, mitigating, and managing natural disasters as well as various earth resource surveys. While satellite-based remote sensing has attention-deserving credentials due to its sensitivity, multispectral photo captivity, and repetitive imaging capabilities of the terrestrial surface, aircraft-based remote sensing has its credentials in displaying the Earth system features in their physiographic perspectives dimensionally. In addition to its other benefits, the satellites' continuous coverage is particularly advantageous for evaluating natural catastrophes. The image processing methods are uniquely equipped with the ability to exhibit different Earth surface aspects more favorably. While GPS may provide accurate assistance with location, digital cartography can visually display spatial maps of a variety of Earth surface phenomena, including catastrophes. The GIS is endowed with several qualifications because of its ability to:

1. Preserve a large amount of spatial data on a range of topics.

2. Thematic maps are shown in preference.

3. Present the data as graphs, tables, histograms, contours, etc.

4. Presenting the map data as visibility maps, line site maps, shaded relief outputs, digital elevation models, etc.

5. Choices for addition, subtraction, multiplication, division, and other statistical operations.

6. Networking, spatial decision support systems, buffering, and corridors are among the examples.

This chapter discusses the use of geomatics technology for creating disaster management plans during crises using newer methodologies developed out of research studies carried out in nationally renowned institutions and published in top journals. Due to such advanced virtues, geomatics technology has gained an unrivaled position in various disaster vulnerability mapping, risk analysis, mitigation, management, etc.

Earthquake:

The historical earthquake records serve as an essential resource for identifying seismically vulnerable areas, from low-magnitude tremors to larger earthquakes. According to seismological statistics, there are around 1,000 earthquakes every year that have a Richter scale intensity of at least 5.0. The frequency of large earthquakes, defined as those with a Richter magnitude of 8.0 or higher, significant earthquakes, defined as those with a Richter magnitude of 7.0 to 7.9, strong earthquakes, defined as those with a Richter magnitude of 6.0 to 6.9, and moderate earthquakes, defined as those with a Richter magnitude of 5.0 to 5.9, is strikingly low. However, the majority of earthquakes take place under the sea or in remote locations, going mostly unreported by the general public. However, seismograms, which were created from seismograph equipment, allowed seismologists to record and study them. If an earthquake occurs near the earth's surface, it has the potential to inflict more serious damage. Indian scientists believed that the Southern Indian Peninsula was impervious to seismicity and younger earth movements till the late 20th century. However, the often occurring earth tremors seen in South India have proven this hypothesis incorrect. Numerous academics have studied the continuous seismicity connected to South Indian tectonic processes. Ramasamy has made several fascinating study observations and has published updated results on Palaeo-, Neo-, and Active tectonism in south India. This research shows a striking correlation between historical seismicity data and NE-SW and ENE-WSW trending linear structures in South India, including lineaments, faults, shear zones, and lithological boundaries.

Despite the advancement of various technology, there is still more work to be done in terms of earthquake prediction. However, the recently developed Geomatics technology may be used to accurately assess the seismic vulnerability of any region. In light of this, suitable regulatory actions may be prepared, and sustainable development can be accomplished via appropriate implementations. It is useful to locate and map seismically susceptible places using a false-color composite of many resource satellites. The details that can be collected through satellite image interpretations on the basis of certain signatures, imprints or surface indicators over seismic vulnerable zones, 1) displacement of rocks and structural features along fault planes and the direction and distance of block movements, 2) linearity in vegetation alignment, drainage, river and soil tone, representing the structural features such as shear zones, foliation and lineation directions, and the anomalies such as annular lineaments, radial lineaments, annular lineaments, lineament swarms, tear-off lineaments, etc., 3) folds in sedimentary rocks, 4) tectonic geomorphic anomalies such as escarpment slopes of different kind, water falls along such escarpment slopes, dissections over structural plateau, fault scarps, triangular facets and contorted ridges, 5) fluvial geomorphic anomalies such as incised meandering of rivers, unpaired flood plains, eyed drainages, parallel and rectilinear drainages, existence of several parallel streaks of palaeochannels, buried rivers, rejuvenated river, etc., and 6) denudational geomorphic anomalies such as bazada zones, tor complexes, and several other erosional and depositional patterns.

Using data from the Landsat MSS satellite, Bakliwal, and Ramasamy have mapped the lineaments of tectonic origin, identified the surface signatures of deep-seated crustal fractures, and noted that these fractures have played a significant role in the tectonic evolution of various sedimentary basins from the Archaeozoic to Cenozoic era in Rajasthan and Gujarat. These lineaments have been linked directly to tectonism, mineralization, and magmatism. The field survey studies on subsurface geology, in addition to these surface markers of seismicity, provide additional vital information for validating the presence of these active faults. There is linkage between the surface linearities and the underlying structures discovered via field study, according to a number of studies. For comparison with surface linearities, it will be important to compare the gravity maxima axes formed linking high gravity contours, the minima axes over low gravity regions, and rapid shifts in gravity values along a line known as gravity breaks [2].

Other studies have discovered significant changes in surface temperature, unusual observations like groundwater oozing, mud eruptions, and radon gas emissions, as well as atmospheric changes over large lineaments and fault swarms that are crisscrossing an area and some unusual behaviors of animals and birds before an earthquake. To determine the impending seismic event in that region, all these abnormalities based on remote sensing data were connected in a GIS context. With the use of geospatial technologies, it is feasible to identify a number of these seismic abnormalities and learn more about seismically sensitive regions. As a result, it is also somewhat feasible to predict earthquakes shortly.

Landslide:

The Himalayas in the north, the Western Ghats of Maharashtra in the west, and the Nilgiris in the south are the three primary regions of the Indian Subcontinent where major landslides often occur. The Western Ghats landslides are brought on by significant weathering, slope erosion, and hilltop landslides, whereas the Himalayan landslides are brought on by tectonic movements. The Nilgiris landslides are caused by unstable slope brought on by toe removal along Ghat road segments, deforestation, and other human interventions such as risky slope-side structures, poor drainage systems, etc.

Landslide Hazard Zonation Models Based on Geomatics:

Utilizing the unique benefits of geoinformatics technology, newer approaches have been developed. Several approaches have been developed to identify landslide danger zones using maps of landslide incidence and various grades of landslides regulating terrain characteristics.

1. Integrated slope mapping using GIS
2. Integrated Terrain Analysis using GIS
3. Information value technique based on GIS
4. BIS-based approach
5. The Weights of Evidence approach,
6. Technique of index overlay.

The first model uses DEM, topographic contours, and satellite data to create a variety of slope maps, including Active and Passive, Steep, Moderate, Shallow and Rolling, Convex, Plain, and Concave, as well as Dissected and Undissected slopes. Each polygon class received weightage values based on the quantity of historical landslide occurrence, which were then rasterized. The region was divided into 48 integrated slope classes, such as Active + Steep + Convex + Undissected, Active + Steep + Convex + Dissected, and so on, using GIS to combine raster layers with these four kinds of slope classes. This integrated slope map was scaled to 0-10. It had pixels with accruing weights.

In terms of the second method, which is referred to as "Integrated Terrain Analysis," the terrain parameters, including lithology, lineament frequency, density, intersection density, slope, geomorphology, ridgeline vs. joint angular relation, amount of dip, regolith, land use and land cover, and drainage density, were prepared and individually superposed with the historic landslide data to identify the vulnerable zones. Then, to define Landslide Hazard Zones, all the layers with susceptible polygon classes were combined [3].

Resulting from Various Methodologies:

More statistical and numerical computations are used in the information value technique. By rasterizing the 12 numbers of regulating parameters following the sensitivity to landslides, the information value of each pixel in each unique theme layer had been determined. In the case of the weights of evidence technique, weightage values were supplied based on the number of prior landslides that had occurred in each pixel of all rasterised thematic maps, and raster-based calculations were made to identify the landslide danger zones.

Rankings should be given according to how important a layer is to causing a landslide in a particular location when using the index overlay approach. Then, weights are assigned to the various polygon classes in each theme layer. Weighting is dependent on how susceptible each polygon is to the possibility of a landslide. After that, a certain theme layer's weightage values were multiplied by the rankings of each type of polygon, and the data was rasterized. Then, all the pixel values of each thematic layer were added, scaled from 1 to 10, and regrouped into 5 landslide vulnerability classes, such as Very High, High, Moderate, Low, and Very Low using pixel-based addition in GIS Raster Analysis. To create the Landslide Hazard Zonation map using the BIS approach, the Maximum Landslide Hazard Evaluation Factor ratings were applied to the regulating parameters and merged into GIS.

By creating the maps of geological characteristics utilizing remote sensing and GIS technology, the author has brought forth a spectrum of information on various techniques for determining Landslide Hazard Zones for a section of the Nilgiri massif via this work. Additionally, the ideal approach the information value method as well as the diagnostic criteria for this Landslide Hazard Zonation mapping have been established. The Information Value Method has been determined to be the most effective technique for Nilgiris after examining the outcomes generated by all of the aforementioned models. Because the largest number of landslide events per unit area was found in the extremely high landslide susceptible region determined by the Information Value approach. Additionally, this study clearly shows that for terrains like The Nilgiris, landslides may be better analyzed using Geomorphology and Slope Factors Using the Information Value Method [4].

Mitigation of Landslides:

Then, in accordance with the local terrain factors that cause landslides, or a combination of parameters, the following mitigation techniques were recommended:

1. All areas along active slopes have been forested.

2. Reduction of the convex slope

3. In a sloped area, gully plugging and vegetation are present.

4. In Tor Cliff and on concave slopes, nets with trash are suspended.

5. Removing rubble and trash from the Mid slope Mound

6. Above the Mid slope Mound, the Garland Drainage

7. Keeping settlements away from slopes,

8. Weak toes, slopes with toe cuts, regions with toes removed, etc. have leak holes in the retaining wall.

In several areas of Tamil Nadu as well as for TirumalaTirupathi hill, similar types of geoinformatics-based research investigations have been undertaken in order to designate Landslide Hazard Zones and treatments have been offered. Therefore, geospatial technology may be very effectively used to identify landslide-prone areas and the factors that cause them so that early mitigation strategies can be planned.

Cyclone:

Cyclones are very low pressure zones with increasing pressure outside of the center. The intensity of cyclones and the force of winds are determined by the magnitude of the pressure drop in the center and the pace at which it rises outward. the cyclonic storm's many phases and the corresponding wind speed. It is simple to comprehend the direction and motion of the air and spiraling rain clouds during a cyclonic storm. The gales create a choppy sea with waves up to 20 meters high and surges that reach 1,000 kilometres. Joining them are torrential rainfall, sporadic thunderclaps, and lightning strikes. The cyclone travels 300 to 500 km in a day across this churned-up chaotic sea and atmosphere, hitting or dodging a shore while bringing storm waves with it. When cyclones originate over the northern hemisphere, they often migrate north and then north-east; while, when they form over the southern hemisphere, they typically move south and south-east. Recurvation is the name of the procedure. The speed drops and the system remains immobile for about a day before it repeats.

When two cyclones are close to one another, they interact and rotate counterclockwise to one another. Tracks in the Atlantic often form a parabola. When cyclones strike India again, they are dispersed across the Himalayas and stop moving farther east. The World Meteorological Organization and the United Nations Economic and Social Commission for Asia and the Pacific have established a systematic process for naming cyclones. The coastal India cyclonic wind speed chart revealed that the whole east coast is very vulnerable to greater damages from cyclone passes.

The characteristics of cyclones are studied using various geostationary satellite photos, and the India Meteorological Department notifies the public of the region that will be immediately attacked along with the wind speed and intensity of the rainfall. The website run by IMD displays all weather and climate updates, including cloud top temperature, sea surface temperature, land surface temperature, pressure, fog, cloud height, water vapour, humidity, aerosol density, and ground-based and satellite-based rainfall occurrence in millimeters, among other information, in the form of maps, tables, and charts. Geostationary satellite pictures are very helpful for weather and cyclone monitoring and warning on a continual basis. Furthermore, high resolution panchromatic data, PAN integrated FCC data, and Cartosat-1 and IRS-P4 satellite pictures may be used to correctly plan mitigation strategies and analyze damage [5].

Flood:

In India nowadays, floods are a common and recurrent natural calamity because of human influence on climate. Planners and administrators are becoming more concerned about it since it results in significant losses for people, their possessions, and other living things. Particularly in Tamil Nadu, the floods of 2005 had severely damaged the majority of the coastal, deltaic, and central regions. To reduce the time of flooding, however, our primary impulse during such floods was to fast drain off the flood water by rushing it into the ocean. After the floods had subsided, these flood-affected communities were in a drought because the groundwater table was rapidly falling from overuse and pollution, leaving them without access to fresh water. Since our ancestors often harvested flood water during the Pandia and Chola Kingdoms in the past, the time has come to do so once again. Because of this, the flood catastrophe is distinct in that it may also be gathered throughout the mitigation phase.

In order to regularly desilt the tanks, rivers, lakes, and supply canals and strengthen their bunds, during the Tamil month Aani, or during June-July each year before monsoon, one of the very old festivals known as "Pittukkumannsumaththal" is still observed in Madurai and other areas of Tamil Nadu along the banks of the River Vaigai. In the past, all temples had roof-mounted rainwater collection systems that gathered in the grounds' ponds. There are supply canals from the nearby main rivers/streams to these temple tanks, and a flower garden on the temple grounds named Nandhavanam was created as a catchment for collecting rainfall in temple tanks. To efficiently capture monsoon rainwater, the kingdoms regularly desilted and maintained all of these water-carrying facilities, including as canals and tanks. Additionally, they were very knowledgeable about harvesting floodwater by building long-term water diverting and storage facilities, such as dams across major rivers with diversion canals almost completely encircling all villages and agricultural lands, check dams, weirs, nala bunds, storage tanks, and reservoirs using the naturally occurring inter lagoonal depressions and beach ridges. As needed, several canals have also been built along palaeochannels that run parallel or subparallel to the main rivers in the upstream regions, covering all farmland and settlements.

Utilizing Geomatics Technology to Map Flood Hazard Areas:

The flood-inundated regions may be efficiently mapped using MODIS Terra satellite data that is collected every day during the monsoon season. Using this satellite data collected on wet days between October and December 2005, a flood-inundated map of the whole state of Tamil Nadu was created. These MODIS Terra satellite photos made it simple to establish the areal extent and duration of the submersion. Similar to how panchromatic data gathered before and after a flood would clearly illustrate the damage caused by a flood, high resolution satellite data with submeter precision will do the same. Delineating flooded regions may also be done using microwave imaging.

DISCUSSION

If adjusted or resampled using the existing rain gauge data, rainfall data received from the TRMM satellite would serve as the foundation for estimating flood in a given region. Shaded Relief depict generated from DEM resampled with DGPS data would be utilized to correctly depict the low-lying regions vulnerable to flooding. The flood polygons that were defined using the above-discussed panchromatic, visible, infrared, thermal infrared, passive microwave, and active microwave data photographed by different satellites may be compared to those. Collateral data from the media and other trustworthy sources can also be utilized [6].

Through a research study conducted for Tamil Nadu by the Centre for Remote Sensing, Bharathidasan University, it was identified that the terrain systems, geodynamics, land use/land cover, and aquifer dynamics control such flooding phenomenon. This can be accomplished by simply integrating GIS layers showing flood-affected and vulnerable zones and other layers showing Drainage, Groundwater level, Tectonism, and Geomorphology. Through the use of visual image interpretation keys and elements, aerial photogrammetry, remote sensing, digital image processing, and geographic information systems are excellent tools for mapping a variety of geologic parameters in the lab, including lithology, structure, geomorphic landforms, land use and land cover pattern, siltation in water bodies, drainages, slope, etc. Accurate maps may be created and digital geodatabases can be produced in GIS simply by adding ground check/field survey data. For mapping flood-affected or vulnerable polygons as well as on terrain parameters and generating digital spatial and non-spatial databases with higher accuracy, other field survey-based platforms include the Global Positioning System/Differential Global Positioning System and Ground Penetration Radar.

To understand the relationships between the various controlling factors, such as lithology, structure, geomorphology, subsurface geology, aquifer characters, drainage patterns, watershed characters, land use, and land cover, etc., it is possible to perform a GIS union overlay with flood polygons. For instance, depicts the integrated GIS map of Tamil Nadu displaying flood polygons controlled by groundwater level. It is extremely easy to see where the shallow groundwater level between 0 and 10 m blog is where the very high and high flood polygons are descending. That means it is recognized that strong rainstorms fill subsurface reservoirs quickly, making it impossible for further rain to percolate through the system and causing flooding. Instead, when the groundwater level is deep more than 10 meters, there is less flooding. Therefore, it is simple to recommend that pumping and using groundwater for all purposes by the public and the government before monsoon season would be beneficial to the aquifer and avoid floods in the region.

Similar to this, Tamil Nadu's drainage density and flood connection have also been created using GIS. From this, it can be seen that the drainage density will directly affect floods; that is, wherever there is a high drainage density, the floodwater may quickly drain via the drainages, resulting in nil or little flooding.

Conversely, in areas where drainage density is poor, surplus rainwater becomes stagnant and causes flooding. It would be feasible to lessen flooding in these places if we recommended the right creation of suitable drainages, desolation of existing drainages to prevent sediment clogging, and removal of water plants, weeds, and shrubs. Similar to how all-terrain factors may be connected with flood polygons and analyzed using GIS to understand their control, integrated corrective solutions can be suggested to protect the land from flooding and receive diverse advantages from storm water.

Harvesting Flood Water is Possible:

During a storm, flood water may be gathered and kept extremely well, and flood inundation can be averted at the same time. To do this, it is crucial to create the pertinent thematic maps of the surrounding regions and have a thorough understanding of the local circumstances. This will allow the floodwater to be diverted via palaeochannels to the nearby downstream communities that are experiencing a water shortage. Similar to this, the flood water may be swiftly recharged into the aquifer systems by pumping down the local groundwater level. With the aid of terrain parameter maps, comparable alternative options may be quickly and readily explored in a GIS context [7].

Detour Canals:

The analysis done for the base study showed that the flooding in certain areas has been impacted by the active faults and the associated tectonic movements. Active tectonic zones like these limit drainages to several alterations like deflected drainages, compressed meanders, eyed drainages, etc. Therefore, it is evident that the water's flow dynamics become impeded when it enters such anomalous zones, resulting in floods. Therefore, in such areas, water must be checked/dammed upstream of such drainage anomalies and redirected via diversion canals along the best pathways in order to transport floodwater to basins/regions that lack water.

Additional Drainages and Networking of Drainages:

Wherever there are poor drainage densities, it means that the present drainage systems are insufficient to remove the floods. As a result, more drainages are needed. Therefore, it is necessary to network existing drainage systems in these areas and to build new drainage systems.

Distribution Canals are revived:

The geomorphology and flood study has once again shown that the deltaic area took the brunt of the flooding. Deltas in certain areas showed preferred river movement, the abandonment of some of their distributaries, etc. To ensure that the floodwater is spread uniformly and radially, it is necessary to deepen and revive these abandoned distributaries in these places.

River Mouth Control:

Littoral currents cause sand bars to form in the river mouths along the majority of Tamil Nadu's convex beaches. These bay mouth barriers prevent water from flowing freely into the ocean, which causes the low-lying coastlines to flood. Therefore, more research is necessary to comprehend their dynamics and to dredge such bay mouth barriers to allow river water to easily flow into the ocean during the wet seasons.

Lowered Ground Water Levels:

Brief investigations using GIS that looked at the relationship between groundwater extraction and water levels showed that areas with shallow water levels did not let floodwater percolate into aquifer systems.

Therefore, it is important to critically examine and simulate such shallow water zones and piezometric highs. Water levels should also be appropriately lowered before the monsoon, and any pumped-out water must be directed to water-scarce locations to enable floodwater to seep into the subsurface system.

Synthetic Recharge:

In-depth investigations are required to find the best locations for artificial recharge since flooding is forcing water into the deeper portions of aquifer systems. To determine the best locations for artificial recharge, factors such as lithology, structure, and tectonics, particularly the density of open and active faults, geomorphology with a focus on porosity and permeability, slope, drainage patterns, regolith thickness, etc. need to be studied. Generally, by utilizing digital elevation models to visualize groundwater levels in three dimensions and identifying the basins from them, viable locations for artificial recharge may be quickly found [8]. To collect floodwater, it is necessary to identify locations that are suited for artificial recharge as well as site-specific artificial recharge technologies, such as:

- Dendritic Flooding and Furrow
- Pitting
- Retention ponds
- Well Battery Batteries
- Desilting of current tanks
- Echelon damming, etc.
- Earth Erosion

Geomatics Technology for Soil Erosion Area Mapping:

The satellite photos provide essential information for protecting soil from siltation and erosion. It is possible to discern the surface reflectance fingerprints of soil erosion zones including first-order drainages, active slope areas without vegetation, gullies, active foothills with loose sediments from the upstream, and mass wasting. As a result, the regions of soil erosion may be very accurately analyzed by satellite FCC photos and classified according to how severe the soil erosion is there: Very severe, Severe, Moderate, Less, and Very Less.

Any coastal location may easily have its changes caused by tsunami damage mapped using remote sensing pictures. In addition, tsunami warning systems are set up using a satellite network to communicate with inland monitoring centers and buoys deployed in the water to learn more about the specifics of wave propagation and alert coastal populations as soon as feasible. After the tsunami of 2004, India undertook several research projects to better understand how the natural coastal features that might shield the land and people from tsunami flooding and devastation responded. By employing the imprints of the tsunami inundation over several features and the relationships between the tsunami wave propagation and the inundation pattern, the flooded regions delineated using ENVISAT microwave data were confirmed by field inspections.

Geomorphic features including bay mouth bars, spits, river/creek mouths, mudflats, and saltpans have been shown to operate as tsunami wave facilitators. where there was a significant level of tsunami run-up and flooding. However, features like rivers, creeks, and rivers/creeks that cross swales have served as tsunami wave carriers. Swales, backwaters, mangrove swamps, paleo backwaters, and paleo mudflats, on the other hand, served as accommodations. The beaches have absorbed the energy of the tsunami waves because they include sorted, rounded, and unconsolidated alluvium. But it turns out that the seaward and landward beach rides were discovered to be the structures that protected against tsunami waves the best, thus their designation as tsunami wave barriers [9].

Before implementing any development plans or tsunami mitigation strategies, planners must thus be aware of how various coastal geomorphic landforms react to tsunami waves. Anthropogenic intervention in the form of port development, which included redirecting the flow of the Uppanar river and building a sea wall along Nagappattinam town's shore, has led to very high flood levels in the region. The planners and administrators can very effectively execute certain tsunami mitigation measures recommended for coastal regions to protect against tsunamis and also for the sustainable development of the coastal areas. Therefore, it has been conclusively shown that the advantages of recently developed geospatial technology may be efficiently harnessed to provide sustainable and environmentally friendly development of any coastal regions that can safeguard against the negative impacts of tsunamis.

Drought:

Drought results from a severe water scarcity brought on by a reduction in rainfall, a rise in temperature, and the inefficient and unsuitable use of available land for various forms of development in a region. When compared to the research studies carried out for other disasters, the phenomena of drought, causes for it, and mitigation techniques are not thoroughly investigated. Additionally, only a small amount of geomatics technology has been used for drought studies. The research study carried out by Parul Chopra in 2006 for the Gujarat region is one of the geomatics-based approaches for drought. Using Remote Sensing, Digital Image Processing, and GIS tools, a highly thorough approach has been developed to comprehend the drought risk in Gujarat. It would be quite likely to bring the relationships between meteorological, agricultural, and hydrological droughts thanks to the versatility of geospatial technology. The association between rainfall anomaly and the NDVI/Crop yield anomalies was brought forth with drought severity classes by combining the rainfall of the previous 23 years with other topics such as NDVI-based Agricultural Drought and Crop yield. Finally, by combining the agricultural and meteorological drought risk regions, combined drought risk areas have been identified, and this demonstrates that appropriate and timely strategies may be developed and executed to reduce the drought condition and to boost crop output in those areas.

In order to lessen the effects of catastrophes on vulnerable populations, mitigation measures are essential. By offering tools for hazard mapping, land-use planning, and infrastructure development, geomatics technology aids in the design and implementation of efficient mitigation solutions. The combination of socioeconomic and geographic data identifies at-risk locations and makes it possible to carry out targeted actions like building defenses, relocating residents, or setting up early warning systems. Damage assessment is a crucial part of post-disaster management, helping to prioritize response activities, estimate losses, and allocate resources. Through the use of satellite photos, aerial surveys, and GIS-based analysis, geomatics technology enables quick and precise damage assessment. With the use of these techniques, infrastructure, land use, and natural resource impacts may be mapped and quantified, giving recovery and reconstruction planning crucial data.

CONCLUSION

In conclusion, geomatics technology, which includes vulnerability mapping, mitigation tactics, damage estimation, and comprehensive management, provides useful applications in disaster-prone locations. Geomatics technology improves our awareness of hazards by using remote sensing, GIS, and GPS technologies. It also enables proactive actions to decrease vulnerabilities and helps with the effective allocation of resources for reaction and recovery. To solve the difficulties of catastrophe management, this study underlines the importance of geomatics technology and stresses the necessity for its incorporation into decision-making procedures. Geomatics technology must be incorporated into decision support systems to effectively manage disaster-prone regions. Geomatics technology improves the situational awareness of decision-makers by merging real-time data, modeling, and simulation tools, allowing them to react successfully during crises. Geomatics technology also makes it easier to monitor and assess mitigation strategies, enabling adaptive management strategies and continual development of catastrophe resilience.

REFERENCES:

[1] P. Boccardo, F. Chiabrando, F. Dutto, F. G. Tonolo, and A. Lingua, 'UAV deployment exercise for mapping purposes: Evaluation of emergency response applications', *Sensors (Switzerland)*, 2015, doi: 10.3390/s150715717.

[2] Mario Baum, 'Geo-information: technologies, applications and the environment', *Choice Rev. Online*, 2012, doi: 10.5860/choice.49-3272.

[3] M. Giardino, L. Perotti, M. Lanfranco, and G. Perrone, 'GIS and geomatics for disaster management and emergency relief: A proactive response to natural hazards', *Appl. Geomatics*, 2012, doi: 10.1007/s12518-011-0071-z.

[4] F. Verjee, 'The Application of Geomatics in Complex Humanitarian Emergencies', *Risk Manag.*, 2005.

[5] S. Pirasteh and J. Li, *Global changes and natural disaster management: Geo-information technologies*. 2017. doi: 10.1007/978-3-319-51844-2.

[6] S. Madry, 'Introduction and history of space remote sensing', *Handbook of Satellite Applications*. 2013. doi: 10.1007/978-1-4419-7671-0_37.

[7] P. Boccardo and F. G. Tonolo, 'Remote sensing role in emergency mapping for disaster response', in *Engineering Geology for Society and Territory - Volume 5: Urban Geology, Sustainable Planning and Landscape Exploitation*, 2015. doi: 10.1007/978-3-319-09048-1_3.

[8] A. Tiwari and K. Jain, *Concepts and Applications of Web GIS*. 2017.

[9] M. Lemmens, 'Airborne Lidar', in *Geo-information*, 2011. doi: 10.1007/978-94-007-1667-4_8.

CHAPTER 5

AN OVERVIEW OF DISASTER INFORMATION SYSTEM

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ABSTRACT:

Emergency management groups, humanitarian organizations, and impacted communities all face difficult issues as a result of disasters. Effective disaster response, recovery, and decision-making depend on the prompt and effective sharing of correct information. A complete framework for gathering, examining, and disseminating information on catastrophes is provided by a disaster information system. This essay seeks to provide a broad overview of the essential elements, advantages, and difficulties involved in putting in place a catastrophe information system. Data collection, data administration, data analysis, and information distribution are the main elements of a disaster information system. Information is gathered via data collecting from a variety of sources, including social media, sensor networks, remote sensing, and government organizations. The management and storage of this data in a centralized database ensures its security, accessibility, and integrity. To extract useful insights from the gathered data, data analysis methods including geographic information systems (GIS), statistical modeling, and machine learning are used. Finally, using a variety of methods, including online portals, mobile apps, and real-time alert systems, the information obtained from the analysis is sent to the relevant stakeholders.

KEYWORDS:

Disaster Information System, Mitigation, Emergency Management, and Geographic Information Systems.

INTRODUCTION

Disaster Information System Requirement:

The Query-Based Information Retrieval System is a special development and versatility in GIS that helps users, planners, and administrators make quick decisions and prepare strategic strategies. By pre-processing, analyzing, and post-processing several layers as spatial data in QUBIS, prior cooking of non-spatial or spatial or attribute data for proper retrieval of precise data, and creating links between spatial and attribute data, the necessary database will be kept in a readily retrievable format. Once such a database is prepared, all the user-required data may be shown instantly as an output map on the display utilizing the layers offered by GIS with just a single click or two using a mouse or touch screen by the user thanks to Application Programming Interfaces. Through queries, it is simple to create and maintain buttons and menus with GUI-based information that the user commonly needs.

For the user to get the necessary information by simply clicking on these buttons or menus, a connection to the database must first be created, much as it is with information kiosks or bank ATMs. When a button with a query attached is clicked, relevant data is searched for and, if the query condition is met, the received data is shown as a map, table, chart, or as a combined form of all three [1].For more effective, quicker, more accurate, and impartial planning for disaster management, the QUBIS system may be developed with a variety of sophisticated choices in an interactive kiosk mode. Thus, planners, administrators, and civil engineers for installing disaster prevention structures, effectively using and monitoring structures, and social workers and other officials for accurate assessment of damages caused for quick recovery and rehabilitation activities during crises can all benefit from the advanced virtues of GIS in the form of QUBIS.

The spatial Decision Support System is QUBIS's Advanced variant. To achieve accuracy in the resulting output map, the most recently updated datasets will be employed for timely analyses using the proven procedures offered with it. To choose the relevant data and method/model for analysis, several of the labor-intensive stages involved in standard GIS database construction, preprocessing, analysis, and post-processing, may be automated. It may also be created utilizing a local GIS platform with customization options or Web-GIS software with internet access and its utilities. The SDSS may be able to automatically or with the use of digital image processing methods produce an on-time database from the unprocessed satellite data. For instance, 'first level outputs' are the pixels of satellite images that can be improved and classified using digital image processing techniques like Atmospheric Haze Removal, Band Ratioing, separation of the vegetated area using Normalized Difference Vegetation Index, separation of water covered area using Normalized Difference Water Index, etc. These first-level outputs serve as timely vectorization and layer input. These vector layers, also known as "second-level outputs," provide the input for further SDSS analysis using GIS and represent the current state of characteristics including forests, agriculture, and infrastructure development.

Similar to this, the SDSS may be set up to manage current or most recent collateral data that has been gathered from various Government or quasi-Government agencies for its database. By using user-defined manipulation techniques and the most recent spatial or attribute data that was received online from a secondary source or agency, such as rainfall, groundwater level, water spread area in water bodies, etc., an SDSS could also prepare a spatial database containing isolines. Create preprocessed second-level output layers from this data that comprise grouped elements directly related to the issue, such as places with the most rainfall that are creating landslides, areas with circumstances where deeper groundwater levels are causing land subsidence disasters, etc[2], [3].

In the following step, self-analyses could be carried out in the background of a GIS to identify the quantity of water available in water bodies, areas prone to flood disasters, vulnerable areas for landslides, etc., as "third level outputs" by directly inputting these second level outputs derived from various sources into the disaster vulnerable zonation model in SDSS. These third-level outputs, which often contain hundreds or even thousands of finely divided polygons as a result of the integration of multiple combinations of disaster-inducing parameter classes during the previous modeling phase, cannot be displayed in this manner because it would be cumbersome and extremely challenging for users and planners to handle or use them. Therefore, a fourth-level output can be produced by reclassifying third-level output using post-classification methods, and finally, displaying the result in a tidy map layout that could be user-attractive and make it easy for planners, civil engineers, and other users to recognize the relationship between the inducing parameters and the disaster.

The administrators' ultimate strategic planning tool may be this SDSS-based final product. In light of this, SDSS is an explicit design in GIS with a strong and simple user interface to solve poorly structured problems with the ability to continue analytical models flexibly with data, explore the solution space by building alternatives, support and provide a variety of effective decision-making styles, and allow users for an interactive, user-friendly, and recursive problem-solving environment.

Disaster System Dynamics and Non-dynamics:

Disaster systems include the characteristics of both gigantic systems and complex network systems. They are typically connected human-environment systems or socioecological systems. Complex network system phenomena, such as disaster swarms, chains, and compounds, may be present in a regional catastrophe system. Disasters often occur in geographical and temporal clusters, which is referred to as a catastrophe swarm. It closely resembles the idea of many risks, and this clustering feature largely relies on the local environment. A temporal co-occurrence and a geographical cluster of hazards are additional categories that may be used to classify a catastrophe swarm. tragedy chains describe the connection or cause-and-effect link between one tragedy and another. It may be further broken down into sporadic and parallel catastrophe chains. A hazard/disaster compound is defined as "the co-occurrence of multiple disasters that could induce social risks" and was first put out by Hewitt and Burton. Hazard compounds, which happen when two or more climatic extremes occur simultaneously, are a specific instance in the context of the Intergovernmental Panel on climatic Change. When two or more catastrophes strike simultaneously or consecutively without any apparent cause, this is referred to as a "disaster compound" and results in far bigger repercussions than the mere aggregate of each disaster, even if they are not severe when seen independently. For a deeper knowledge of how risks and catastrophes develop, it is crucial to comprehend these intricate aspects of disaster systems.

The existing literature has gained some insight into calamities brought on by harsh climates. However, there are still knowledge gaps about the complexity of global change, notably regarding how climate change affects catastrophe systems. Our past research has shown that there are three distinct elements to the influence of climate change on disasters: the trade-off caused by climatic trends, the uncertainty brought on by climate variability, and the catastrophic impact associated with climate extremes. The trade-offs brought about by climatic shifts mostly depend on the region. For instance, a warmer environment may result in greater potential benefits than losses for crops planted at higher latitudes or elevations. In contrast, warming would worsen dryness in middle- and lower-latitude arid and semi-arid areas, making it extremely harder to cut agricultural hazards. The trigger threshold has a significant bearing on the influence of climatic variability. Variations in temperature and precipitation that don't go beyond what human civilization can do to prevent them from happening might have some impact, but nothing catastrophic. A tipping point might be reached when impact preventive capabilities for climate change are exceeded, triggering a catastrophic severe weather and climate calamity that would result in significant losses and long-term effects.

Understanding regional hazard mechanisms and catastrophe processes requires research into multi-hazard, disaster chain, and compound occurrences as well as the implications of climate change on its trend, variability, and extremes. The numerous characteristics of disaster system dynamics and non-dynamics, such as their interconnection, regionality, complexity, and interaction, are now still being studied. The present literature often only takes into account one or two aspects at once and mostly concentrates on a specific kind of danger. There have been relatively few studies on the dynamics of multi-hazard, disaster chain, and disaster compound occurrences. current research on how climate change affects catastrophes devoted more attention to changes in climatic variability and extremes than to the influence of climate trends, that is, the calculation of loss and the effects of a rise in the world's average temperature. There are relatively few studies on how the mean, variability, and extremes of climate change interact to create systemic risk. Complex network system dynamics are still a major focus of research into the dynamics of catastrophe systems. Further developing fresh quantitative indicators and expanding our knowledge of the fundamental mechanisms and processes underlying network system dynamics are urgently required. The majority of research on catastrophe risk management and policy challenges, or the non-dynamics of disaster systems, has focused on statistical analysis.

The trend of globalization has drawn even more attention to the regional, connected, coupled, and complex characteristics of catastrophe systems. The system dynamics and non-dynamics of catastrophe systems show both the "consilience" and "node degree" behavior of their constituent parts. The distinctions between regional catastrophe systems may be seen in the consilience of disaster systems, which can also be seen in the integrated elements of their structures and functions. The idea of consilience also allows for the quantitative modeling and study of catastrophe systems. Mechanisms, procedures, and dynamics models are all part of disaster system dynamics. Statistical models and numerical simulations have often been used to simulate the behavior of nonlinear dynamic systems. Like many other human-environment systems, a disaster system's non-dynamic processesdisaster and disaster risk management schemes and policieshad few quantitative indicators and data to model and mostly depended on statistical models. In disaster risk science research, integrating and coupling the study of system dynamics and non-dynamic characteristics of catastrophe systems has always been a difficult task. Promotion in the integration and coupled study on the system dynamics and non-dynamics of disaster systems is anticipated with the development of the supercomputer, big data, artificial intelligence, visualization, and modern 5G network systems and their application in coupled human-environment systems, making it possible to better understand the formation processes of hazard and disaster.

Disaster Management Electronic Systems:

In disaster response, information systems have been crucial. Digital Earth systems, such as the disaster response system, digital disaster system, and modeled disaster system, all depend on the digital system for disaster response. The disaster response system is the system that outlines how a regional DS responds to specific catastrophe occurrences and regional disasters of many sizes, including community, local place, country, subregion, region, and the whole world. These consist of numerous disaster response materials and initiatives, such as DRR demonstration communities, the undrrdisaster resilience scorecard for cities, the WHO-international safe community approach to injury prevention, and others.

The data center of a regional catastrophe system, the digital disaster system focuses primarily on the creation and standardization of information products. Yokohama Strategy, Hyogo Framework for Action, and Sendai Framework for Disaster Risk Reduction implementation-created databases can be expanded, and new data obtained from new technologies and approaches such as earth observation, internet resources, big data processing, and supercomputing can be incorporated. The purpose of creating such digital disaster systems and data centers is to transform the observation of specific disaster events from sporadic observation to long-term and fixed-site observation, from static observation to dynamic analysis, and from human observation to observation supported by artificial intelligence. This makes it feasible to provide crucial data management and support services for both global and regional DRR. Such data centers must be able to access telecommunication, navigation, and remote sensing data, as well as multisource, spatial-temporal data. They also need to be able to receive data from local sources and the cloud.

The framework for quantitative research on regional DS mechanisms, processes, and dynamics, loss calculation and modeling for disaster occurrences, disaster risk assessment, and simulation of regional catastrophes is the modeled disaster system. Technologies like cloud computing, geographic information systems, big data visualization, virtual reality and augmented reality, and artificial intelligence can be used in conjunction with various types of disaster and disaster-risk models to conduct an all-weather, full-element, whole-process, and all-scale integrated simulations.

Models for Disaster Response:

Models for individual catastrophe occurrences and regional disaster systems are under the category of disaster response models. A paradigm for systematic reaction to specific crises According to the disaster management cycle, the phases of readiness, prediction, early warning, emergency response, relief, recovery, and rebuilding are all part of managing a specific catastrophe occurrence. The reaction to a catastrophic occurrence is broken down into five phases by the Sendai Framework: preparation, emergency, rehabilitation, recovery, and rebuilding. Pre-disaster, during-disaster, and post-disaster are the three stages we use to categorize the reaction to a specific catastrophe occurrence. The stages of readiness, emergency response, recovery, and rebuilding are covered by these three phases, which together make up the operational system of integrated disaster risk governance. The most important of the four steps is being ready. China's reaction to the 2020 new coronavirus has highlighted the constraints of a small resource reserve and the limitations of the current forecast and early-warning system.

Model for systematic response to local catastrophes at the regional level, disaster response must work to combine prevention, resilience, and relief, with a strong emphasis on the former two. Additionally, this is how integrated disaster risk governance is structured. Regional catastrophe response relies heavily on prevention. In the context of disaster response, prevention refers to a collection of actions that includes risk surveying and identification, regionalization of disaster governance, setting of preventative benchmarks, and creation of disaster insurance. Construction and retrofitting of infrastructure are essential for resilience. Rapid catastrophe assessment and humanitarian help are essential for relief. The developing disaster risk governance paradigm and the regional disaster response system are closely connected. A regional disaster response system's efficacy and cost-effectiveness may be increased by optimization in accordance with the principles of effectiveness, efficiency, and equality.

DISCUSSION

Disaster Information System Design:

The basic thematic maps for an area and various specific thematic maps on various disasters and their related maps, such as, Areas affected by previous disasters, Frequency and Intensity of occurrence, Vulnerable zones of disasters, Causative Parameters, Mitigation Measures, and related non-spatial data, such as nature of damage, property loss, and life lost, due to d For the advantage of the users, this main menu may also have other choices like Data Update, Print, Help, and Exit. Similar to this, all aspatial data should be appropriately connected with spatial data such as state, district, taluk, block, village, and other levels utilizing the unique identifiers included in each layer and aspatial data. Then, by using polygons like state, district, block/taluk, village, basin, sub-basin, watershed, subwatershed, mini-watershed, and micro-watershed as appropriate units for display, users would also be able to access and show any kind of data or information on different levels. Similarly, if the user wants to see a certain feature for the whole region, it may also be presented at that specific feature level. Additionally, the enhanced efficiencies, unique designs, benefits, and qualifications of API, GIS, and other Geospatial technologies may have been successfully included into the spatial decision support system as stated in the following paragraphs with the help of the database that was accessible [4], [5]. At the State, District, Taluk, Block, Village, and Mini Watershed levels as well as Feature wise, the fastest retrieval on any spatial and non-spatial data may be done in a maximum of three clicks for swift decision making for disaster mitigation and management planning.

Wrapping in Layers:

For a quick comparison and visual study, any spatial layer may be superimposed over the presented map and examined jointly. With the help of the five various map zooming capabilities offered by SDSS, each of the presented digital maps may be zoomed in or out to the users preferred level. The SDSS may additionally store additional map management capabilities like panning, going to a previous or subsequent map extent, getting a full map extent, graphic selection, etc.

There are two ways to list the map data and additional information that is provided. At each desired point on the displayed map, the 'Identify' tool may be used to list the attribute information of a specific spatial feature. For instance, by hovering the mouse over a silted tank on the shown map, statistics about the tank's perimeter, average amount of silting, etc., may be viewed. The second is the 'List Data' option found in the Statistics menu, which can be used to list all of the information about the features of the shown map. For the users to grasp the spatial variability, occurrence, geometry, and other associated qualities, additional choices such as see average, mean, median, frequency, and other varied relevant capabilities may be preserved above the window of the attribute table.

Updated data:

By using the 'Data Updation' option, authorized users with a User Name and Password may add, delete, or modify both spatial maps and non-spatial data. For instance, if 50 water bodies are listed in the "Water bodies to be Desilted" category under the "Soil erosion and Siltation" theme in the Main menu, and subsequently some of the tanks have been designed as part of a government program, the information may be updated. The next version of the aforementioned map will only display 45 water bodies in the region that need desilting, of which 5 are colored differently and fall into the already desilted group. It is also possible to make provisions for the automatic calculation and updating of reachability data upon the installation of such facilities and infrastructures in a given area, i.e., whenever any information pertaining to the physical resources sector is entered or changed by the authorized user [6], [7].

Structure of Data:

Each natural resource's spatial data has been preserved in both its raw and final GIS-based models. The raw maps may also be used to create new models that one creates on their own. Longitude and latitude values are automatically and constantly shown for mouse cursor movement within any displayed map in one of the status bar panels at the bottom of the screen. The full forms of the shortened field names will automatically be shown at the bottom panel in the status bar whenever the attribute table, which is presented by the user in a separate window in SDSS, is displayed. Similar to the 'Help' option in the Main Menu, the relevant help note may be presented during retrieval or usage of the SDSS in order to go on with the specific user interaction procedure. The model therefore has special qualities, and in addition to many others, the user does not need to be familiar with GIS and the software aspect. After 15 to 20 minutes of training, he may obtain any data. Additionally, the user may seek assistance with the SDSS information retrieval process or analysis by simply clicking the 'Tutor' option, which can be retained at the end of the Main menu.

Special SDSS Credentials:

The model therefore has distinct advantages, and in addition to many others, the user does not need to be familiar with GIS and the software aspect. With only 15 to 20 minutes of training, the official may use SDSS to get any data or information [8].Government, quasi-government, and non-government departments are frequently gathering and storing data in databases that serve as digital records. The India Meteorological Department, State Land Use Board, Pollution Control Board, Department of Statistics, Public Works Department, Tamil Nadu Water Supply and Drainage Board, etc. keep these databases current and maintain them. On-time information such as rainfall, humidity, climate, aerosols, and other pertinent variables may be found on the IMD website. Similar to this, the IMD and National Geophysical Research Institute also have seismological data accessible. National Informatics Centre, New Delhi's Corporate Disaster Resource Network and India Disaster Resource Network, both of which are administered by the National Institute of Disaster Management, offer online information on the most recent inventories of equipment and human resources from every district and state in our nation. Some of our Indian Government Departments hosting websites providing online details on disaster vulnerability status and other pertinent information on disaster management activities include National Disaster Response Force working under National Disaster Management Authority, Geological Survey of India, Indian National Centre for Ocean Information Services, ISRO, NRSC, Registrar General of India, and Survey of India.

Foreign organizations offering real-time information on disaster vulnerability and the status of disasters and damages in various parts of the world include the International Search and Rescue Advisory Group, Indian Disaster Knowledge Network operating under the South Asian Disaster Knowledge Network, Federal Emergency Management Network, Global Disaster Alert and Coordination System, and United Nations Office for the Coordination of Humanitarian Affairs. In order to get catastrophe warnings and the most recent information for the catastrophe Information System for disaster mitigation and management, it would be apparent to have an online connection with these National and International institutions [9], [10].

CONCLUSION

There are several advantages to implementing a catastrophe information system. First of all, it makes it possible to combine data from many sources, giving a comprehensive picture of the catastrophe scenario. This gives decision-makers a thorough grasp of the disaster's scope, the impacted regions, and the people most at danger. The system also enables real-time monitoring and early warning capabilities, allowing pro-active reaction actions and perhaps saving lives. Thirdly, a disaster information system aids in efficient resource allocation and coordination across emergency response organizations, guaranteeing appropriate use of the resources at hand. Additionally, by providing precise damage assessment data and making it easier to follow recovery progress, the system supports post-disaster recovery and rebuilding activities. But there are obstacles to overcome while putting in place a catastrophe information system. Data interoperability is one of them, since various data sources often have distinct forms and standards. Another significant problem is ensuring data quality, accuracy, and dependability since the system depends on reliable and current data being available. Additionally, all stakeholders, especially those in resource-constrained contexts or with little technological experience, must be able to utilize and access the system. To preserve the confidence of the public, privacy and security issues around the gathering and storage of sensitive data must also be addressed. In conclusion, a disaster information system is essential for improving decision-making, disaster response, and recovery procedures. The system offers precise and fast information to help emergency management activities by combining data collection, administration, analysis, and dissemination. While there are obstacles, improving data interoperability, data quality, accessibility, and security may help a catastrophe information system achieve its full potential. In order to successfully meet changing disaster management demands, this study highlights the significance of building such a system and stresses the necessity for ongoing development and adaptation.

REFERENCES:

[1] V. Nespeca, T. Comes, K. Meesters, and F. Brazier, "Towards coordinated self-organization: An actor-centered framework for the design of disaster management information systems," *Int. J. Disaster Risk Reduct.*, 2020, doi: 10.1016/j.ijdrr.2020.101887.

[2] N. Uchida, G. Sato, and Y. Shibata, "Device-to-device communication based DTN for disaster information system by using emergent user policy and locational information," *J. Internet Serv. Inf. Secur.*, 2019, doi: 10.22667/JISIS.2019.08.31.041.

[3] Dini Aprilia Puspitasari and Ade Eviyanti, "Web-Based Integrated Disaster Information System For Optimizing The Role and Function of The Data and Information Center (PUSDATIN) Badan Penanggulangan Bencana Daerah Kabupaten Sidoarjo," *Procedia Eng. Life Sci.*, 2021, doi: 10.21070/pels.v1i1.868.

[4] T. A. Purnomo, R. A. Widyanto, A. Setiawan, P. Hendradi, and P. Suksmasetya, "Usability analysis of disaster information systems using usability testing," in *Journal of Physics: Conference Series*, 2020. doi: 10.1088/1742-6596/1517/1/012089.

[5] K. P. Sari, H. Kanegae, and M. Roychani, "Local risk managers' and disaster volunteers' awareness of, attitudes toward, and intention to use a local government-developed disaster information system: A Case study of SIKK Magelang," in *IOP Conference Series: Earth and Environmental Science*, 2021. doi: 10.1088/1755-1315/708/1/012056.

[6] P. Lestari, E. T. Paripurno, and H. Surbakti, "Social Cohesion through Social Media as Part of Disaster Information System in Disaster Prone Area," *J. Komun. Ikat. Sarj. Komun. Indones.*, 2021, doi: 10.25008/jkiski.v6i2.606.

[7] T. Shigeyasu and N. Matsumoto, "A new and effective disaster information sharing system gathering data locally and widely based on mobility of the Mobile Agent," *Internet of Things (Netherlands)*, 2020, doi: 10.1016/j.iot.2020.100226.

[8] M. M. Rafi, T. Aziz, and S. H. Lodi, "A comparative study of disaster management information systems," *Online Inf. Rev.*, 2018, doi: 10.1108/OIR-06-2016-0168.

[9] A. Santoso, J. Parung, D. N. Prayogo, and A. Lolita, "Designing an indonesian disaster management information system with local characteristics: A case study of mount merapi," *J. Disaster Res.*, 2021, doi: 10.20965/JDR.2021.P0765.

[10] E. Cąlik, R. Atilla, H. Kaya, A. Aribaş, H. Cengiz, and O. Dicle, "Development of a Medical Module for Disaster Information Systems," in *Studies in Health Technology and Informatics*, 2014. doi: 10.3233/978-1-61499-432-9-632.

CHAPTER 6

A FUNDAMENTAL STUDY OF UNDERSTANDING NATURAL DISASTERS

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ABSTRACT:

Natural catastrophes have a big effect on ecosystems, infrastructure, and human lives. Effective disaster management, risk reduction, and resilience building depend on an understanding of the origins, characteristics, and effects of catastrophic occurrences. The main elements of comprehending natural catastrophes, such as their categorization, causes, and social repercussions, are briefly discussed in this study. Understanding the variety of natural catastrophes requires understanding their classification. This essay looks at a variety of natural catastrophes, including geological disasters (such as earthquakes and volcanic eruptions), meteorological disasters (such as hurricanes and tornadoes), hydrological disasters (such as floods and droughts), and climatological disasters (such as heatwaves and wildfires). Disasters may be categorized so that their distinct traits, patterns, and underlying processes can be examined. Natural catastrophes have many different root causes, many of which involve the interaction of many environmental elements. The main causes of these events are examined in this paper, including geological processes (such as plate tectonics and volcanic activity), meteorological phenomena (such as temperature gradients and atmospheric pressure systems), hydrological cycles (such as precipitation patterns and river flow dynamics), and climate patterns (such as El Nio and La Nia). Understanding these factors makes it easier to see possible dangers, forecast future events, and put effective mitigation measures in place.

KEYWORDS:

Natural Catastrophes, Disaster Management, Catastrophic Occurrences,Human Lives, and Possible Dangers.

INTRODUCTION

Disasters may be caused by both natural and man-made factors. They cannot be anticipated, and once they do, they must be handled with maturity, subtlety, and responsibility. Numerous immediate choices must be made, and relief efforts must be planned and managed. You will study many catastrophes in this course, along with how they affect the environment and living things [1].

Disaster and its Types:

A catastrophe is an accident or risk that results in significant loss of life and property and upsets the stability of the economy. It is a sad occurrence that will have profound effects on human and societal development as well as on living things. Natural or man-made forces may result in a catastrophe. To avoid a catastrophe or decrease its effects, these two variables must be addressed. Ineffective risk management is another factor that leads to disasters. Disaster-related losses would be decreased if a safety net was created to address possible dangers. Disasters may strike more often in developing nations. An environmental catastrophe is a mistake or dangerous occurrence that negatively impacts the environment and causes significant changes to it. These changes become the primary factor in environmental effects;

they may impede economic development, generate socioeconomic failures, wreak havoc on the environment, or endanger human life. A disaster's long-term repercussions, which may be expensive, are felt by the environment in addition to the severe immediate effects or damages. Over the coming years, these long-term consequences might increase the number of fatalities by causing an increase in certain illnesses and diseases as they change the environment. They may also abruptly halt agriculture in a specific region or slow down tree development. When a catastrophe hits, the economy must direct all of its resources to the afflicted regions to minimize damage to its key components. Recovering the items lost in the tragedy or damaged by it, however, comes at a significant expense.

Different Disasters:

Based on their causes, catastrophes have been broadly divided into natural and man-made disasters. The cause-based catastrophe categorization makes it easier to change or cease completely those actions that produce a disaster. Such actions would assist in lessening the effects of a catastrophe, should one occur. The kind of damage a catastrophe might produce and the procedures needed to prevent or mitigate the harm are also determined by the disaster's size. As a result, catastrophes are often categorized according to their size. Major catastrophes are ones that result in significant loss, while small disasters do not result in significant destruction. Natural disasters are dangerous occurrences that are caused by the environment. They result from abrupt changes in the environment. Earthquakes, cyclones, volcanic eruptions, forest fires, and tornadoes are examples of natural catastrophes. They may result in significant human casualties and physical structural damage, which results in significant monetary losses. These catastrophes may range in size. Every region is vulnerable to a unique combination of natural catastrophes, thus it is crucial to take appropriate precautions. For instance, regions with too close tectonic plate boundaries would be vulnerable to earthquakes, but regions adjacent to volcanic formations would be more prone to volcanic eruptions. Governments must take the necessary steps to safeguard citizens from regional natural catastrophes. This would guarantee little harm. Utilizing cutting-edge technology is one efficient technique to lessen the effects of calamities. For instance, by using modern building techniques and materials, infrastructure and structures may be made more resilient to natural calamities. Geographical catastrophes, which are covered in more detail below, are another name for natural disasters [2].

DISCUSSION

Man-made catastrophes:

Man-made catastrophes, as their name implies, are brought on by human activity or action. These might be life-threatening, physically hazardous, or economic environmental aspects, and the harm that results could be terrible for the whole economy. Numerous factors may contribute to man-made catastrophes. One factor is the hardened human attitudes and ways of looking at things and circumstances. These trigger human-made catastrophes such as major crimes, arson, civil unrest, war, and terrorism. Hazardous incidents brought on by technical errors or failures are another category of man-made catastrophes. Disasters including industrial fires, building collapses, chemical or gas releases, and mishaps involving vehicles like automobiles, aircraft, ships, trains, or space shuttles are included in this list. The only actions that may avoid or decrease the harm from technology-related catastrophes are better technology, adequate protection, and judicious use of technology. Humans are becoming increasingly susceptible to catastrophes and risks as a result of the global warming trend and unstable landforms. Numerous calamities have occurred as a result of the abrupt shifts in weather patterns. The world is getting more hazardous due to both technological development and rising human density. Anthropogenic catastrophes are dangers that include a human aspect, such as human intention, neglect, or mistake, or that have seen a human-made system collapse. Since they are caused by a human shortcoming or mistake, they are sometimes referred to as man-made disasters.

Floods:

Floods occur when there is too much rain or water in a certain area and the surplus water exceeds the capacity of the area. Floods often occur more frequently in low-lying areas. A flood plain is a plain that sometimes floods. These floods were essential to ancient Egypt's agriculture. Floods pose a serious risk because they have the power to take away large things like homes, automobiles, and trees. A flood might occur for a variety of causes, such as heavy rain from a storm lasting a long time, thunderstorms, quick snowmelt, overflowing rivers from too much rain, or the breaching of man-made dams or levees. Due to prolonged periods of rainfall, the monsoon season may sometimes result in floods, as was the case in Bangladesh. There is a growing perception that the frequency and severity of floods have increased alarmingly over time. The increasing encroachment of flood plains brought on by population growth and development is a significant contributing factor. Flood damage can only be minimalized, not completely prevented; in other words, there is no such thing as "absolute flood control" or "foolproof protection" for floods of all sizes. Therefore, the idea of flood management strives for such pre-planned actions that enable the lucrative and economical usage of the flood plains for the benefit of humanity, while also stressing that there is as little severe damage as possible during big floods. The education of persons who may be endangered by a catastrophe is a crucial component of a disaster preparation strategy [3].

Different Floods:

1. Flash floods: This sort of flood often happens when there has been a sustained period of exceptionally high rainfall and the earth has lost its ability to absorb it. These floods have a relatively high peak flow and a brief duration.

2. Floods in rivers happen when the river's water level rises significantly over the danger threshold as a result of a lot of rain.

3. Storm surge: When a low-pressure system with high winds is present, the sea level will quickly increase. Seawater is driven ashore by strong winds that are blowing in that direction. The storm that causes the surge may also create significant amounts of rain, which may cause coastal regions to experience both rain and saltwater flooding at the same time.

Draughts:

A drought is a protracted period of months or years during which an area has a water supply shortage. Even a brief, extreme drought may inflict major damage and hurt the local economy, even if it can last for many years.

Causes:

Droughts often happen when an area continually experiences precipitation levels below normal. The environment and agriculture of the afflicted area may be significantly impacted. The agricultural sector is significantly impacted by this worldwide problem. In general, rainfall is correlated with both the atmospheric water vapor concentration and the upward pushing of the air mass that contains that water vapor. A drought occurs when one of these is diminished. High-pressure ridges form with behaviors that prevent or restrict the development of thunderstorm activity or rainfall over one specific region. This can be caused by an above-average prevalence of high-pressure systems, winds carrying continental rather than oceanic air masses (i.e., reduced water content), and winds carrying high-pressure systems.

Drought is a common repeating weather phenomenon in the Americas along the Pacific Coast and Australia caused by oceanic and atmospheric weather cycles like the El Nio-Southern Oscillation (ENSO). Drought-exacerbating issues including over-farming, over-irrigation, deforestation, and erosion may all be directly attributed to human activity and negatively affect the land's capacity to store and retain water. The actions leading to global climate change are anticipated to cause droughts with significant effects on agriculture all over the globe, particularly in poor countries, even if they tend to be rather isolated in their breadth.

Global warming will generally lead to more rain falling on Earth. Drought in some regions will be accompanied by an increase in erosion and floods in others. Contrarily, several active methods that are suggested as ways to combat global warming, such as using a space sunshade to moderate solar radiation, may also increase the likelihood of drought [4].

Effects:

Tropical cyclones are capable of producing tornadoes, high waves, destructive storm surges, and very strong winds in addition to heavy rain and hail. They grow over large warm bodies of water, and if they migrate across the land, they lose strength. This is why tropical cyclones may cause major damage to coastal areas while posing little risk to interior areas. However, severe coastal flooding may result from storm surges up to 40 kilometers from the coast and significant interior floods from heavy rainfall. Tropical cyclones may alleviate drought conditions, despite the catastrophic impact they can have on the human population. They are a crucial component of the global atmospheric circulation system because they move heat and energy away from the tropics and toward temperate latitudes.

As a consequence, tropical cyclones contribute to maintaining global temperature stability and warmth as well as the troposphere's state of balance. Tropical cyclones at sea impede global commerce and can result in shipwrecks due to their enormous waves, torrential rain, and strong winds. Tropical cyclones churn up water, leaving colder air in their wake, making the area less conducive to further tropical storm activity. Strong winds may damage or completely demolish buildings, bridges, automobiles, and other exterior items on land, converting loose material into dangerous flying projectiles. The deadliest consequence of tropical storms, the storm surge, or the rise in sea level as a result of the cyclone, traditionally accounts for 90% of tropical cyclone fatalities.

Tornadoes are produced by the vast rotation of a tropical storm and the vertical wind shear near its edge. Tropical cyclones have killed roughly 1.9 million people globally during the last two centuries. Flooding-related large-scale standing water causes infection and contributes to diseases spread by mosquitoes. The danger of sickness rises when evacuees are overcrowded in shelters. Infrastructure is severely disrupted by tropical cyclones, which result in power outages, bridge damage, and difficulty in restoration.

Natural and Geological Catastrophes:

Disasters caused by nature or geography were previously covered in the previous section. We shall talk about the many kinds of geographic catastrophes in this part.

Earthquakes:

Earthquakes are brought on by a rapid change or movement in the tectonic plates of the Earth, which causes the crust to tremble violently and vibrate to varied degrees. On the surface, this seems to be a ground tremor that harms shoddily constructed buildings. Along fault lines, earthquakes happen randomly and have the potential to kill thousands of people. Even the best-built buildings may be destroyed by the strongest earthquakes. Tsunamis and volcanic eruptions are two more tragedies that may be brought on by earthquakes. A seismometer can measure an earthquake's intensity. Seismologists have historically gauged earthquake strength using Charles Richter's Richter scale. Seismologists now use the moment magnitude scale, an updated version of the Richter scale, to gauge the size of earthquakes based on the amount of energy they release. An earthquake's 'focus', or subsurface origin, is located there. 'Epi center' refers to the place on the surface that is immediately above the focus. People and animals are seldom killed by earthquakes alone. Typically, they cause secondary events like building collapses, fires, tsunamis (seismic sea waves), and volcanoes. Since many earthquake-related disasters are caused by people and might be prevented with improved building practices, safety measures, early warning systems, and evacuation plans, the term "unnatural disaster" is not overused.

Landslides:

Landslides are a very common geological occurrence. They happen when disruptions in a slope's inherent stability induce masses of rock, dirt, or debris to slide down the slope. They are described as dirt and rock slides that result from either natural occurrences or human-made activities. There are many different types of motions, including flows, slides, topples, and lateral spreads. Hillslopes are often where landslides happen. Since the Himalayas are a geologically young mountain range that is prone to earthquakes and severe soil erosion, they often happen there in India. Less often and violently, landslides may also happen in the Nilgiri hills, Eastern Ghats, and Western Ghats. Because of rising human activity, landslides have been occurring more often throughout time and causing alarmingly greater loss of life and property. When a slope's inherent stability is disturbed, landslides may occur.

They may come before or after severe storms, earthquakes, or volcanic eruptions. When water quickly builds up in the ground, a rush of water-soaked rock, soil, and debris occurs, leading to the development of mudslides. Natural catastrophes have the potential to cause mudslides, which often begin on steep slopes. During and after heavy rains, areas, where wildfires or human land alteration have killed vegetation on slopes, are especially susceptible to landslides. Landslides are often unintended consequences of severe weather, volcanic eruptions, and earthquakes. They have a high fatality rate, burying communities and homes on hillsides and washing cars off the road and into ravines, killing hundreds of people. Most deaths are caused by injuries and asphyxia from being trapped beneath debris. Significant property loss is also brought about by breakdowns in water systems, structures, and communication lines, as well as by damaged crops. Landslides are often brought on by man-made factors such as severe deforestation, soil erosion, human habitation in landslide-prone regions, the building of roads or communication lines in mountainous places, and underground pipelines, among others [5].

Avalanches:

Avalanche is the rapid flow of snow down a slope that may have been caused by a natural occurrence or human intervention. Avalanches often occur in mountainous areas and carry snow, air, and water with them. If an avalanche is powerful enough, it may carry down the hill along with it huge items like boulders, trees, and other materials as well as ice. Although icefalls are the source of rock slides, mudslides, serac collapses, and rock avalanches, an avalanche is distinct from them since it is predominantly made up of moving snow. Avalanches are one of the most frequent risks to life and property in mountainous areas, mostly due to their speed and ability to bring other items down with them. Avalanches are often assessed and classified based on their potential for damage as well as their magnitude and other shape-related qualities. The nature of the failure, the sliding surface, and the kind of snow involved, the propagation mechanism of the failure, the cause of the avalanche's trigger, the direction, slope height, and slope angle are some characteristics of an avalanche that are used to classify it. Avalanche size, mass, and destructive potential are classified using logarithmic magnitude scales, which typically have 4 to 7 categories and depend on the observational system and/or area being employed.

Weather:

Only a snowpack that is still standing will cause an avalanche. It is typical for snow to build up into a snow pack throughout the winter months at high elevations. The existence of a snow pack is controlled by several climatic factors coming together with a very little margin of error. The sun's warmth, radiational cooling, vertical temperature gradients in standing snow, snowfall volumes, and snow kinds are among the key circumstances. Surprisingly, mild winters encourage snow pack growth while very cold and violent winds cause snow packs to deteriorate. The free-thaw cycle is milder than it is in harsher weather when the temperature is around 0 degrees, the freezing point for water, or even when the sun is warm. The snow pack is enhanced during the freezing stage of the free-thaw cycle and becomes weaker when the thawing stage begins. An avalanche may be started under these circumstances by a rapid rise in temperature that causes it to rise above zero degrees. When the temperatures rise in the spring, this occurs. Temperatures that are persistently extremely low for an extended period may cause a snow pack to stabilize or destabilize. When a snow pack's base temperature is just below freezing, cold winds that reach the snow surface cause a temperature differential. The base of the snow pack will, however, be considerably colder than the freezing point if it is on top of a glacier [6].

A deep hoar would be produced in the snow pack if the temperature gradient inside the snow pack is more than 10°C difference per vertical meter for longer than a day. This is because moisture will flow from the bottom to the top of the temperature gradient. The formation of grains is a result of the snow pack's inherent weakness, which is caused by the deep hoar. An avalanche will start if a slab resting on this unstable area is unstable. On slopes that are downwind and protected, snow will rapidly accumulate in any relatively strong wind. In addition, a favorable wind pressure angle causes slopes to stabilize. A wind slab is a fragile, unsteady construction that is weakly attached to the surface it is resting on. Strong winds have the potential to top load or cross load this structure, which both have the potential to cause an avalanche. When snow is deposited on a slope perpendicular to the fall line, top-loading is said to occur, while cross-loading is said to occur when snow is placed parallel to the fall line. Avalanches are more likely to occur during or just after snowstorms and downpours. Due to weight and the fact that it has not had time to bind to the existing snow layers, newly fallen snow destabilizes the snow cover. Rain also contributes to the instability of the snow pack by adding weight to it and decreasing the friction that keeps the different layers of snow together, which leads to the avalanche.

Triggers:

Avalanches never happen at random. They always happen as a result of the snowpack being under external stress. Heavy rain or snowfall, a sharp temperature change, and rapid impacts from ice or rock falls are a few typical natural causes. The cracks and fractures that form over time despite steady temperatures and pressures are a more gradual cause. The snow pack gradually creeps downhill, causing these fractures to form. Skiing, planned explosives, and snowmobiles are a few human triggers. An avalanche's stress cause might be nearby or far away. The most frequent localized cause is heat-emitting pebbles from sunshine. A distant trigger occurs when there is some stress transfer from the slab to the origin, causing a crack to start that quickly spreads and releases an avalanche. An avalanche's triggering is a crucial occurrence at all times. Avalanches may sometimes be stopped in their tracks. Avalanches may be less often and with less devastating force because to innovations made by mankind throughout time. There are primarily two categories of techniques:

Active Techniques:

In this approach, little, artificial avalanches are created, which are less dangerous than large ones. This is accomplished by purposefully disrupting the snow using explosives such as bombs, shelling, or even howitzer weapons.

Passive Techniques:

Basically, with this approach, snow is either halted, slowed down, deflected, or prevented from travelling in enormous volumes that might cause harm. Building a cement structure to block snow is one method of doing so. Avalanche control structures may be divided into a few categories, including,

Snow Retention Structures:

Snow retention structures including snow racks, avalanche snow bridges, and snow nets. Each of these is applied to the upper path of potential avalanche pathways. A sturdy steel wire mesh that is stretched over the slope is essential for avalanche barriers. The mesh's support assists to stop crawling within the snowpack. As a result, the avalanche is halted just where it began, and little snow changes continue to be harmless. The strain brought on by the weight of the snow is taken up by the snow nets, then dispersed across the swivel posts and anchor ropes into anchor points.

Snow Deflection Structures:

they are used to stop and reroute the flowing snow inside the avalanche path. They include wind baffles and snow barriers. They risk being overwhelmed by the avalanche if the diverting is abrupt rather than gradual. Snow catchment structures. Direct protection of significant objects and buildings, such as employing snow sheds (avalanche sheds). Snow retardation structures, such as snow breakers, which are often employed in minor slope areas of the avalanche route to enhance its natural slowing.

Volcanic Occurrences:

A volcano is a hole in the earth's surface through which lava, volcanic ash, and gases may escape from a magma chamber underneath. A volcanic eruption is the unexpected occurrence of a powerful outpouring of steam and volcanic debris from a volcano. Volcanic eruptions fall into one of three categories. The most frequent eruptions are magmatic ones, which are brought on by the decompression of gas inside the magma, which gives it momentum. Phreatomagmatic eruptions are different kinds of volcanic eruptions. The mechanism fueling them is the exact opposite of that driving magmatic activity, it is the compression of gas inside the magma. Phreatic eruptions are the third kind of volcanic explosion. It happens when steam becomes overheated by contact with magma. Phreatic eruptions often result in the granulation of preexisting rocks rather than any magmatic discharge. Explosive eruptions and effusive eruptions are two different kinds of volcanic eruptions in terms of activity. Gas-driven explosions that push magma and tephra are what distinguish explosive eruptions from other types. Conversely, effusive eruptions are characterized by lava outpouring without a large explosive explosion. Explosive eruptions are the most hazardous kind of eruptions, and several explosive eruptions in earth's history are considered to have changed the climate, such as the eruption of Lake Toba in Indonesia, which took place 69,000 years ago.

Heat And Cold Wave:

A heat wave is a protracted period of unseasonably high temperatures, which may also include significant humidity. A heat wave is a specific kind of weather that varies from place to place; there is no one meaning for the phrase. If they are outside the typical climatic pattern for that place, temperatures that individuals from a hotter environment would consider usual may be referred to as a heat wave there. The word is used to describe both normal weather changes and very hot times that may only happen once every century. The growing usage of air conditioning during extreme heat waves has resulted in massive power outages, catastrophic crop failures, and hundreds of fatalities from hyperthermia. The World Meteorological Organization suggests using the criterion of when the daily maximum temperature surpasses the average maximum temperature by 5°C for more than five straight days. An extended stretch of very hot and uncomfortable weather that is often humid is described in a formal, peer-reviewed term from the Glossary of Meteorology. A heat wave must endure for at least one day to qualify, but often they continue for many days to several weeks. In 1900, A.T. A "hot wave," as it was more precisely described by Burrows, is a period lasting three or more days during which the maximum shade temperature reaches or surpasses 90°F (32°C). Realistically speaking, the comfort standards for any given place rely on its typical climate. In addition to physical stress, extreme heat also results in psychological stress, which harms performance and is linked to a rise in violent crime [7].

How They Happen:

Due to a high-pressure region with little to no rain or clouds throughout the summer, the air and ground in warm areas may rapidly get overheated. A heat wave that lasts for days might be imposed by a stationary high-pressure region. Air on one side might be much warmer than air on the other due to the location of the jet stream. Because there is seldom a substantial cloud cover with extremely low humidity, large desert zones, and arid places are more prone to experience excessive temperatures. Usually, winds from hot deserts blow hot, dry air in the direction of places that are generally cooler than during a heat wave. Near the summer solstice, when long days and a high sun would produce scorching conditions even without the passage of hot air from other regions, an area that lacks topographical characteristics that may chill breezes that originate in the hot deserts receives minimal mitigation throughout the summer. When a hot air mass crosses a large body of water, like a sirocco from the Sahara crossing the Mediterranean, it is likely to pick up a lot of water vapor, which will result in a drop in temperature but a significant increase in humidity, making the original desert air somewhat less moderate as evidenced by a high heat index. Air from tropical oceans may also penetrate far into the middle latitudes and produce heat waves, as is often seen in the eastern United States and southeast Canada. Due to the ineffectiveness of nighttime cooling, the heat island effects of big cities only make heat waves UN big cities worse.

Mortality:

Excessive sweating may be an indication of being exposed to too much heat. Overall, the deadliest weather occurrence is heat waves. Over five days, the 1995 Chicago Heat Wave, one of the deadliest in American history, resulted in almost 600 fatalities from heat-related causes. Despite the risks, Scott Sheridan, a geography professor at Kent State University, discovered that less than half of seniors 65 and older follow heat-emergency advice like drinking plenty of water.

'Harvesting' and Underreporting Effects:

Due to a lack of data and inaccurate records, the number of heat-related deaths is significantly underreported. However, a short-term forward mortality shift known as the "harvesting effect" may be blamed for a portion of the death seen during a heat wave. Some heat waves are accompanied by a compensating decline in overall mortality in the weeks that follow.

Heat Waves' Effects:

Power outage: The situation is made worse by the fact that heat waves often cause electricity spikes because of increased air conditioner consumption. Thousands of households and businesses lost electricity during the 2006 North American heat wave, particularly in California. Electrical transformer failures in Los Angeles caused thousands of people to lose power for as long as 5 days. Over half a million people were left without power in Melbourne, Australia, as a result of the heat wave blowing transformers and overloading the electrical infrastructure.

Flames:

A heat wave amid a drought may exacerbate flames and bushfires by drying out the vegetation. 440 square kilometers (110,000 acres) of agricultural land and approximately 3,010 square kilometers (7,40,000 acres) of woodland were destroyed by fires in Portugal during the terrible heat wave that swept across Europe in 2003, resulting in estimated loss of €1 billion. Irrigation systems are available on high-end farms to support crops.

Physical Harm:

Heat waves have been known to cause electricity transformers to explode, which results in fires, water lines to break, and roads and highways to crumble.

Changing Climate:

Climate is a region's typical weather pattern. It is a region's average weather patterns, seasonal changes, and weather extremes. Climate refers to such situations that average out over a lengthy time of at least 30 years. The strongest known information about historical climate change, the greenhouse effect, and current variations in global temperature was released by the Intergovernmental Panel On Climate Change (IPCC) in 1990 and 1992. The temperature of the planet has been found to shift significantly throughout time. It has gone through a number of glacial and interglacial eras. The mean average temperature has changed by 0.51° C during a 100- to 200-year period, but, over the last 10,000 years of the present interglacial period. Even little climate changes have the potential to disrupt agriculture and cause animal and even human migration. The delicate equilibrium that has been formed between different elements of the ecosystem is being disrupted by human activity. The atmosphere's concentration of greenhouse gases is rising, which has raised the world's average temperature. This might throw off the hydrological cycle, induce floods and droughts in various parts of the planet, raise the sea level, alter agricultural production, lead to famines, and kill both people and cattle.

Worldwide Warming:

Since 1900, the planet's average temperature has risen by more than one degree Fahrenheit, and since 1970, the rate of warming has accelerated almost thrice. Global warming is the term used to describe this rise in the planet's average temperature. The National Oceanic and Atmospheric Administration's experts place the years between 1998 and 2007 among the top 25 warmest years on record for the United States. Since the US and China are the two major polluters in the world and have drawn criticism for their dumping practices, we are using the US as an example. If we do not limit emissions from fossil fuels like coal and oil, the globe might warm by an extra 7.2 degrees Fahrenheit this century. All living species and the patterns of the earth's climate will be affected by this increase in average temperature, and many of these changes have already started.

Causes of Global Warming:

The atmosphere's accumulation of greenhouse gases including carbon dioxide, methane, and nitrous oxide is the main contributor to global warming. One of the main producers of carbon dioxide is power plants. These power stations generate energy by burning fossil fuels, which releases carbon dioxide into the atmosphere. Around 20% of the carbon dioxide exhaled into the atmosphere comes from the burning of gasoline in automobiles. Buildings, both commercial and residential, contribute more to global warming pollution [8]. These must be built using a lot of fuel, which when burned releases a lot of carbon dioxide into the environment. When it comes to retaining heat in the atmosphere, methane is 20 times more effective than carbon dioxide. It comes from the microbes in bogs, the fermentation of fossil fuels, and the flatulence of cows. Field flooding causes anaerobic bacteria to multiply and organic materials in the soil to decompose, which releases methane into the sky. Nitric acid and nylon are produced when organic waste is burned, fertilizers are used in agriculture, and vehicles with catalytic converters. Global warming is also a result of deforestation, which is the chopping and burning of forests for industrialisation and habitation.

Combating Global Warming:

Several countries are taking several actions to slow the pace of global warming. The Kyoto Agreement, which was negotiated between several countries to minimize the emissions of different greenhouse gases, is one such initiative. Additionally, a lot of nonprofit organizations are devoted to the same objective. One of the most prominent American politicians to sound the alarm about the dangers of global warming is Al Gore. He has authored a book that documents his belief that the world is heading toward a very heated future as well as the critically acclaimed documentary film An Inconvenient Truth. Additionally, he has spoken out against global warming and cautioned others about its negative implications and possible solutions.

Economics of Climate Change:

The term "economics of global warming" refers to the financial costs and gains associated with the phenomenon as well as the financial repercussions of efforts to slow down and adapt to it. Estimates are derived from several sources, such as integrated assessment models, which aim to incorporate socioeconomic and biophysical analyses of climate change. At an Intergovernmental Panel on Climate Change (IPCC) summit in April 2007, representatives from 120 different countries reviewed the particular social and economic implications of preventing global warming. The IPCC Fourth Assessment Report was subsequently accepted. The IPCC's Fourth Assessment Report, which was released in 2007, examined the overall financial effects of climate change. Net yearly expenses associated with climate change impacts are extremely likely to occur (more than 90% likelihood), and these costs will rise over time as global temperatures rise. Peer-reviewed estimates of the social cost of carbon (net economic costs of climate change damages aggregated globally and discounted to the specified year) in 2005 averaged US$ 12 per tonne of carbon dioxide, however, there was a wide range of estimates (from 100 estimations). Disparities in assumptions about climate sensitivity, response delays, how risk and equity are handled, economic and non-economic repercussions, the inclusion of potentially catastrophic losses, and discount rates are largely to blame for this. Since numerous non-quantifiable effects cannot be taken into account, aggregate estimates of costs often underestimate damage costs and conceal considerable disparities in impacts among industries, regions, and people.

A catastrophe is an accident or risk that results in significant loss of life and property and upsets the stability of the economy. It is a terrible incident with serious ramifications for human life as well as for societal and personal growth. An environmental catastrophe is a mistake or dangerous occurrence that negatively impacts the environment and causes significant changes to it. Based on their causes, catastrophes have been broadly divided into natural and man-made disasters. Threats that have a human component, such as human intention, neglect, or mistake, or that have seen a human-made system collapse, are known as anthropogenic catastrophes. Since they are caused by a human shortcoming or mistake, they are sometimes referred to as man-made disasters. Floods are brought on by excessive rainfall or water in one area, which exceeds the area's capacity to contain it. There are three different forms of floods: storm surges, river floods, and flash floods.

A drought is a protracted period of months or years during which an area has a water supply shortage. A tropical cyclone is a kind of storm system that has several thunderstorms, a significant low-pressure center, high winds, and heavy rain. Earthquakes are brought on by a rapid change or movement in the tectonic plates of the Earth, which causes the crust to tremble violently and vibrate to varied degrees. An earthquake's 'focus', or subsurface origin, is located there. 'Epi center' refers to the location immediately above the focus on the surface. Landslides are a very common geological occurrence. They happen when disruptions in a slope's inherent stability induce masses of rock, dirt, or debris to slide down the slope. Avalanches are sudden flows of snow down a slope that may be caused by either natural or man-made causes. An avalanche may combine snow falling from the sky with air and water, usually happening in steep terrain. Avalanches are never the result of chance or spontaneous occurrences; they are always brought on by an external force on the snow pack.

A volcano is a hole in the Earth's surface through which lava, volcanic ash, and gases may escape from a magma chamber underneath. A heat wave is an extended period of unseasonably high temperatures, which may also include high humidity. A cold wave is an unexpected decline in temperatures over a brief period. The climate is a region's typical weather pattern. It is the region's average weather patterns, seasonal changes, and weather extremes. Climate refers to such situations that average out over a lengthy time of at least 30 years. Since 1900, the planet's average temperature has risen by more than one degree Fahrenheit, and since 1970, the rate of warming has accelerated almost thrice. Global warming is the term used to describe this rise in the planet's average temperature. Ozone shields humans from dangerous UV rays while it is in the stratosphere, but it is damaging when it is in the troposphere because it aids in the creation of photo-chemical smog.

CONCLUSION

Furthermore, there is a wide range of effects that natural catastrophes have on society. The effects on human populations, the economy, and the environment are thoroughly examined in this essay. Disasters may cause the loss of life, the dispersion of people, the destruction of infrastructure, the interruption of vital services, and financial losses. Ecosystem devastation, biodiversity loss, soil erosion, and water resource pollution are some of the environmental effects. Planning for disaster response, post-disaster recovery, and disaster preparation all depend on an understanding of these social ramifications. This study also highlights the value of multidisciplinary methods and the contribution of scientific research to the advancement of our knowledge of natural catastrophes. To fully comprehend these complicated occurrences, scientists, engineers, social scientists, politicians, and local communities must work together. To improve our knowledge and decision-making processes, it emphasizes the use of data gathering, monitoring systems, modeling methodologies, and risk assessment tools. To sum up, knowledge of natural catastrophes is essential to efficient disaster management and the development of resilient communities. The categorization causes, and social ramifications of natural catastrophes are briefly discussed in this essay, which also highlights the need for multidisciplinary cooperation and scientific investigation. To lessen the effects of natural disasters on human civilizations and the environment, we may increase preparation, response skills, and long-term planning by furthering our knowledge of these occurrences.

REFERENCES:

[1] J. C. Morganstein and R. J. Ursano, 'Ecological Disasters and Mental Health: Causes, Consequences, and Interventions', *Frontiers in Psychiatry*. 2020. doi: 10.3389/fpsyt.2020.00001.

[2] H. Guo, 'Understanding global natural disasters and the role of earth observation', *Int. J. Digit. Earth*, 2010, doi: 10.1080/17538947.2010.499662.

[3] S. Tang and Z. Chen, 'Understanding natural disaster scenes from mobile images using deep learning', *Appl. Sci.*, 2021, doi: 10.3390/app11093952.

[4] H. Syahputra, 'Indigenous knowledge representation in mitigation process: a study of communities' understandings of natural disasters in Aceh Province, Indonesia', *Collect. Curation*, 2019, doi: 10.1108/CC-11-2017-0046.

[5] S. L. Cutter *et al.*, 'A place-based model for understanding community resilience to natural disasters', *Glob. Environ. Chang.*, 2008, doi: 10.1016/j.gloenvcha.2008.07.013.

[6] U. Haring, R. Sorin, and N. Caltabiano, 'Circling the cyclone: Children's understanding of natural disasters through the arts', *Int. J. Pedagog. Curric.*, 2018, doi: 10.18848/2327-7963/CGP/V25I04/1-15.

[7] B. S. Lai and A. La Greca, 'Understanding the Impacts of Natural Disasters on Children', *Soc. Res. Child Dev.*, 2020.

[8] T. Lukić *et al.*, 'Classification of natural disasters between the legislation and application: Experience of the Republic of Serbia', *Acta Geogr. Slov.*, 2013, doi: 10.3986/AGS53301.

CHAPTER 7

EXPLORING THE CAUSES OF MAN-MADE DISASTERS AND POLLUTION

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ABSTRACT:

The environment, human health, and socioeconomic systems are all significantly impacted by man-made catastrophes and pollution. Effective environmental management, the protection of public health, and sustainable development depend on an understanding of the causes, effects, and mitigation measures related to these occurrences. This essay gives a general review of man-made catastrophes and pollution while examining their different manifestations, root causes, and effects. A broad variety of incidents brought on by human activity are included under man-made catastrophes. This study looks at a variety of man-made catastrophes, such as infrastructure failures, industrial accidents, chemical spills, nuclear mishaps, and oil spills. These catastrophes have the potential to cause both short-term and long-term environmental damage, human casualties, community uprooting, loss of livelihoods, and monetary losses. To limit their incidence and effects, preventative measures, emergency response plans, and regulatory frameworks may be developed with the assistance of an understanding of the origins and features of man-made disasters.

KEYWORDS:

Man-Made Disasters, Environment, Catastrophes, Human Health.

INTRODUCTION

Ecosystems and human health are seriously threatened by pollution, a persistent byproduct of human activity. This essay examines several types of pollution, including noise pollution, soil contamination, water pollution, and air pollution. Pollutants are released into the environment due to industrial emissions, inappropriate waste disposal, agricultural activities, and transportation. Pollutants may harm human health and cause malignancies, neurological problems, respiratory ailments, and other maladies. Ecosystems are also impacted by environmental pollution, which results in a decline in biodiversity, deterioration of the ecosystem, and disturbances of ecological processes. The effects of man-made catastrophes and pollution go beyond issues of the environment and human health. Social structures, local economies, and local communities may be impacted by these events' socioeconomic effects. Social injustices, population relocation, lost livelihoods, and increased vulnerability among vulnerable groups are all possible outcomes of disasters and pollution. It takes interdisciplinary methods that take into account environmental justice, fair resource access, and sustainable development principles to address these socioeconomic ramifications [1], [2].

It takes a mix of preventive, readiness, reaction, and recovery efforts to mitigate pollution and man-made catastrophes. The numerous techniques covered in this essay include risk assessment and management, legal frameworks, technology developments, public awareness campaigns, and international collaboration. These initiatives are meant to lessen the likelihood of man-made catastrophes, lessen pollution, improve environmental monitoring, and encourage sustainable activities.

Man-Made Catastrophes:

Man-made catastrophes may be less severe in scope yet occur more often. These are the hazards brought on by negligence or by human actions that cannot withstand the forces of nature. Accidents are a kind of man-made catastrophe that cause death and property damage. Environmental damage results from mining accidents. A few examples of man-made catastrophes are the Bhopal Gas tragedy in India and the Chernobyl nuclear accident in what was once the Soviet Union. The recent tsunami that hit Japan was a natural catastrophe that, when it came into touch with the country's nuclear reactors, was transformed into a massive man-made tragedy.

Nuclear Catastrophe:

Military action may result in nuclear catastrophes as well. The biodiversity will be impacted. Back in 2006, when Israel bombed an oil reservoir in the southern part of Beirut, the Lebanese shoreline was severely contaminated by 15,000 tons of oil slicks. Many endangered bird, turtle, and seal species have entirely vanished. The Chernobyl Nuclear Power Plant in Ukraine had one of the biggest nuclear power plant catastrophes in 1986. Due to the radioactive discharge into the atmosphere, which spread over a wide region, this accident resulted in several fatalities from radiation sickness. The reactor was wrecked by the enormous power outburst. According to reports, the fallout was 400 times more than what the Hiroshima atomic blast had produced. Even Ireland had some nuclear rain. Large portions of Belarus, Ukraine, and Russia were contaminated. The nuclear power industry's growth significantly slowed down for many years following it [3], [4].

Over the years, cleanup costs have been shared by Russia, Ukraine, and Belarus. When the Union Carbide pesticide facility in Bhopal, India, leaked methyl isocyanate into the atmosphere, a similar catastrophe occurred. Numerous thousands of lives were lost. Children are still born with problems, and when they become older, many of them develop deadly illnesses and physical deformities. Thousands of people have been impacted by the hundreds of tonnes of dangerous chemicals that were abandoned at the factory and are still leaking and polluting the ground water in the area after 25 years. The MP Government founded the Disaster Management Institute to provide training to citizens in the wake of the Bhopal Gas Tragedy. The Institute also carries out research and offers consulting services related to catastrophe management, mitigation, and prevention.

The Institute conducts training programs on managing natural catastrophes for working managers and government officials. In the post-Chernobyl recovery, the combined radiological and socioeconomic restoration of the damaged regions was the most difficult endeavor. Rehab, economic recovery, and sustainable development of the devastated communities are the main goals. The President of the Republic of Belarus actively participates in the development and execution of the governmental policy for mitigating the effects of the Chernobyl catastrophe. According to the Chernobyl Act, the President and his administration rigorously oversaw the execution of the governmental program for mitigating the effects of the catastrophe. The system of control entails the President traveling to radioactively polluted areas and making judgments there about the most pressing issues impacting the affected people.

The population of the most polluted districts have been entirely resettled under the main radiation protective mechanisms. The nation effectively employs radiation monitoring and control procedures. Medical treatment is being offered to those living in the radionuclide-contaminated areas, and an effective social protection system has been put in place to cover all affected individuals. The system being used to protect the populace from radiation exposure entails the creation of legislative documents addressing rules pertaining to radiation safety, sanitary regulations for radiation safety, and permissible levels of radio cesium and radio strontium concentration in food, agricultural products, and water. The rehabilitation of pastures and grassland for private and state farms, the liming of acidic soils, and the application of phosphate and potassium fertilizer to the whole polluted zone of agricultural land are all closely adhered to. A variety of innovative agricultural production methods were developed. Because of these actions, almost all agricultural products and foods produced on affected Belarusian territory meet radioactive concentration regulations. Facilities for agriculture have been reorganized. The altered facilities make sure that there is less radioactive buildup in the finished goods. With environmental monitoring units dispersed around the nation, an efficient system of radiation-ecological monitoring and radiation control has also been set up. To stop radionuclides from migrating to less polluted areas, research and radiation-ecological monitoring are being carried out.

Chemical Catastrophe:

Most companies employ chemicals in their manufacturing processes. Even some industries create chemicals. Chemicals may be categorized as either organic or inorganic depending on where they came from. Organic compounds are found in nature or are made there. Laboratories manufacture inorganic compounds. Numerous industrial chemicals may be detrimental to the objects they are exposed to, regardless of where they come from. Chemicals may sometimes have serious negative impacts on people or the environment. They may be classified as reactive, corrosive, flammable, or poisonous depending on the kind of harm they can do. Any kind of accident, leak, or explosion involving dangerous industrial chemicals is considered a chemical catastrophe. When chemicals seep into the environment, they could have serious negative impacts, including many fatalities, as was the case with the Bhopal gas leak in December 1984. All parts of the environment, whether social, economic, or ecological, are harmed by these catastrophes. Even when all safety procedures are taken, chemical mishaps may still happen. Chemical catastrophes may range in size based on the substance they are made of and how vulnerable their surrounds are. A variety of signals and color codes are used when chemicals are stored or transported so that those handling them may recognize the kind of chemicals and are aware of their negative consequences. This aids in notifying the emergency management team of any catastrophe involving chemicals. Based on the kinds of effects connected to certain compounds, color codes are utilized [2].

DISCUSSION

Source of the Incident:

Chemical catastrophes often result from a mix of mechanical and human errors while handling toxic substances. Any business, industry, or workshop that uses hazardous chemicals is vulnerable to these mishaps. A chemical leak or spill in the environment is the major reason for chemical catastrophes. As a result of the environment's reaction with the released chemical, both individuals and the ecosystem are severely harmed. This is the reason why before using particular chemicals, a company must put in place a variety of safeguards. To guarantee that no harm comes from the use of these chemicals, a variety of legal processes and regulations also govern the exposure of these compounds. Chemical disasters may also result from human mistake brought on by ignorance. However, chemical catastrophes often happen as a result of inadequate planning and the implementation of inadequate emergency and safety protocols. A specific industry's attempt to save costs associated with adhering to failsafe safety regulations may be one explanation for this. A chemical spill or leak may cause a crisis that might endanger both the personnel in the sector and people around if the company is not prepared to handle chemicals safely or to act quickly to stop it.

Chemical transportation is the primary cause of catastrophes. This might be the consequence of inadequate infrastructure being given for chemical transportation or a lack of coordination between the chemical's sender and recipient. In certain situations, the chemical may be left unattended outside of an industrial campus for a long period, which might cause an environmental response. Stringent protection measures are established and put into place to provide effective protection against any harm from spills or leaks during chemical handling. However, chemical catastrophes may also result from flaws in the design of protective protocols. Chemicals may evaporate from the equipment or storage devices if their designs are not compatible with the kind of technology being employed. Therefore, it is crucial to create such designs and practices that enable one to handle chemicals. Additionally, the designs must work with the equipment and practices now used in industry. To be able to respond quickly to emergencies and launch an efficient rescue operation, designs should be periodically updated to reflect changes in processes or equipment.

Environmental Impact:

Chemical catastrophes have a negative impact on every aspect of the ecosystem. They may bring death and devastation as well as significant financial outlays to repair any environmental harm. The fact that chemical catastrophes have impacts outside of the immediate aftermath raises serious concerns in the environmental context. Years after the event, these repercussions could still be felt. To analyze their genuine meaning, these impacts have been divided into three categories: immediate effects, short-term effects, and long-term effects. The following are some potentially harmful effects of chemical disasters on the environment: Exposure to carcinogens: Chemical disasters like spills or leaks expose living tissues in people, animals, or plants to carcinogens. Even while this exposure may not have an immediate impact, it might eventually play a significant role in the development of cancer in catastrophe victims. Cancer is brought on by carcinogens, which harm living tissues. At work, workers may be exposed to high concentrations of carcinogens (such asbestos or ionizing radiation). Workplace exposure may cause tiny epidemics of uncommon malignancies, such as the increase in liver angiosarcoma among American employees who cleaned vinyl chloride polymerization vessels in 1974 [5].

Fires: If the chemical that is escaping is combustible and is not instantly spread far over the environment, it might cause huge fire breakouts that release dangerous compounds into the atmosphere. Apart from doing a great deal of harm to the equipment and infrastructure, the leaking chemical would also injure living things if they came into touch with it. A variety of chemical explosions may be set off by fires, or they may be the outcome of the same. Fire damage could have instant effects. However, the short-term effects of the resultant air pollution might include disease and damage of the ecosystem. For instance, two research scientists perished in a laboratory fire at the Bhabha Atomic Research Centre (BARC) in Trombay that was unintentionally started by chemical reactions. Toxic penetration: After a chemical accident, many poisons, including arsenic, may seep into the ground or water around industrial facilities and have immediate, short-term, and long-term impacts. Animal and plant deaths might be the immediate result. The water quality would decline, rendering it unsafe for use, or the soil would deteriorate, resulting in a decrease in agricultural output. In the long run, infections would spread or children's development would be slowed. When chemical reactions after a chemical accident cause radioactive alterations in the environment, it is known as radioactive fallout. These interactions might result in flames and explosions as well as the release of carcinogens. The ecology suffers greatly from the radioactive fallout.

Corrosion:

When chemicals corrode objects by touch, it happens. It may harm human tissues, machinery, and equipment. Although most of the effects are rapid, certain short-term problems might develop and cause impairment. For instance, nitric acid causes a yellow burn when it comes into contact with skin. Severe burns are the consequence of sulfuric or sulphuric acid reacting with skin moisture. Hours after exposure, hydrofluoric acid still produces excruciating deep burns.

Costs of Compensation:

These must be paid in order to make up for the consequences of chemical catastrophes on individuals. Depending on the harm done to them, they need adequate care. In addition, expenses are paid to repair the infrastructure damage. In addition, it is necessary to restore the crops and plants. For instance, the Bhopal Gas Tragedy victims received financial compensation [6].

Biological Panic:

A biological catastrophe is a kind of natural disaster that has catastrophic consequences and is often brought on by a wide-spread biological agent, bacteria, or virus. A abrupt increase in the population of a particular species of plant or animal, like a locust plague, is another feature of this tragedy. The unexpected spread of a disease or pandemic that affects living things is another definition of a biological catastrophe. It may have an impact on both plants and animals, resulting in widespread mortality and incapacity. Because they have a negative impact greatly on human health and development, biological catastrophes are the most harmful for people. In the event of a biological calamity, the mortality rate in an economy increases significantly. It may quickly exterminate a large population. Occasionally, biological catastrophes turn out to be more costly economically than other natural catastrophes.

As a result, it is critical to keep an eye on any developments that can trigger a biological catastrophe. Depending on the agent that produces them, biological catastrophes are divided into natural and man-made categories. Natural biological catastrophes are epidemics that are brought on by bacteria or viruses that have evolved spontaneously. Natural biological catastrophes cause a big number of people to get sick at the same time, which often results in numerous deaths. Human involvement introduces biological agents into the normal consumption cycles of living things, resulting in biological catastrophes that affect the health of living things. A number of species have a bottleneck in their DNA structure, indicating the existence of a disease that killed many individuals of the species and ultimately caused the extinction of the species. The Spanish influenza, which spread due to population mobility after World War I, is the most well-known example of a biological calamity brought on by human intervention.

Source of the Incident:

However, because naturally occurring diseases are widespread, taking precautions is the best way to avoid their harmful effects? Hospitals and medical institutions are the primary suppliers of diseases or biological agents, as well as the epidemics they create. These facilities house a large number of patients as well as other individuals who are infected with biological agents. Additionally, the corpses of patients who have passed away from a sickness act as reservoirs for lethal germs. Another factor that might contribute to a biological catastrophe is contaminated water or food that is being given to people. If the major source of these items becomes contaminated with infections or poisons, many individuals who eat these products will have the same sickness at the same time. More individuals may become victims of a biological catastrophe as a result of a generalized panic. Because specific illness signs may not always be present, individuals may sometimes get a disease without being aware of it. But these folks decide to leave because of the widespread terror brought on by the disease's development in their neighborhood. In addition, they spread the illness to a large number of people in their new site. Sometimes individuals are unaware of the risks associated with biological catastrophes and the possible harm they might experience. Again, it is required of the government to inform the public about possible biological calamities and the protective measures they may take. The presence of insects and rodents in a region may enable a biological catastrophe to spread there more quickly. They develop into the disease's carriers or the potential disease-causing germs.

Environmental Impact:

A biological calamity that results in the loss of life exacts a hefty economic cost. In addition to impeding economic growth, the growing death toll also makes it difficult to recover from disaster-related effects, which calls for the active engagement of important human resources. The economy's livestock suffers as a result of an epidemic animal spread, and the human food chain is also affected. By consuming the flesh of diseased animals, humans may get ill. This quickens the illness's transmission, making disease control more challenging. The transfer of illnesses from one species to another may cause environmental damage and ecological imbalance. It is very hard for the ecosystem to return to its pre-disaster state of equilibrium if a species becomes extinct or becomes endangered during a biological catastrophe.

Mitigating Actions:

Hospitals produce biological waste that is potentially hazardous and pathogenic microorganisms. Therefore, it is crucial to modernize and expand medical facilities to stop an epidemic from becoming a biological calamity. Building large hospital complexes with well-spaced out blocks for treating patients with various disorders is preferable. It would aid in halting the rapid spread of a disease among affected individuals. The public health authorities should thoroughly inspect food and water sources before allowing them to reach people in order to avoid an epidemic of a suspected virus. To allow people to act sanely and without fear, it is crucial for the government to disclose all pertinent information regarding a disease epidemic.

Air Toxicity:

The many sorts of pollution will be thoroughly covered in this section. Air pollutants are compounds that, when released into the atmosphere, may affect both people and the environment. These pollutants might be chemical or biological elements that are apparent to the human eye or could take on an unseen form. There are many different kinds of air pollutants that may seriously harm the ecosystem. In addition to global warming, the environment is suffering from other serious harms that might endanger living things. One such harm is that brought on by the thinning of the ozone layer. When carbon monoxide and the ozone molecule, which has three oxygen molecules, combine, carbon dioxide and oxygen are produced. Vehicle exhaust produces the extremely reactive and unstable chemical known as carbon monoxide. The upper atmosphere's thick ozone layer is in charge of blocking the sun's dangerous ultraviolet (UV) radiation.

The removal of this crucial layer renders all living things vulnerable to the sun's destructive rays and eliminates the protective support. Ozone is very unstable and cannot be created intentionally since it would react with carbon monoxide practically soon. The ozone molecule transforms into diatomic oxygen and a free radical when it absorbs UV radiation. Another chemical that is very harmful to the environment is the chlorofluorocarbon (CFC) released by refrigerators. Electromagnetic radiation's impact on CFCs results in the production of chlorine, which is extremely reactive with ozone. The displaced chlorine molecule will interact with the ozone and cause ozone depletion.

Due to the instability of the chlorine oxide, it will react with one additional ozone molecule to produce two diatomic oxygen molecules and one chlorine molecule. The quantity of ozone molecules will decrease as a result of this chlorine molecule's reaction with other ozone molecules.

Each chlorine molecule needs around two years to discover a stable complex containing elements like hydrogen in order to produce hydrogen chloride. Several ozone molecules are transformed into diatomic oxygen molecules during this time. Initial applications of CFC included cleaning technical machinery and air conditioners. Today, its usage is limited to refrigerators, and there is a greater awareness of the need to eliminate it.

Ozone-depleting chemicals (ODS) are compounds that have an impact on the ozone layer, such as CFC. Other ODS include things like freons and sulfuric acid. Aerosols should only be used in moderation since they also contain ODS. The Total Ozone Mapping Spectrometer (TOMS), which aids in estimating the thickness of the ozone layer, is used to provide the proof that the ozone layer has been depleted. In the spring, an ozone hole is visible over the Arctic area; it grows over the summer and may spread across nations like Australia, New Zealand, and Chile. Living things are exposed to the damaging effects of UV radiation due to this hole in the ozone layer, which might raise their chance of developing some cancers, cortical cataracts, and vitamin D deficiency. When these pollutants fall as acid rain on land, they may cause further damage, demonstrating that the impacts of air pollution go beyond just poisoning the air that people breathe.

Nitrogen oxides, sulfur dioxide, and carbon dioxide are the main pollutants that cause acid rain. Sulfur dioxide is produced during several industrial operations, however due to regulatory regulations, treatment is now required. Sulfur dioxide emissions from industrial sources have been significantly decreased as a result, although volcanic eruptions still release sulfur dioxide into the atmosphere. Lightning strikes result in the production of nitrogen oxides. Sulfuric acid, which damages clothing, statuary, and even paint, is produced when rain and sulfur dioxide combine. The government has taken strict action against air pollution and is looking for measures to minimize hazardous emissions from industry as a result of acid rain and its impact on the ecology. An important kind of pollution that has to be immediately addressed and curbed is air pollution. Identifying the causes of pollution is the best method to properly comprehend this kind of pollution.

Water Contaminant:

Water pollution is the term used to describe the contaminating of water bodies with substances that might be dangerous to humans and other living things. Due to the high concentration of harmful substances present in the water, the unpleasant alteration may induce changes in the water's color, taste, and/or odor, making it utterly intolerable. Water is a precious resource that is necessary for many everyday activities, such as drinking, bathing, washing, and cooking. Therefore, a high degree of water pollution will have a significant impact on people and, depending on the amount of contamination, cause a variety of illnesses and ailments.

Water Pollution Sources:

Industries:

Due to the possibility of factory waste being dumped into surrounding streams and rivers, industries are one of the main contributors to water pollution. This causes the water bodies to become contaminated with dangerous substances, endangering aquatic life. Lead, mercury, asbestos, sulphur, and nitrous oxides are a few of the substances found in chemical effluents produced by various industrial processes. These compounds, both metallic and non-metallic, should be thoroughly cleaned before being released into streams since they are dangerous to life. Fish swallow metallic contaminants like mercury, which have an impact on everyone who eats the infected fish. It is crucial to make sure that these compounds are transformed into safe alternatives before being released into the environment due to the high hazardous levels of such contaminants.

Sewage:

Another form of water contamination is sewage, particularly in a growing nation like India. In underdeveloped nations, it is typical for there to be no suitable sewage infrastructure in place to collect all of the sewage from a home and drain it into a public pool for treatment. The majority of household sewage is made up of human feces and is perfectly biodegradable, but when it is dumped into a body of water without being properly treated, it may seriously affect the aquatic life.

People who are unwell will pass out bacteria with their feces, which will cause these hazardous bacteria to be released into the sewage system and contaminate the water body. People who consume water that has been polluted by sewage pipes risk becoming sick and developing diarrhea [7].

Nuclear Sludge:

Nuclear waste is another cause of water contamination since it endangers all life when it is disposed of. Nuclear waste is produced by nuclear mines in addition to nuclear reactors. The nuclear waste that is dumped in bodies of water is difficult to break down. This was seen in Greenland, where remnants of radioactive waste from reactors in East Europe were discovered.

Oil:

Because oil creates a coating over water and limits contact with air, it is a major pollutant that may have a significant impact on marine life. Water plants and fish are impacted by this. Additionally, oil adheres to the feathers of birds that scoop down to catch fish, making it impossible for the bird to fly. When oil is transferred from ships and other vessels to the water through oil pipelines, oil pollution occurs.

Despite being confined, the impact of oil spills may result in a significant loss of marine life. Unmindful trash dumping by visitors to beaches and lakes also has an impact on marine life. The routine disposal of Styrofoam, paper, plastic, glass, and even aluminum in water bodies has an adverse effect on fish and other aquatic life. Acid rain is caused by air pollution and includes sulphuric and nitric acids that may harm marine life.

Acidic rain is produced when the sulphur dioxide and nitrous oxide from industrial pollutants combine with raindrops. Additionally, the temperature of the water is rising, which may affect marine life. People who live in impoverished countries are at risk from water pollution because numerous illnesses that are transmitted via polluted water. Other than human-made factors, such as volcanic eruptions, there are certain natural factors that may contribute to water pollution, such as the addition of sulfur. Algal bloom is another naturally occurring water pollutant, however in contrast to other water pollution sources, it has a very little and careless impact [8], [9].

CONCLUSION

Consequently, for efficient environmental management, public health protection, and sustainable development, it is essential to comprehend man-made catastrophes and pollution. In this study, the origins, effects, and prevention measures of these problems are highlighted. We may endeavor to reduce man-made catastrophes and pollution, building a healthier and more sustainable future for both people and the environment, by addressing the fundamental causes, strengthening legislation, adopting sustainable habits, and raising awareness. Due to global warming, it has been discovered that the rise in air pollution also has an impact on aquatic bodies in the form of increased water temperatures. Global temperatures rise as a consequence of the trapping of solar heat caused by an increase in atmospheric carbon dioxide concentration. The amount of water increases as a result of the melting of glaciers and snow-covered mountains as the temperature rises.

REFERENCES:

[1] S. A. Shah, D. Z. Seker, M. M. Rathore, S. Hameed, S. Ben Yahia, and D. Draheim, 'Towards Disaster Resilient Smart Cities: Can Internet of Things and Big Data Analytics Be the Game Changers?', *IEEE Access*, 2019, doi: 10.1109/ACCESS.2019.2928233.

[2] M. Degg, 'Geological Hazards: their assessment, avoidance and mitigation', *Q. J. Eng. Geol. Hydrogeol.*, 2001, doi: 10.1144/qjegh.34.2.239.

[3] H. Akdoğan and E. Hicyorulmaz, 'The Importance of the Sustainability of Environmental Accounting', *J. Econ. Dev. Environ. People*, 2015, doi: 10.26458/jedep.v4i2.104.

[4] M. Farrokhi, Z. Abbasi Dolatabadi, S. Pakjouei, and V. Pouyesh, 'Review Paper: Approaches to Post-disaster Environmental Recovery', *Heal. Emergencies Disasters*, 2016.

[5] N. Karim, 'Disasters in Bangladesh', *Nat. Hazards*, 1995, doi: 10.1007/BF00613409.

[6] M. Hess, V. Petrovic, M. Yeager, and F. Kuester, 'Terrestrial laser scanning for the comprehensive structural health assessment of the Baptistery di San Giovanni in Florence, Italy: an integrative methodology for repeatable data acquisition, visualization and analysis', *Struct. Infrastruct. Eng.*, 2018, doi: 10.1080/15732479.2017.1349810.

[7] Z. B. Khesina, A. E. Karnaeva, I. S. Pytskii, and A. K. Buryak, 'The mysterious mass death of marine organisms on the Kamchatka Peninsula: A consequence of a technogenic impact on the environment or a natural phenomenon?', *Mar. Pollut. Bull.*, 2021, doi: 10.1016/j.marpolbul.2021.112175.

[8] E. Ali, A. Dabour, and M. Khalil, 'Emergency Shelter In Case Of Direct And Indirect Disasters (Community-Based) (An Applied Study On The City Of Al-Arish - North Sinai)', *J. Al-Azhar Univ. Eng. Sect.*, 2020, doi: 10.21608/auej.2020.73138.

[9] 'European Environment Outlook Report', *Manag. Environ. Qual. An Int. J.*, 2006, doi: 10.1108/meq.2006.08317aag.001.

CHAPTER 8

A FUNDAMENTAL STUDY OF INDUSTRIAL POLLUTION

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ABSTRACT:

Industrial pollution is a serious problem that affects public health, socioeconomic development, and environmental sustainability. It is essential to comprehend the underlying elements of industrial pollution in order to pinpoint its origins, evaluate its effects, and create efficient mitigation plans. This essay provides a thorough analysis of industrial pollution, looking at its sources, traits, and possible remedies. Industrial pollution results from the discharge of hazardous materials and pollutants during manufacturing operations, energy generation, and industrial activities. The main causes of industrial pollution are examined in this essay, including emissions from industrial facilities, poor waste management, chemical spills, and the release of pollutants into the land, water, and air. It is feasible to identify the main causes of industrial pollution and develop focused solutions by examining these sources. Analyzing industrial pollutants' nature and makeup is crucial for determining how they affect the environment and public health. This essay examines a number of industrial contaminants, including persistent organic pollutants, heavy metals, greenhouse gases, pstudy matter, and hazardous compounds. It is possible to identify these pollutants' environmental routes and the potential threats to ecosystems and human populations by understanding their behavior, transport, and transformation.

KEYWORDS:

Industrial Pollution, Socioeconomic Development, Human Populations, Hazardous Compounds, Management.

INTRODUCTION

Rapid and uncontrolled urbanization, deforestation, and industrialisation result in the constant and uninterrupted release of a range of extra geneous elements (inorganic, organic, biological, or radioactive) and energy into the environment. Industrial pollution may take on many different forms, including noise, soil, water, and air. Air and water pollution were previously covered in the section before this one. We shall go into great depth on noise, soil, thermal, and nuclear pollution in this part. In addition to looking at distinct pollution kinds like chemicals, noise, or light, we can also categorize pollution based on where we find it, such as in the air, water, or soil. Investigating the origins of pollution is a different perspective. While certain pollution sources, including automobiles, agriculture, and buildings, are dispersed, other sources are best evaluated as single emission locations. major establishments like industries and power plants make up a major portion of these point sources.

An important part of Europe's economy is industry. In 2018, it contributed 17.6% to the GDP and directly employed 36 million people, according to Eurostat. In addition, industry is responsible for a majority of the emissions of several significant greenhouse gases and air pollutants, as well as other significant environmental effects such the contamination of water and land, waste production, and energy usage. The combustion of fossil fuels is often linked to air pollution. This clearly applies to power plants, but it also holds true for many other industrial processes that could generate their own on-site heat or energy, such as the manufacture of iron and steel or cement. While certain activities produce dust that adds to the amount of particulate matter in the air, others, like the use of solvents in metalworking or chemical manufacture, may result in the emissions of harmful organic compounds.

Trends in Industrial Air Emissions:

Stricter environmental regulations, increased energy efficiency, a shift to less polluting manufacturing processes, and voluntary environmental impact reduction programs are just a few of the factors that have led to these improvements in environmental performance by European industry. Environmental control has long prevented industrial operations from having a negative influence on the environment and human health. The Industrial Emissions Directive, which applies to around 52 000 of the biggest industrial units, and the Medium Combustion units Directive are two important EU policies aimed at reducing industrial emissions.

In contrast, the EU Emissions Trading System (EU ETS) regulates greenhouse gas emissions from more than 12 000 industry and power production facilities across 31 nations. About 45% of the EU's greenhouse gas emissions are covered under the EU ETS. Nevertheless, despite these advancements, industry continues to place a heavy strain on our environment in terms of waste output and pollution. The E-PRTR and openness of industrial emissions data are examples of public accountability. To improve public access to environmental information, the European Pollutant Release and Transfer Register (E-PRTR) was established in 2006. E-PRTR statistics include information on the quantity of pollutants emitted into the air, water, and land for each facility and each year, as well as the off-site transfers of waste and contaminants in waste water. E-PRTR data may be accessed for free on a special, interactive webpage. The website has historical information on 91 pollutant emissions and transfers from 65 different economic activity. Additionally, the Industrial Emissions Directive now incorporates the E-PRTR with broader reporting, including additional data for big combustion facilities. The EEA is now developing a new website with the European Commission to enhance access to this statistics and information.

Costs of Industrial Air Pollution Calculation:

An individual pollutant's detrimental effects on human health and the environment are stated in a standard measure, a monetary value, which has been produced via collaboration across several scientific and economic disciplines, in order to account for the external costs of air pollution. Estimates of the cost of damage are just that: estimates. They may, however, enhance judgments by highlighting the implicit trade-offs in decision-making, such as the cost-benefit analyses used to guide impact assessments and subsequent legislation, when taken into account with other sources of information. Emissions of the principal air pollutants and carbon dioxide are to blame for the bulk of the measured damage costs. Even while estimates of the costs of the damage caused by emissions of heavy metals and organic pollutants are substantially smaller, they nonetheless endanger human health and the environment and have a considerable negative effect on the local level, costing hundreds of millions of euros.

Noisy Environment:

Every day, we hear a variety of noises. Mechanical energy in the form of sound is released from a vibrating source. Some people may find a certain sound to be pleasing while others find it to be unpleasant. Noise is the unwelcome and undesired sound. For various places, the CPCB (Central Pollution Control Board) has suggested acceptable noise levels [1].

Noise's Effects:

Man's ability to communicate is hampered by noise: In a loud environment, communication is greatly hindered. Damage to hearing: Noise damage may result in temporary or permanent hearing loss. It is based on the volume's intensity and duration. For more than a few minutes, noise levels exceeding 90 dB in the mid-high frequency impair auditory sensitivity. Physiological and psychological modifications: Prolonged exposure to noise alters how the body's systems work. It may cause digestive, gastrointestinal, and hypertensive issues, as well as insomnia.

Noise Pollution Reduction:

Reducing the sources of noise is one of the many strategies that aid in noise pollution management. Noise-generating equipment has to be stored in containers with sound-absorbing materials. The course of the noise will be diverted, keeping it from the employees. Machinery noise may be decreased with proper lubrication. Utilizing sound-absorbing silencers, which absorb sound, may help minimize noise. Numerous kinds of fibrous material may be employed for this purpose. At different social gatherings, sound output may be limited by legislation. Horn blowing should be discouraged, particularly in regions with heavy traffic and places near medical facilities.

For determining its effects and directing mitigation measures, it is essential to evaluate the effects of industrial pollution. This essay addresses the negative impacts of industrial pollution on the environment and human health, including soil erosion, biodiversity loss, climate change, and threats to public health. Policymakers and stakeholders may prioritize activities and devote resources to alleviate the negative consequences of industrial pollution by measuring these impacts through scientific study and monitoring. A multifaceted strategy incorporating technology developments, political interventions, and industry best practices is needed to address industrial pollution. This essay examines various remedies and countermeasures, such as more eco-friendly manufacturing methods, waste management procedures, pollution control technology, environmental laws, and corporate social responsibility programs. In order to promote innovation, information exchange, and sustainable development, it is also stressed how crucial it is to establish cooperation among businesses, governments, academic institutions, and civil society [2]–[4].

Industrial Waste Pollution:

The industries take raw materials, refine them, and create finished goods. Some byproducts are then dumped as industrial wastes, whether they be gases, liquids, or solids, damaging the air, water, or land.

Biological and non-Biological:

Paper mills, cotton mills, textile manufacturers, and food processing facilities all produce biodegradable trash. Thermal power plants, iron and steel mills, and the fertilizer industry all produce non-biodegradable waste, which is very dangerous for humans.

Chemical Wastes And Process Wastes:

Whether organic or inorganic, process waste created during the washing and processing of raw materials is harmful to living things. For instance, organic waste is released from food processing facilities, distilleries, sugar mills, etc., while inorganic process waste is produced by the caustic soda, paint, petroleum, iron and steel, and thermal power industries, among other industries. Aerosol pollution from thermal power stations' fly ash damages the respiratory system. Gypsum is created by the fertilizer industry. Slag is produced at iron and steel industries. A select few industries may also contribute to noise and heat pollution.

Chemical waste is made up of acids, alkalis, detergents, and other toxic materials that are created by factories, sugar refineries, etc. The wastes are often released into surrounding bodies of water, such as lakes, seas, etc., changing the pH of both the biological and chemical oxygen demands. The trophic levels and food chains of the ecosystem are destroyed as a result of the aquatic animals and plants absorbing chemical waste. To reduce environmental contamination, non-biodegradable industrial solid waste may be disposed of in the manner listed below.

(i) Fly ash and slag from the steel sector may be used in the cement business.

(ii) Before being discharged, waste shall undergo the appropriate treatment.

Industrial Pollution Types:

Water contamination Organic and inorganic residues of various types may be found in industrial wastewaters. All rivers and waterways are severely polluted by them. Chemicals that are very dangerous, such as cyanide, cadmium, mercury, lead, arsenic, and chromium, are present in the discharge of toxic industrial wastes. They render river water unsafe for consumption by humans and other aquatic life. Color-producing dyes alter the color of the water and lower the oxygen content, which has an impact on aquatic life. Additionally, acids and alkalis quickly alter the pH of water, having an impact on fish and other marine organisms.

Soil Pollution:

The quick expansion of enterprises has led to the discharge of many industrial wastes, many of which include hazardous compounds that are often not biodegradable and contain poisonous acids. Industries temporarily discharge their solid waste overland. Heavy metals and hazardous substances contaminate the soil by washing into it during rainstorms. It is mostly released by sectors including pulp and paper mills, oil refineries, sugar plants, glass companies, and medication manufacturers. Industrial waste has an impact on and changes the chemical and biological properties of soil, which ultimately penetrate the food chain, disrupt biochemical processes, and ultimately pose major risks to living things.

Air Pollution:

Many businesses, including chemical plants, steel mills, fertilizer, sugar, and cement factories, release a lot of smoke and air pollutants into the atmosphere, including oxides of sulphur and nitrogen, lead particles, and chlorofluorocarbons. For instance, sulphur dioxide, which contributes to acid rain, is present in the emissions from the oil refinery in Mathura and the various coal-burning industries in Agra. In addition, a lot of companies manufacture chemicals, some of which escape and pollute the air. Noise pollution may be brought on by industrial activity. Road traffic, airplanes, trains, industries, building sites, electronic and electrical equipment, and the setting off of fireworks are a few well-known forms of noise pollution.

Industrial Pollution's Root Causes:

Urbanization and industrial growth have advanced unexpectedly in the majority of nations. It is in charge of all forms of pollution. Many industrial facilities are hesitant to implement new technology to reduce pollution.

Water Use in Industrial Processes:

The majority of industrial units needed a lot of water. After usage, the water is discharged into water bodies, producing water pollution. Hazardous chemicals, heavy metals, biological waste, etc. come into touch with the water utilized in various manufacturing processes.

1. Poor Policy and Law Implementation: Many developing nations lack strong environmental policies and legislation.
2. Ineffective garbage disposal systems: All nations produce industrial trash fast due to unplanned and rapid industrial growth. All nations struggle with the problem of safely getting rid of industrial trash, which includes dangerous e-waste.
3. Absence of a Global Pollution Tax: All nations do not implement a global pollution tax. So there is a lot of industrial pollution.

Assessment, legislation, and implementation of measures to reduce industrial pollution. These analyses demonstrate that, for emissions to both air and water, industrial pollution has reduced during the last ten years. Although it is anticipated that new and existing EU policy instruments will further cut industrial emissions, pollution is likely to have negative effects on public health and the environment going forward. A key component of the EU industrial policy goal is a robust, expanding, low-carbon industry built on circular material flows. The objective is to develop an expanding industrial sector that uses fewer and fewer natural resources, minimizes polluting emissions to the air, water, and land, and produces progressively less waste.

The National Emission Ceilings Directive and the Industrial Emissions Directive, which aim to achieve the ambitious prevention and reduction of emissions, in particular through the continuous uptake of so-called best available techniques (BATs), set more specific air emission reduction targets in the meantime. According to a recent EEA study, adopting the Industrial Emissions Directive's more ambitious objectives while employing the best practices now available would result in significant reductions in emissions of sulphur dioxide, particulate matter, and nitrogen oxides, 91%, 82%, and 79%, respectively. The full implementation of these directives would aid the EU in achieving its environmental goals, such as those relating to the quality of the air and water. The emission-related directives, however, often function autonomously, and it is obvious that the environmental goals may be further incorporated into the EU's industrial strategy. To guarantee that the industries of future are both sustainable and pollution-free, even more stringent laws, implementation, and monitoring will be necessary as we move toward zero pollution.

DISCUSSION

A major worldwide issue that presents serious risks to the environment, human health, and sustainable development is industrial pollution. Understanding the fundamentals of industrial pollution is essential for properly tackling this problem as industries continue to grow and manufacturing methods get more intricate. This thorough explanation offers a thorough examination of industrial pollution, including its sources, traits, effects, and proposed mitigation measures.

Industrial Pollution's Fundamental Causes:

The manufacturing, industry, and energy sectors all have different sources and activities that contribute to industrial pollution. The main sources of industrial pollution are examined in this research, including emissions from manufacturing facilities and power plants, poor waste management procedures, incorrect disposal of hazardous items, and the discharge of pollutants into the atmosphere, water, and soil. Knowing these reasons makes it possible to pinpoint particular places where pollution prevention and control efforts may be made.

Industrial Pollution Characteristics:

Industrial pollutants are made up of a diverse spectrum of compounds, each of which has distinct properties and environmental behaviors. The different industrial pollutants, including harmful chemicals, heavy metals, volatile organic compounds (VOCs), particulate matter, and greenhouse gases, are thoroughly examined in this in-depth research. It looks at the persistence, bioaccumulation potential, toxicity levels, and long-distance transport capability of these contaminants, among other physical and chemical characteristics. Such information is essential for determining their environmental destiny, effects, and possible health hazards.

Industrial Pollution Effects:

Industrial pollution has several negative effects that may seriously harm ecosystems, the general public's health, and the socioeconomic well-being. The impacts of industrial pollution on the environment and human health are fully examined in this research, including air and water contamination, soil degradation, acid rain, ozone depletion, climate change, biodiversity loss, and unfavorable health outcomes in populations who are exposed. It investigates the ways in which industrial pollutants have an impact on various environmental components and the ripple effects on ecosystems and human cultures.

Solutions and Strategies for Mitigation:

A complex strategy that incorporates regulatory changes, technology breakthroughs, and industry best practices is needed to address industrial pollution. This comprehensive account explores a range of mitigation measures, including the use of cleaner production methods, advanced pollution control technologies, better waste management procedures, the enforcement of environmental laws, and the promotion of corporate social responsibility. It also looks at how circular economy ideas, eco-industrial efforts, and frameworks for sustainable development may all help to reduce industrial pollution and advance a more sustainable industrial sector [5], [6].

Observation and Research:

This study underlines the value of monitoring, data collecting, and scientific inquiry in furthering our knowledge of industrial pollution. It emphasizes the need for reliable monitoring systems to gauge pollution levels, locate pollution hotspots, and monitor the advancement of pollution abatement initiatives. We can lessen the negative consequences of industrial pollution and move toward a more ecologically sustainable and socially responsible future by taking preventive measures, adopting cleaner technology, improving laws, and encouraging cooperation among stakeholders [7]–[9].

CONCLUSION

For successful environmental management and sustainable industrial operations, a basic knowledge of industrial pollution is essential. This essay offers a thorough analysis of industrial pollution, outlining its sources, traits, and possible remedies. We can reduce the negative effects of industrial pollution and progress toward a more ecologically and socially responsible industrial sector by implementing sustainable production techniques, introducing cleaner technology, and improving regulatory frameworks. It also emphasizes how crucial multidisciplinary cooperation is for fostering innovation, information exchange, and the creation of fact-based pollution prevention and control policies. This collaboration should include scientists, policymakers, industrial stakeholders, and members of civil society. This in-depth explanation offers a thorough analysis of industrial pollution, including its sources, traits, effects, and proposed countermeasures.

REFERENCES:

[1] D. J. Winton, L. G. Anderson, S. Rocliffe, and S. Loiselle, 'Macroplastic pollution in freshwater environments: Focusing public and policy action', *Sci. Total Environ.*, 2020, doi: 10.1016/j.scitotenv.2019.135242.

[2] I. Khouni, G. Louhichi, and A. Ghrabi, 'Use of GIS based Inverse Distance Weighted interpolation to assess surface water quality: Case of Wadi El Bey, Tunisia', *Environ. Technol. Innov.*, 2021, doi: 10.1016/j.eti.2021.101892.

[3] W. Yang, Y. Zhao, D. Wang, H. Wu, A. Lin, and L. He, 'Using principal components analysis and idw interpolation to determine spatial and temporal changes of Surfacewater quality of Xin'Anjiang river in huangshan, china', *Int. J. Environ. Res. Public Health*, 2020, doi: 10.3390/ijerph17082942.

[4] P. Sharma, A. K. Pandey, S. H. Kim, S. P. Singh, P. Chaturvedi, and S. Varjani, 'Critical review on microbial community during in-situ bioremediation of heavy metals from industrial wastewater', *Environ. Technol. Innov.*, 2021, doi: 10.1016/j.eti.2021.101826.

[5] S. Aracri *et al.*, 'Soft Robots for Ocean Exploration and Offshore Operations: A Perspective', *Soft Robot.*, 2021, doi: 10.1089/soro.2020.0011.

[6] L. Deineko, M. Sychevskiy, O. Tsyplitska, N. Grebeniuk, and O. Deineko, 'Increasing resource efficiency in the industrial complex ensuring environmental human rights', *Environ. Econ.*, 2021, doi: 10.21511/EE.12(1).2021.11.

[7] K. Yoshida, 'Ambient air quality standards.', *J. Toxicol. Sci.*, 1988, doi: 10.2131/jts.13.262.

[8] E. Kilic and N. Yucel, 'Determination of spatial and temporal changes in water quality at asi river using multivariate statistical techniques', *Turkish J. Fish. Aquat. Sci.*, 2019, doi: 10.4194/1303-2712-v19_9_02.

[9] M. S. S. Danish *et al.*, 'A systematic review of metal oxide applications for energy and environmental sustainability', *Metals*. 2020. doi: 10.3390/met10121604.

CHAPTER 9

EXPLORING THE DIFFERENCE BETWEEN A CATASTROPHE SCENARIO AND EMERGENCY SITUATION

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ABSTRACT:

Effective emergency management and response depend on knowing the difference between an emergency and a catastrophe scenario. The main elements and criteria that separate these two concepts are summarized in this chapter, with an emphasis on the consequences for readiness, reaction, and resource allocation. A sudden occurrence or scenario is referred to as an emergency if it presents a direct risk to people, property, or the environment and calls for quick action to prevent further damage. Most emergencies are small-scale and controllable with the available tools and resources. Automobile accidents, medical crises, small-scale fires, and isolated power outages are a few examples of emergencies. In an emergency, quick help, public safety, and preventing additional damage are the main goals of response actions. A larger-scale incident or set of events, on the other hand, that are greater than the capabilities of the affected community's or region's reaction. Disasters cause extensive disruption, substantial damage, fatalities, and serious socioeconomic effects. Earthquakes, hurricanes, floods, pandemics, and significant industrial mishaps are a few examples of catastrophes. Multiple agencies, organizations, and stakeholders must work together in a coordinated manner to handle the immediate needs of the impacted people, restore vital infrastructure, and aid in long-term recovery.

KEYWORDS:

Catastrophe Scenario, Disaster, Environment, Emergency Situation, Emergency Management.

INTRODUCTION

Disasters and Emergencies Are Two Distinct Situations:

An emergency is a condition with which the neighborhood can deal. It is a circumstance brought on by the actual or impending occurrence of an incident that has to be addressed right away and that calls for the use of emergency resources. An emergency is a problem with which the community cannot deal. It is a natural disaster or human-made disaster that has severe adverse effects on people, property, services, and/or the environment and overwhelms the capacity of the affected community to react. As a result, the community asks the government and international organizations for help [1].

Causes:

Natural Disaster:

These kinds of catastrophes always happen near and endanger people, buildings, or financial resources. They result from natural environmental processes or situations that are biological, geological, seismic, hydrologic, or meteorological (such as cyclones, earthquakes, tsunami, floods, landslides, and volcanic eruptions).

Hurricanes, Cyclones, Or Typhoons:

When a warm ocean produces hot air, which then fuels convectional air currents, cyclones form. When these regular air currents are diverted, cyclones develop. A "tropical cyclone" is referred to locally as a hurricane or typhoon. Typhoons are what they are known as in Asia. Cyclones are what they are known as in the Indian and Pacific Oceans. Hurricanes are what they are known as throughout the North Atlantic and Caribbean Basin [2], [3].

DISCUSSION

Tropical Storm Warning Protocols:

1. Small vessels and fishing boats: winds of around 25 to 35 mph.
2. Public wind advisory: about. Winds of 25–35 mph.
3. When a mature tropical cyclone has a good chance of endangering a region of the nation within 48 hours, it is said to be under a gale watch.
4. When wind gusts of between 34 and 47 knots are predicted to occur over the next 24 hours, a gale force warning is issued.
5. A storm watch statement would be included with a gale warning if a post-tropical cyclone disturbance posed a significant hazard to a region or the whole nation during the next 24 to 48 hours.
6. When the average wind speed is predicted to reach storm force strength of 48–63 knots during the next 12–24 hours, a storm warning is issued every three (3) hours.
7. A cyclone watch is issued when tropical cyclone winds are predicted to reach cyclone force in the next 24 to 48 hours, which is over 63 knots (or 70 mph).
8. Every three (3) hours when wind gusts are predicted to surpass 63 knots in the following 12 to 24 hours, a cyclone warning is issued.

Earthquakes:

When plates move along a fault line or as a consequence of volcanic activity, the earth's surface shakes or trembles, causing an earthquake. At any hour of the day or night, earthquakes may occur abruptly, violently, and without warning. The terms epicentre, fault, magnitude, and seismic waves are all related to earthquakes. For practical reasons, an earthquake's magnitude (or quantitative energy released) is often quantified using a logarithmic scale with values ranging from 1 to 10. The Richter scale is the name given to this logarithm scale. Seismometer-derived seismic data are analyzed to estimate the magnitude. The Modified Mercalli strength (MMI) Scale, which is calculated qualitatively by physical measurements of the earthquake's effect, is used to gauge an earthquake's strength.

The National Disaster Advisory Committee (DAC) has accepted SNAMI as the Samoan translation for the tsunami, which was previously known in Samoa as a Galu Afi. more than 1,000 km/hr in speed. Therefore, you must follow the tsunami warning when one is issued. For instance, residents in low-lying coastal districts must promptly migrate to higher and safer lands.

Floods:

When significant volumes of water flow from a source like a river or a burst pipe into a previously dry region, or when water exceeds banks or obstacles, this phenomenon takes place, covering previously dry areas. Floods may have a significant environmental impact on nearby ecosystems. For instance, certain river floods provide nutrients to the soil, as is the case in Egypt each year when the Nile River floods, bringing nutrients to otherwise barren territory. People may have economic and psychological effects from floods, especially if their property is directly impacted. Understanding what causes flooding will enable individuals to better prepare themselves and, maybe, reduce or even avoid flood damage [4], [5].

Landslides:

The downward movement of large quantities of rock and soil is referred to as a landslide. Landslides can be brought on by any one of the following factors, individually or in combination. A change in slope gradient, an increase in the load that the land must support, shocks and vibrations, a change in water content, ground water movement, frost action, weathering of shocks, removal of, or a change in the kind of vegetation that covers slopes. Areas with a high risk of landslides arise when the terrain has particular features that raise the possibility of material moving downward. These qualities consist of:

i A slope that is higher than 15%.

ii Landslides have moved or been active throughout the last 10,000 years.

iii Wave or stream action that has eroded a bank or cut through a bank, making the surrounding terrain unstable.

iv The possibility or existence of snow avalanches.

v The existence of an alluvial fan, which indicates exposure to sediment or debris movement.

vi The presence of soils that are impermeable and combined with granular soils like sand and gravel, such as silt or clay.

Other natural disasters like rain, flooding, earthquakes, as well as man-made factors like grading, terrain clearing and filling, excessive development, etc., may also create landslides. Landslides may happen in developed regions, undeveloped areas, or any location where the terrain has been transformed for roads, housing, utilities, buildings, etc. since the elements causing them can be geophysical or man-made.

Disasters Caused by People:

These are catastrophes or emergency situations with recognizable human behavior, whether intentional or not, as the primary, direct cause. This mostly refers to circumstances in which civilian populations experience deaths, losses of property, essential services, and means of subsistence as a consequence of war, civil unrest, or other conflicts, or the execution of policies, apart from "technological disasters". People are often compelled to flee their homes due to civil unrest, an aircraft disaster, a large fire, an oil spill, an epidemic, terrorism, etc., leading to communities of refugees or internally and/or externally displaced people.

Velocity of Onset:

1 Sudden onset: little to no notice, little opportunity to plan. For instance, a volcano, earthquake, tsunami, cyclone, etc.

2 Slow onset: bad occurrence takes time to manifest; first, a crisis arises; next, it progresses to an emergency; finally, it becomes a tragedy. For instance, a drought, a riot, an epidemic, etc[6].

The primary dangers to which an area is exposed or may be exposed depend on the country's geographical position. For instance, the primary risks that might result in catastrophes in Samoa are:

1. Cyclones
2. Earthquakes
3. Tsunami
4. Flooding
5. Landslides
6. Epidemics

Catastrophes' effects on the environment and in your area. For the last ten years, cyclones have been a common cause of tragedy in Samoa; each occurrence has had a terrible effect. Some of the adverse effects are included in the list below [7], [8].

1. Harm to the infrastructure
2. Lack of communication
3. Flooding
4. Landslides
5. A power outage
6. Water issues
7. Agriculture harm
8. Damage or loss to housing
9. Environmental harm to inland and coastal areas
10. Alteration of lifestyle, level of living, etc.

While disasters are sometimes seen as external shocks, disaster risk is really the outcome of intricate interactions between systems that lead to circumstances of exposure, vulnerability, and risk. Therefore, disaster risk is defined as the sum of a hazard's frequency and intensity, the quantity of persons and assets it exposes, and the susceptibility of those things to harm. In contrast to extensive risk, which is linked to high-probability, low-impact catastrophes, intensive risk is the disaster risk connected to low-probability, high-impact events. Both development and catastrophe risk are increased by disasters.

The secret to comprehending disaster risk is realizing that catastrophes are a sign of failed development, making disaster risk a gauge of how sustainable growth is. Numerous risk factors, such as poverty and inequality, poorly planned and managed urban and regional growth, climate change, and environmental degradation, have an impact on risk, susceptibility, and exposure. Understanding catastrophe risk necessitates taking into account society's ability to defend itself from disasters in addition to the hazard, our exposure, and our susceptibility. Resilience is the capacity of groups, cultures, and systems to withstand, withstand, accommodate, and recover from calamities while simultaneously enhancing welfare.

Disasters disproportionately afflict the most vulnerable and marginalized individuals, exacerbate social disparities, and impair economic progress, as research over the last few decades has shown. The likelihood of dying in a disaster is highly associated with wealth and the effectiveness of risk management. Despite the fact that some nations have effectively decreased the number of fatalities due to floods and tropical storms, research indicates that the number of deaths from high-risk situations is rising. There is evidence that rising substantial catastrophic loss and destruction is a sign of unsustainable economic and social systems, unfit societies, and failed or distorted progress. In most countries, the private sector makes between 70 and 85 percent of all investments, and it typically does not include catastrophe risk in its portfolio of risks. High-value assets are now more concentrated in risky places than ever before. However, when catastrophe losses are seen in relation to the nation's income level, low- and middle-income nations seem to be bearing the brunt of the losses. Disaster risk is a concern for everyone, including individuals, corporations, and governments.

How do We Gauge The Danger of A Disaster?

The key to lowering catastrophe risk is to recognize, evaluate, and comprehend it. By examining patterns, such as those in recent catastrophe losses, we can assess the danger of a disaster. These patterns may be used to assess the efficacy of catastrophe risk reduction. By analyzing the risks, we may also predict future losses. A thorough risk assessment takes into account the complete spectrum of possible catastrophic occurrences, as well as the underlying causes and unknowns. It may begin with an examination of past events and go ahead by including futuristic viewpoints and the projected effects of events like climate change that are changing historical tendencies. Additionally, risk assessment may take into account uncommon occurrences that are outside of predictions of potential dangers but that, according to scientific understanding, might happen. It takes a variety of data points, multidisciplinary discoveries, scenario development, and simulations to predict uncommon occurrences. These methods may be augmented by knowledge from a broad range of fields.

Data on risks, exposures, vulnerabilities, and losses help risk assessments be more accurate, which results in better ways to avoid, plan for, and manage the financial risk of disasters. Risk modeling is one of the contemporary methods of risk assessment, and it was made possible by the development of more potent and accessible computing resources. We may simulate the results and probability of various scenarios using risk models. Risk assessments are created to calculate potential repercussions on infrastructure, society, and the economy due to a single or a combination of risks. The following factors are used in estimating risk (and the resulting losses). In general, a historical or user-defined scenario, probabilistic hazard assessment, or other approach is used to calculate the likelihood of encountering a certain intensity of hazard e.g., earthquake, cyclone, etc. Secondary hazards such as soil liquefaction, earthquake-caused fires, or storm surge related to cyclones may be included in certain hazard modules. The stock of property and infrastructure that is exposed to a danger is known as exposure, and it may also include socioeconomic aspects. The susceptibility of the assets exposed to the pressures produced by the danger to harm is accounted for by vulnerability.

According to a given exposure, the fragility and vulnerability functions evaluate the damage ratio, resultant loss, and/or social cost such as the number of wounded, homeless, and murdered caused by a hazard. Emergencies may occur at any moment, often with little prior notice. Even if in an ideal world they wouldn't happen, it's important to be ready to face crises and their effects in case they do. Emergency and catastrophe management is a multifaceted, well-coordinated operation. At the forefront of this endeavor are experts in emergency and disaster management who make sure the appropriate kind of aid is given and the situation is managed as efficiently as possible. For those who want to be ready to act when an emergency or catastrophe happens, getting an advanced degree, such as a Master of Science in Safety, Security, and Emergency Management, may be essential. To maintain the best degree of emergency readiness possible, experts must be informed of the many concerns and trends in emergency and catastrophe management.

Emergency Management:

Professionals in emergency management are crucial in helping to prepare and be ready for a catastrophe response. In a 2019 news release, Massachusetts Secretary of Health and Human Services Marylou Sudders said that "being adequately prepared is the best defense for an emergency. Emergency management specialists in the public and commercial sectors seek out novel approaches to address the daily influx of risks, learn from previous mishaps, and spot emerging trends in emergency management to aid in catastrophe prevention. When creating a risk-based strategy to disasters and crises, emergency management professionals concentrate on five mission areas, as stated by the Federal Emergency Management Agency's (FEMA) National Preparedness Goal. Stopping, averting, or preventing a calamity, whether it is impending, threatening, or has already occurred

1. Protection: Ensuring that persons and property are secure from risks and dangers
2. Mitigation: Reducing the effect of catastrophes in the future in order to minimize the loss of life and property
3. Response: Quick action taken after a calamity to save lives, secure property, protect the environment, and take care of fundamental human necessities.
4. Recovery: The process of rebuilding, bolstering, and reviving a community's infrastructure, housing stock, economy, and general well-being after a calamity.

Issues in Emergency Management:

104 of the 310 disaster declarations by states in 2020 were classified as catastrophic disasters, according to FEMA. These announcements cover extreme weather conditions including tornadoes, earthquakes, and wildfires. The Insurance Information Institute estimates that insured losses from natural disasters in the United States will cost $74.4 billion in 2020. The expense of these announcements emphasizes the need for disaster managers to approach their job in a proactive manner, one that is firmly based on FEMA's five mission areas. To do this, emergency managers must be properly informed about current concerns in disaster management, especially those that may jeopardize personal safety.

Planning Based On Risk:

Today's emergency management is mostly driven by a trend that emphasizes risk-based planning. Natural disasters and weather-related tragedies not only significantly harm economies, but also significantly harm the people directly impacted by the occurrences. Effective emergency management notably depends on keeping this latter aspect in mind. An expert in environmental policy and national security, suggested that safeguarding civilians from risks must be a top priority for disaster preparation planning in a 2019 article examining emergency management trends. Trends that are essential to risk-based planning activities include reinforcing weak infrastructure, obtaining access to better resources, and improving emergency communications systems. When creating a risk-based planning approach, there are numerous elements that may also alleviate different safety hazards, such as inadequate supply chains, poor communication, and a lack of high-quality resources. The creation of reliable, trustworthy public and private partnerships is one of these elements. The proper individuals can react to a disaster by forming partnerships with companies, community stakeholders, and first responders. According to Jutro, cooperation between the public and commercial sectors also aids in providing these responders with the equipment they need to handle a crisis.

Technology and Social Media:

The rising usage of social media to improve communication is another significant development. Federal and local government organizations have used social media sources to quickly disseminate information to a wide number of people after recent catastrophes. However, Jutro cautions against using social media under these circumstances since these platforms can be susceptible to hacker assaults and disruptions. For emergency management, "reliable, secure communication systems are critical. The broader incorporation of machine-learning techniques is another technological development that might aid emergency and disaster management experts in achieving their objectives. In a 2019 article for The Hill, Craig Fugate, the chief disaster management officer of One Concern in Gainesville, Florida, said that machine learning techniques may assist in predicting harm from future occurrences far more quickly than previous technology. The next catastrophe won't always be the same as the last one. However, Louise Comfort, the former director of the Center for Disaster Management at the University of Pittsburgh, stated to a group of Arizona State University students participating in a reporting initiative that "it's important to go through those events and learn them, but the hard part is anticipating what the next disaster is going to be". "While I think it's very useful to do after-action plans and identify what the failures were in that particular instance," said Comfort, "those lessons need to be projected forward".

Emergency Management in the Future:

The reaction to the COVID-19 epidemic pushed the boundaries of contemporary disaster management in ways it had never been pushed before. The pandemic response was complicated by "an onslaught of additional emergencies and disasters," ranging from meteorological occurrences to civil upheaval, according to emergency management expert Kyle R. Overly. However, this strain resulted in important data that may be used to prepare for future calamities. While overly acknowledges the future significance of emergency management, he also emphasizes the growing need for emergency managers to locate and make use of lower-level personnel with transferrable abilities to manage future community-wide responses. He emphasizes the need of creating future response plans that are more egalitarian and take into account the needs of all communities, regardless of their financial standing. Additionally, overly makes the case that the COVID-19 pandemic increased public awareness of emergency management specialists. Theoretically, their elevated status may enable them to provide knowledgeable counsel in the future about other crises, such as those involving public health and social issues like opioid addiction or homelessness.

Become an Emergency Management Leader:

Emergencies will keep happening, and each one will add something new to the mix. However, the emergency manager's efforts will continue to serve as the cornerstone of a successful disaster response even as these situations change. By incorporating FEMA's five mission areas into a comprehensive process that creates a better response in the event of a crisis, graduates of advanced emergency management programs may get the competence required to proactively plan and execute emergency management plans. The fundamentals of safety, security, and emergency management via the online Master of Science in Safety, Security, and Emergency Management degree at Eastern Kentucky University. Through a Multidisciplinary Track or concentrations in Corporate Security Operations, Occupational Safety, or Emergency Management and Disaster Resilience, the program gives students the option to tailor their learning.

CONCLUSION

To efficiently deploy resources and customize response efforts to the type and scale of the occurrence, it is crucial to distinguish between emergencies and disasters. While catastrophes sometimes need extra help from state, national, or international organizations owing to their scope and complexity, crises frequently may be handled with local resources and aid. The difference aids disaster management and first responders in setting priorities, securing the necessary resources, and coordinating with pertinent parties. The distinction between crises and disasters is made by a variety of variables, such as the size and impact of the event, the degree of infrastructure damage, the number of people impacted, the length of the event, and the need for outside help. Knowing these elements makes it easier to create proper response plans, activate emergency operations centers, and decide how much interagency collaboration is needed. For successful emergency management and response, it is essential to differentiate between an emergency and a catastrophe scenario. The differences between these two concepts are briefly discussed in this abstract, with an emphasis on how these differences affect resource allocation, reaction, and readiness. Emergency managers can effectively evaluate the scope and impact of an occurrence, deploy resources as needed, and guarantee a coordinated and effective response to preserve lives, reduce damage, and assist the impacted community by knowing the difference.

REFERENCES:

[1] M. Diakakis *et al.*, ‘Proposal of a flash flood impact severity scale for the classification and mapping of flash flood impacts’, *J. Hydrol.*, 2020, doi: 10.1016/j.jhydrol.2020.125452.

[2] S. K. Stavroglou, B. M. Ayyub, V. Kallinterakis, A. A. Pantelous, and H. E. Stanley, ‘A Novel Causal Risk-Based Decision-Making Methodology: The Case of Coronavirus’, *Risk Anal.*, 2021, doi: 10.1111/risa.13678.

[3] C. Lin, Y. Yu, D. Wu, and B. Gong, ‘Traffic flow catastrophe border identification for urban high-density area based on cusp catastrophe theory: A case study under sudden fire disaster’, *Appl. Sci.*, 2020, doi: 10.3390/app10093197.

[4] A. Pérez-Morales, F. Gomariz-Castillo, and P. Pardo-Zaragoza, ‘Vulnerability of transport networks to multi-scenario flooding and optimum location of emergency management centers’, *Water (Switzerland)*, 2019, doi: 10.3390/w11061197.

[5] P. V. Klaine, J. P. B. Nadas, R. D. Souza, and M. A. Imran, ‘Distributed Drone Base Station Positioning for Emergency Cellular Networks Using Reinforcement Learning’, *Cognit. Comput.*, 2018, doi: 10.1007/s12559-018-9559-8.

[6] A. Dunant, M. Bebbington, T. Davies, and P. Horton, ‘Multihazards Scenario Generator: A Network-Based Simulation of Natural Disasters’, *Risk Anal.*, 2021, doi: 10.1111/risa.13723.

[7] J. M. Keller *et al.*, ‘ICU Emergencies Simulation Curriculum for Critical Care Fellows: Neurologic Emergencies’, *MedEdPORTAL J. Teach. Learn. Resour.*, 2019, doi: 10.15766/mep_2374-8265.10813.

[8] U. Merle, A. Laßmann, A. R. Dressel, and P. Braun, ‘Evaluation of the COVID-19 pandemic using an algorithm based on the Bateman function: Prediction of disease progression using observational data for the city of Heidelberg, Germany’, *Int. J. Clin. Pharmacol. Ther.*, 2020, doi: 10.5414/CP203824.

CHAPTER 10

EXPLORING THE DISASTER MANAGEMENT CYCLE PHASE I: MITIGATION CHALLENGES AND SOLUTIONS

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ABSTRACT:

The goal of the mitigation phase of the disaster management cycle is to lessen the effects of catastrophes on people, property, and the environment. The mitigation phase, its goals, important tactics, and the significance of preventative actions in fostering resilience and minimizing vulnerabilities are all summarized in this study. In order to reduce or eliminate the risks and vulnerabilities linked to possible catastrophes, mitigation entails adopting proactive measures. Its main goal is to lessen the possibility and effect that catastrophes may have on people, communities, and society as a whole. The many aspects of mitigation are examined in this abstract, including structural and non-structural solutions, legislative interventions, community participation, and technology breakthroughs. Structure-based mitigation strategies concentrate on adjusting the surrounding environment to tolerate possible risks. These actions include of developing resilient infrastructure, putting construction rules and standards into place, creating early warning systems, and taking action to manage flooding. On the other hand, non-structural mitigation methods have an emphasis on steps that lessen the exposure and vulnerability of people and assets. Planning for land use, public awareness campaigns, educational and training initiatives, and the creation of evacuation plans and contingency plans are a few examples.

KEYWORDS:

Disaster Management Cycle, Disaster, Environment, Mitigation Challenges, Technology Breakthroughs.

INTRODUCTION

The challenge of disaster management is huge. They don't stay in one place for very long, yet neither do they vanish as fast as they emerge. Therefore, effective management is crucial to maximizing planning and reaction efficiency. Collaboration between the public, business, and community sectors is required due to few resources. To mitigate against, prepare for, react to, and recover from catastrophes and their impacts in the shortest amount of time feasible, there must be a planned and structured effort [1].After finishing this chapter, reader will be able to:

1. Describe the many steps in the cycle of disaster management.

2. Why is catastrophe mitigation important?

3. Describe the integration of catastrophe management into public policy.

Describe how community vulnerability should be considered in infrastructure planning and design. Consists of identifying threats (hazards that are likely to occur), figuring out how probable they are to occur, evaluating how the danger could affect the populations at risk, figuring out ways to lower the risk, and acting to do so. a situation in which a catastrophe may potentially affect human health, agricultural production, or human settlements because of the way they were built or because they were close to dangerous terrain.

Cycle for Disaster:

Management:

Disaster management is a cyclical process; one phase ends and the next begins, albeit not all phases of the cycle must be finished before the next phase may occur. Numerous stages often occur simultaneously. Making the right choices at the right time throughout each step leads to improved warnings, decreased susceptibility, and/or the avertance of future calamities. In order to effectively manage disasters, public policies and strategies must be developed that either address the causes of disasters or lessen their consequences on infrastructure, people, and property. As changes are made in anticipation of an occurrence, the mitigation and preparation stages take place. A community's capacity to prepare for and mitigate against a catastrophe is enhanced by embracing growth. Disaster managers become engaged in the first response and long-term recovery stages as the incident develops.

1. Measures put in place to lessen the effects of a catastrophe are known as mitigation. Examples include zoning laws and construction rules, vulnerability assessments, and public education.

2. Plan your response in advance to be prepared. Examples include emergency preparations, drills, and warning systems.

3. Initial responses are made while the incident is happening. It entails making attempts to reduce the risks that a catastrophe creates. Examples include emergency relief, search and rescue, and evacuation.

4. Recovery: Getting the neighborhood back to normal. In a perfect world, the disaster-affected region would be restored to its pre-disaster state, if not better. Examples include grants, short-term housing, and health treatment [2].

The Global Environmental Outlook is a great place to find out more information.

In order to lessen the effects of a catastrophe, preparation and long-term risk reduction strategies are all considered forms of mitigation. Generally speaking, there are two types of mitigation activities:

1. Construction initiatives known as structural mitigation that lessen their negative economic and social effects

2. Non-structural activities are practices and policies that increase public awareness of risks or support initiatives to lessen the effects of catastrophes.

examining building rules, updating vulnerability analyses, zoning and land-use management and planning, examining building use laws and safety requirements, and putting preventive health measures into place are all examples of mitigation. The public and companies may be informed about easy precautions they can take to minimize damage or harm, such as securing file cabinets, water heaters, and bookcases to walls to prevent them from toppling during earthquakes. These precautionary measures and public education campaigns should ideally start before the tragedy.

The significance that mitigation must play is not diminished by the fact that sometimes certain mitigation criteria may fall beyond the purview of the disaster management. On the other hand, it is the emergency manager's duty to arm themselves with the knowledge necessary to include the community. The main goal of disaster management is to either completely avoid catastrophes or to minimize those that are unavoidable. There are four groups of tools that might be used to avert or lessen disasters:

1. Managing risks and reducing vulnerabilities
2. Diversification of the economy
3. Political involvement and dedication
4. Public understanding

DISCUSSION

Analysis of Vulnerabilities And Identification Of Risks:

The broad spectrum of natural catastrophes, significant man-made occurrences, and resource crises that affect the entire community and not just emergency management professionals may all be brought on by hazards. Communities should strive to always be ready for any potential threats. However, this is not feasible in real life. Being ready for one threat or tragedy may put you at greater danger of experiencing another. For instance, if there is an earthquake, buildings built to resist hurricane force winds may suffer damage or suffer worse damage. Adapting best practices to the most probable case as much as feasible would be the most sensible course of action. But what about the risks inherent in our modern way of life, such as chemical spills, ecological catastrophes, explosions, and significant traffic accidents? Even though natural and man-made dangers are quite distinct from one another in many ways, mitigation entails dealing with both. Selecting the dangers that have the greatest potential to damage your jurisdiction is an essential first step in mitigation [3].

Understanding the nature of the danger completely is essential to creating a mitigation plan since the risks encountered differ depending on the area and the risk. Some nations are vulnerable to earthquakes, while others have a history of being damaged by tropical storms and floods. The majority of nations are susceptible to at least some mix of dangers, and as industrial growth advances, all may experience technological catastrophes. The dangers, the people, their livelihoods, and the existing infrastructure all influence the consequences and possible harm that these hazards may cause. Knowing which risks are most probable for a certain place is thus crucial.

Furthermore, accurately identifying vulnerability is crucial for focusing mitigation efforts. A vulnerability assessment may also be used to social or economic groups: Renters are more likely to lose their homes after a catastrophe since they depend on their landlords to fix any damage. In the case of a catastrophe, fewer individuals may be left homeless if the groups of tenants are correctly identified, their rights to remain in their homes are established, and landlords are required to make repairs. Similar to this, farmers who take their products over a single mountain pass to markets will not be able to sell their goods if the route is closed. The agriculture industry will see less disruption if a different path to the market is developed. Building or creating a variety of routes is crucial because it will make it simpler for the affected group or community to utilize alternatives during a crisis.

Strategies or Tactics For Mitigating:

Modifying standard development initiatives to cut losses. In places vulnerable to floods, drought, and cyclones, for example, it is often possible to introduce crop types that are more wind, flood, or drought resistant. A diversified economy. Diversifying the economy and introducing less susceptible economic activity should be attempted in locations where the primary or exclusive source of income may be challenged. Where economies are reliant on a single cash crop, diversification is crucial. Creating economic activity that can withstand disasters. Disasters have a comparatively little impact on certain economic activity. For instance, placing warehouses in flood plains may be a better choice than placing industrial facilities there. In cyclone-prone coastal locations, coconut palms could be more suited than other fruit plants. It is important to look for and promote the growth of businesses that are less susceptible to risks [4].

Infrastructure and Disaster Reduction:

Investment in infrastructure to control hydrological hazards, such as cyclones and floods, has drastically decreased the number of fatalities from an annual average of 100,000 over the previous 50 years to 41,000 during the last 15 years. There are two types of investments in disaster management infrastructure:

1 Spending on infrastructure to facilitate long-term socioeconomic growth; and

2 Infrastructure investment for recovery and rebuilding.

Make sure a battery-operated radio is close by, a backup supply of essential goods/needs is accessible, and if at all feasible, a continuous supply is provided in order to sustain operations during a crisis. Make sure there is a backup copy of all important data, such as employee information, a customer list, production formulae, a list of software and hardware, and login and passwords, in a location that is both accessible and secure. Update the backup copy of all files on a regular basis.

Insurance:

Make sure all essential assets, including business interruption, are covered by insurance, and be familiar with the terms of the policy. Natural hazard mitigation should be taken into consideration for the majority of infrastructure projects throughout conceptual development. The prevailing risks and strategies for avoiding or lessening the consequences of severe natural disasters should be taken into account in the preliminary design. A facility should be placed to reduce exposure to storm surge and large waves for harbors, docking facilities, and coastal structures and to prevent floods, soil erosion, strong winds, and unstable soils. Buildings and structural systems are shaped to reduce the impacts of strong winds, earthquakes, tornadoes, and, in the case of protection projects, to prevent unintended consequences like coastal erosion, accretion, or a bad influence on wetlands and coral reefs. Corrosion-resistant building materials that are both strong and durable enough. Furthermore, accurately identifying vulnerability is crucial for focusing mitigation efforts. A vulnerability assessment may also be used to social or economic groups: Renters are more likely to lose their homes after a catastrophe since they depend on their landlords to fix any damage. In the case of a catastrophe, fewer individuals may be left homeless if the groups of tenants are correctly identified, their rights to remain in their homes are established, and landlords are required to make repairs. Similar to this, farmers who take their products over a single mountain pass to markets will not be able to sell their goods if the route is closed. The agriculture industry will see less disruption if a different path to the market is developed. Therefore, creating or establishing a lot of routes is crucial since it will make it simpler for the affected group or community to utilize alternatives during a crisis [5].

Activities for Mitigation at Home:

High winds have the power to damage homes. High winds and rain might enter your home via broken windows and doors caused by flying debris. Your house may collapse in weaker areas if there are strong winds. Personal mitigation techniques might include strengthening weak spots like roofs, external doors, windows, and garage doors, removing debris from potentially damaged locations, and constructing a safe chamber within your house. Encouragement to learn more about other preventive measures that come within the jurisdiction of their local building code is also crucial. Other precautions that must be taken in wind-prone areas include designing buildings to withstand wind loads, incorporating wind load requirements into building codes, planting windbreaks, planning forestry areas upwind of towns, and providing wind-safety structures, such as providing sturdy village halls for community shelter in vulnerable settlements.

Emergency and Development:

Disasters and development are intertwined in that they may both thwart and spur development efforts, and that strategies for development can both heighten and lower vulnerability. The dominant belief has been that natural catastrophes, particularly ones that result in death and material destruction, are acts of nature and, as such, are beyond human control. With this mentality, the majority of growth plans were created without taking into account how catastrophes might affect community planning, and vice versa. When a crisis did occur, the focus of the reaction was on taking care of immediate needs and cleanup. In order to lessen the severity of dangers and catastrophes, it is now understood that much more can and must be done. The following four fundamental themes are suggested by a growing corpus of information on the connections between catastrophes and development:

1. Disasters halt development programs and derail years' worth of development efforts.
2. After a calamity, there are several possibilities to start development programs.
3. Development initiatives may make a region more vulnerable to catastrophes.
4. Development programs may be created to lessen the likelihood of catastrophes and their unfavorable effects.

Decision-makers who fail to take into account the connections between catastrophes and progress are betraying the faith that their constituents have in them. The United Nations and other non-governmental authorities are helping forward-thinking Ministries of Planning and Finance evaluate development initiatives in the perspective of catastrophe mitigation. As a result, projects are being created with long-term development requirements in mind as well as catastrophe recovery plans.

Society's institutional and structural changes are necessary for development to accelerate economic growth, lower inequality levels, and end extreme poverty. Disasters' long-term repercussions may dramatically impair a nation's capacity for sustained growth, forcing governments to significantly alter their objectives and plans for economic development. At the same time, crises often provide chances for advancement. They may encourage change and provide justification for establishing development initiatives including job training, home building, and land reform. However, ineffective management of the relief and restoration efforts may have long-term detrimental effects on development and possibly increase susceptibility to dangers [6].

Catastrophes' Effects On Development Initiatives:

Disasters may drastically reduce the efficiency of allocating resources for development. There are several ways in which harm is done, and the effects may be as intricate as the economy itself. As disasters frequently alter the political, economic, and social conditions within a country, practitioners investigate the issues of lost resources to ascertain what will no longer be available to the country after a disaster. Examples include assessing the effects of programme interruptions and the switching of crucial resources to other, shorter-term needs. To evaluate what chances will be left to attract local and foreign investment capital to the region or country that has been ravaged by the catastrophe, it will also be necessary to take into account the negative implications on investment climates (of the area that is now proclaimed a disaster zone). Last but not least, what condition will the collapse of the informal sector leave the disaster region in terms of people living their lives as closely as possible to how they did before the tragedy? The way private persons do business in their daily lives after the tragedy may fall under this non-formal sector.

Deficiencies Brought On By Development:

Local people may not be aware of the alternatives available to them in lowering their vulnerability as a result of lack of access to education and information, which often has broader ramifications. Poor individuals, for instance, may be less likely to make major investments without rewards that are visible and certain because they have less assets to spend in items that may lessen their vulnerability. Because these groups often include a larger number of women, small children, old people, the ill, and handicapped, they are also less likely to be in a position to organize collectively to lower shared dangers. In addition, the impacts of chronic sickness and starvation increase risk following a catastrophe. Despite the fact that overall, development often helps to reduce susceptibility to natural disasters, some forms of vulnerability may actually be significantly increased by development activities. Examples of such development efforts include the following:

Urban expansion often results in an inflow of low-income individuals, as in the case of extensive settlements on marginal land or in densely populated areas with subpar housing. Buildings may be located near flash flood zones, earthquake faults, or slopes that are prone to landslides. Population concentrations in marine and coastal zones put them at danger for storm surges, strong winds, flash floods, and landslides. When low-lying coastal regions are the focus of infrastructure and capital developments, tourist expansion may significantly enhance potential risk. These gains may be swiftly undone by tsunamis and tropical storms, which also pose a significant danger of death and injury to employees and visitors. Deforestation and increasing landslide hazards are often caused by the construction of road lines and poorly managed forestry programs. Projects for managing water resources, such as dams and irrigation systems, may raise dangers for big populations by uprooting natural ecosystems, posing a greater threat of catastrophic floods, or both [7].

Investment in poorly regulated hazardous businesses may result in population densities around the facility, a rise in air and water pollution, and exposure to risks from toxic material releases both on a long-term and catastrophic scale. Projects for the growth of livestock may result in a substantial loss of plant cover and circumstances that are almost desert-like around certain natural features, such as wells. The growth of cash crops may be hampered by agricultural initiatives. Each of these cases demonstrates the significance of incorporating risk assessment into program design and evaluation, as well as the absolute need of training and education in these fields.

Programs for Development May Lessen Susceptibility:

The word "mitigation" is increasingly used to refer to both actions that lessen economic losses and those that lessen fatalities and injuries. Following are the differences between the two forms of mitigation. Structural mitigation involves construction projects, including dams, windbreaks, terracing, and structures that are resistant to hazards, as well as steps to lessen the economic and social effects of hazardous agents. Most often, the term "non-structural mitigation" refers to laws, regulations, agricultural diversity, construction requirements, and methods for predicting and warning. Non-structural mitigation techniques may also involve community organizing, empowerment, education, awareness, and environmental knowledge.

When hazard-reduction measures are included into routine investment projects as part of a medium- to long-term development program, mitigation is at its most effective. Risks may be analytically and openly evaluated in the framework of national planning and investment program evaluations under these circumstances. It is possible to evaluate the financial viability of certain hazard mitigation and disaster preparation strategies. There are chances to strengthen relationships between the government and international relief and recovery groups, as well as to provide investment institutions the chance to assist governments in gaining access to cutting-edge innovations in hazard-reduction technology. Early warning systems and other components of disaster preparation may be taken into consideration in normal investment project design and industry financing via financial or technical support.

In UNDP national programming as well as other financial and technical assistance projects, using development programs to lessen vulnerability should be progressively included into every level of programme and project planning and assessment. The catastrophe effects of new initiatives should be expressly taken into account, per structured review processes. Options for implementing mitigation strategies into routine development programs are many. The examples that follow each provide suggestions for mitigating risks to people and important economic assets while also lessening the overall effects of a catastrophe.

One common goal of development projects is to strengthen the industrial support infrastructures and urban utility systems. This is accomplished using a range of outside resources, such as financing, technical help, and aid with institutional growth. Water, electricity, transportation, and communications "lifeline systems" may be made more efficient as well as more selectively resistant to certain dangers. Hazard resistant building practices may be incorporated into housing and other construction projects in a variety of various ways. These chances are often unique to the region's home stock and the kinds of dangers that exist there. Such actions may significantly lower the number of people injured or killed in earthquakes and tropical cyclones.

These programs may also save valuable economic assets, lowering overall damage costs and enhancing the likelihood of a quicker recovery. On a larger scale, the implementation of building rules, related training programs, and greater application of zoning laws in urban growth minimize danger for the local people as well as the chance of harm to industrial operations. People and facilities in dangerous regions may be further protected by enhanced drainage systems and flood prevention measures [8].

The efficiency of contingency plans, disaster responses, and the quality of longer-term recovery planning will all be positively impacted by investments in enhancing administration and bolstering the resource base of public institutions. One may anticipate that training programs in general, and particularly those with a management or technical emphasis, will enhance the execution of mitigation and reaction measures. Programs in agriculture and forestry provide a variety of chances for mitigation. Programs for reforestation lower the dangers of erosion, landslides, and flash floods.

Cropping pattern modifications may help reduce erosion issues and losses brought on by floods and drought. The development of pest-resistant crops may lessen the negative effects of infestations on the economy and other areas. Drought impacts may be lessened using programs for boosting on-farm storage, conserving soil, and collecting water. Each of these instances offers a chance for mitigation. Each also calls for the use of limited resources.

1. In a long-term development viewpoint, the operation must be focused on recovering assets or productivity rather than providing alleviation.
2. The potential economic gains ought to be substantial.
3. The emergency should have a huge impact.

4. The likelihood of the emergency-causing circumstance reoccurring soon should be minimal.
5. It should be clear when an immediate reaction is required.
6. Lending for emergencies is only permitted in situations when solutions are two to three years away.
7. There should be a chance that the risk will decrease in the future.

Creating a draft disaster and development policy for the nation. A framework for bilateral foreign assistance strategy is outlined below using USAID as an example. The framework identifies three areas of concern for disaster-affected nations' development attempts. These are these areas:

A Partnership:

Development cannot be imposed and carried out alone. Close cooperation between funders, governments, communities, nonprofit groups, the corporate sector, and universities is necessary for the success, or failureof development programs. Partnerships, which are founded on comparative advantage and shared goals, increase ownership, capability, and produce notable outcomes via collaborative efforts.

B Flexibility:

Local development circumstances might vary greatly and can alter quickly, for better or ill. Development organizations must be effective and adaptable, able to fit into local surroundings, able to change with the times, and able to seize opportunities when they present themselves.

C Selectivity:

Resources for development are few in comparison to global demands. They are a common resource that should be wisely spent for the greatest benefit. The distribution of help among nations should be determined by three factors: necessity; the interests of the nation providing the aid (such as the United States); and the determination of a nation and its leadership to implement change. Resources should be allocated at the national level where they will have the most influence on attaining key strategic goals. No private person or business will have the means to implement catastrophe prevention measures to manage a nation's development given the breadth of the degradation to infrastructures, human and social systems, political, and economic that a country might incur from disasters. Therefore, a nation's government must create laws that direct catastrophe avoidance and, in the long run, sustainable growth. The following is a recommendation made by experts in the area of disaster and development policy for the national, regional, and local levels of government. Disaster effects should be mitigated using measures that support development. The following may be accomplished by development policies if they are created properly [9].

Permit governments to specify response and recovery strategies for rehabilitation and rebuilding throughout the disaster management cycle. Establish guidelines for the sharing of public and private resources for catastrophe victims' recovery. To support local rules and regulations, interagency cooperation and collaboration are used. Ensure that local communities have access to resources for recovery and development-sustaining recovery. Create community-specific risk reduction solutions, such as early warning systems. Permit government personnel to manage relocation using data from hazard vulnerability mapping. enforce land elevation, and provide processes for zoning law observance. Allow for the creation of land preservation in risk areas. Create the structure for public aid and lending programs for disaster relief to help with quick recovery. Specify how to utilize the property, including keeping the native mangroves healthy to prevent storm surges. The aforementioned measures, especially in the most underdeveloped nations, might lessen the disastrous effects that catastrophes have on development efforts.

The four stages of the disaster management cycle are mitigation, readiness, response, and recovery. Measures and regulations put in place to lessen the effects of a catastrophe are referred to as mitigation. Identification of risks, vulnerability assessments, setting up the appropriate infrastructure, and assuring current logistics are all part of the process. Public awareness and proper education are effective instruments for fostering community engagement. Developments and disasters are strongly connected. Disasters have the power to both thwart and open new doors for progress. Development plans have the potential to both enhance and reduce vulnerability. For sustainable socioeconomic growth, it is necessary to consider the connections between catastrophe and development. Effective mitigation strategies include risk management practices in routine investment initiatives. Foreign assistance must be granted in accordance with advancements in acceptable risk reduction and mitigation strategies at the national, regional, and local levels, according to financial institutions.

Policy changes are essential for advancing mitigation measures. This abstract emphasizes the significance of including mitigating factors into zoning laws, environmental management programs, and urban planning. It also underlines the need of encouraging public-private collaborations, ensuring compliance with mitigation measures, and including catastrophe risk reduction into investment and development plans [10].Successful mitigation strategies depend on community involvement and engagement. Greater effectiveness and sustainability may result from giving communities the tools they need to take charge of their resilience-building projects. The significance of community-based methods, participatory risk assessments, and local stakeholders' participation in the decision-making process are all covered in this abstract. Furthermore, it emphasizes the need of inclusive policies that take into account the particular vulnerabilities and requirements of underserved and vulnerable communities. Technological progress is essential to improving mitigation efforts.

CONCLUSION

In summary, the mitigation stage of the disaster management cycle focuses on minimizing the effects of catastrophes via preventative actions. An overview of the goals, crucial tactics, and significance of mitigation in increasing resilience and decreasing vulnerabilities is given in this abstract.

Societies may successfully reduce the risks of catastrophes, reduce the loss of lives and property, and promote sustainable development by combining structural and non-structural measures, executing policy interventions, involving communities, and using technology breakthroughs. The potential of geospatial technology, remote sensing, modeling and simulation tools, and data analytics is highlighted in this abstract for locating hazards, identifying vulnerabilities, and creating evidence-based mitigation plans. Adopting innovative solutions may greatly help with better decision-making, effective resource allocation, and mitigation measure execution.

REFERENCES:

[1] F. Sakinah, “The Study Of Figurative Language In Gayonese’s Traditional Melengkan,” *Linguist. Lit. Stud.*, 2019.

[2] R. Wilujeng, “Pengaruh Persepsi Bidang Perpajakan, Motivasi Karir, Penghargaan Finansial, Pengetahuan Pajak, Dan Kepercayaan Diri Terhadap Minat Mahasiswa Prodi Akuntansi Untuk Berkarir Di Bidang Perpajakan,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[3] M. Irsyad, D. Prasetio, And Y. Asael, “Feeler Gauge,” *Meas. Tools*, 2019.

[4] Ayu Natalia Triatmojo, “Optimasi Polyvynil Alchol Dan Gliserin Sediaan Masker Peel Off Ekstrak Daunsirsak (Annona Muricata Linn) Aplikasi Desain Faktrorial,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[5] M. V. Pilay Malavé, “Calidad Nutricional De La Moringa; Moringa Oleifera Lam, En Las Condiciones Ambientales De La Parroquia Manglaralto,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[6] E. H. Bang, “An Analysis Of Upwork Profiles: Visualizing Characteristics Of Gig Workers Using Digital Platforms,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[7] Mgsc, “Bases Técnicas Para La Formulación De La Políticas Naciona De Ganadería Bovina Sotenible - Colombia,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[8] N. D. Darsono, “Faktor-Faktor Yang Memengaruhi Pemilihan Metode Kontrasepsi Jangka Panjang (Mkjp) Pada Wanita Usia Subur (Wus) Di Puskesmas Sukmajaya Tahun 2019,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[9] A.-F. Y. K. Al-Khaled, “Classification Of Basal Stem Rot Disease In Oil Palm Using Dielectric Spectroscopy,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

[10] D. F. Nisa, “Gambaran Tingkat Pengetahuan Tentang Bantuan Hidup Dasar (Bhd) Awam Terlatih Pada Polisi Lalu Lintas Di Polrestabes Bandung,” *J. Wind Eng. Ind. Aerodyn.*, 2019.

CHAPTER 11

EXPLORING THE DISASTER MANAGEMENT CYCLE PHASE II: PREPAREDNESS

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ABSTRACT:

A critical stage in the disaster management process, preparation enables people, communities, and organizations to react and recover from catastrophes in an efficient manner. The readiness phase, its goals, essential elements, and the significance of proactive planning, training, and coordination in fostering resilience are all covered in this research. Numerous actions are taken as part of preparation in order to increase capability and preparedness for disaster response. This phase's main goal is to make sure that people, communities, and response organizations are capable of efficiently mobilizing resources, coordinating activities, and putting response plans into action in the event of a catastrophe. The fundamental components of preparednessrisk assessment, emergency planning, resource management, and capacity buildingare examined in this abstract. An essential part of preparation is risk assessment, which provides a framework for comprehending and assessing the possible risks, exposure, and vulnerabilities of a place or community. The need of doing risk assessments to detect possible dangers, evaluate their potential effects, and prioritize preparation actions is discussed in this abstract. In order to ensure that communities and stakeholders are informed of possible dangers and the required response activities, risk communication and information exchange are stressed as vital parts of this process. Creating thorough and organized response plans is part of emergency preparation and serves to direct efforts during a crisis. The essential components of emergency preparedness are examined in this abstract, including setting up communication protocols, defining roles and duties, conducting drills and exercises, and detailing protocols for resource distribution, evacuation, and sheltering. The demands of vulnerable groups and the incorporation of available resources should all be taken into consideration when designing preparedness plans, which should be relevant to the local threats and features.

KEYWORDS:

Preparedness, Disaster, Environment, response plans, Management.

INTRODUCTION

In the Disaster Management Cycle, pre-disaster activities include prevention, mitigation, and preparation, while post-disaster activities include response, which includes relief, recovery, and rehabilitation. While immediate relief and recovery efforts are essential, effective disaster management planning must take into account the whole range of activities and circumstances that might arise before, during, and after catastrophes.The easiest way to describe these stages is as a cycle. If used to public policy, this cycle may prevent catastrophes from developing in the future by preventing the vicious cycle of cause and effect. The distribution of resources throughout the catastrophe cycle, which maximizes the overall efficacy of risk reduction efforts and the overall impact of disaster management, is one of the important concerns in disaster management planning.

This method has given disaster management a more comprehensive perspective and helped to integrate disaster management with development planning because the majority of predisaster activities involve efforts to reduce vulnerability, such as reducing poverty and providing jobs, which are also common development concerns.

The Catastrophic Event:

This relates to the actual occurrence of a risk and its impact on the "elements at risk." The length of the event will depend on the kind of hazard; for instance, an earthquake may only cause a few seconds of ground shaking, but floods may last for a longer time. Disasters have a significant modifying effect on the physical environment. In the case of an earthquake, the whole area is turned to rubble in a matter of minutes. In the afflicted regions, the effect results in a loss of life and property, with losses directly connected to the area's socioeconomic and physical susceptibility. Additionally socioeconomic, vulnerability.

Women, children, the elderly and crippled, those with mental illnesses, and other weaker groups in society suffer far more than their stronger counterparts. Studies have also shown a strong link between vulnerability and poverty. Because they are simpler to get and provide extra benefits, such as close proximity to the sea for fisherman or rich soil for farmers near flood prone regions, etc., the poor live in the most dangerous physical places, making them vulnerable to losses of both life and property. The ability to bounce back from shock in the wake of a calamity is also lacking among the impoverished. This highlights the necessity for a comprehensive catastrophe response that considers the social, political, and economic repercussions. Physical, social, and economic vulnerability of weaker areas, which suffer more in comparison to other, better located sections, are all issues that need to be addressed.

Disaster Response:

A disaster is a catastrophic occurrence that has profoundly altering effects. There are both physical and social/human consequences. All of the aforementioned issues must be resolved during disaster response. Reconstruction efforts are made to rebuild the infrastructure that has been destroyed or damaged, as well as physical facilities, impacted communities, and lost livelihoods. The reaction to disasters teaches us some fundamentally significant lessons. Retroactively, it highlights weaknesses in attempts to enhance the social standing of the disadvantaged, especially with regard to access to resources for the underprivileged. These efforts relate to policy and planning with respect to placement and kind of infrastructure and social programmes. The period after a catastrophe is an opportunity for administrative setup examination since a crisis response reveals system flaws. In terms of having a beneficial influence on the environment, readiness, procedural simplicity, logistics, speed, and skill, a disaster is the ultimate test of administrative effectiveness. There are fundamentally significant lessons to be learned about administrative changes via the implementation of policies to ensure:

Improved Institution Readiness:

Overcoming opposing forces, such as a lack of social cohesiveness caused by unreasonable differences that inadvertently prevent action in the sense of "communitarianism" and self-help; Long-term mitigation strategy to address both structural and non-structural risks via allowing legislative provisions and truthful execution of the same.

Recovery:

Following a catastrophe, the recovery phase entails putting plans into place to encourage sustainable regeneration (reconstruction, rehabilitation). It includes long-term actions including the reconstruction of homes, property, infrastructure, educational and healthcare facilities, and other public structures. A community devastated by a catastrophe will go through this process to completely recover to its pre-event condition. Recovery is the process of bringing infrastructure systems back up to minimal operational requirements and directing ongoing initiatives aimed at restoring life to pre-disaster levels or higher. The three overlapping stages of emergency assistance, rehabilitation, and rebuilding are all included in the term "recovery", which is also frequently used to describe those activities.

Emergency Assistance:

The time immediately after a catastrophe when actions are made to address the requirements of survivors in terms of shelter, water, food, and medical treatment is referred to as the "emergency relief" period. Immediate relief, rescue, damage and need assessment, and debris removal are all actions conducted during and shortly after a catastrophe. Critical components of the reaction include relief and rescue. Improvements in decision-making and communication processes, better delegation to field agencies, incorporation of indigenous traditional knowledge on warning signs, a cartographic understanding of safe and unsafe areas, survival techniques, and traditional forms of insurance based on kinship and families are all required to achieve this. Communication between the many entities engaged is the most important factor in relief and rescue. A disaster area is sometimes compared to a combat zone, where communication is vital, frequently crucial, and often the difference between success and failure.

Addiction Treatment:

Rehabilitation refers to actions made to facilitate the victims' transition back to temporary housing and public services as stopgap measures to enable longer-term rehabilitation via permanent housing and infrastructure. Along with the physical aspects, rehabilitation programs also focus on economic recovery via livelihood recovery and support initiatives and the identification of alternative work opportunities for those who are unable to return to their prior professions owing to irreversible damage. For people who have experienced severe trauma and need help in the form of psychosocial therapy or even medicine in certain circumstances, rehabilitation also involves psycho-social rehabilitation.

Reconstruction:

Reconstruction aims to enhance community performance prior to a calamity. It entails replacing structures, infrastructure, and essential amenities like roads, bridges, and communication lines in order to improve long-term growth prospects rather than maintaining the same circumstances that rendered a region or a people susceptible in the first place.

Improvement:

The inclusion of development as a stage in the disaster cycle is meant to guarantee that, in the event of a natural catastrophe, societies take hazard and vulnerability factors into account when formulating development policies and plans. The phrase "disaster management cycle" refers to a series of interconnected tasks that must be completed in order to handle a catastrophe. It is also commonly referred to as the "disasterdevelopment cycle," which implies that catastrophes are cyclical events that happen frequently in a pattern that includes development, followed by a disaster, and then a return to development until the next disaster.

Another phrase that is helpful in this context is "sustainable development," which refers to growth that satisfies existing demands without jeopardizing the capacity of future generations to satiate their own wants. It contains two fundamental ideas about "needs," in particular, the notion that the basic needs of the world's poor should be given top priority and the idea that the environment is limited in its ability to meet both present and future needs because of the state of technology and social organization.

The objective of emergency preparation programs is to increase the technical and management capabilities of governments, organizations, and communities in order to attain a suitable degree of readiness to react to any disaster event. These precautions, which are defined as being logistically prepared to handle catastrophes, may be strengthened by establishing reaction mechanisms and processes, practicing them, creating long- and short-term plans, educating the public, and constructing early warning systems. In the event of a local or national disaster, preparation might also include maintaining strategic stockpiles of food, equipment, water, medications, and other necessities. Governments, organizations, and private citizens create strategies to save lives, reduce catastrophe damage, and improve disaster response operations during the preparation phase. Among the preparedness measures are [1].

1. Preparation strategies
2. Emergency drills and instruction
3. Warning mechanisms
4. Telecommunication systems for emergencies
5. Plans for evacuations and training
6. Inventory of resources
7. Lists of emergency contacts and people
8. Mutual aid contracts
9. Public education/information

Preparation initiatives, like mitigation efforts, rely on the inclusion of suitable measures in national and regional development plans. Emergency preparedness: Pre-disaster measures done by a government to ensure that it can effectively carry out its emergency management duties. Examples include establishing authority and responsibilities for emergency operations and securing the funding to implement them. A suitable level of preparedness to deploy resources in the most effective and efficient way in order to reduce losses brought on by a catastrophe. Memorandum of Understanding: A written agreement that outlines the conditions and specifics of a deal between two parties, as well as the demands and obligations of each.The process through which governmental and non-governmental organizations organize and deploy disaster aid to assist defenseless victims of a catastrophe.

DISCUSSION

Disaster Planning:

A broad variety of activities and resources from various multi-sectoral sources are included in the ongoing and integrated process of disaster preparation. Disaster Preparedness Training Program; International Red Cross and Red Crescent Societies, IFRCRCS, 2005. Those participating in the process must approach disaster preparation from a mitigating, responding, recovering, and business continuity standpoint if they want it to be successful. Therefore, it is important to thoroughly examine the stages of emergency management while thinking about disaster preparation [2], [3].

Policies and procedures for disaster mitigation won't prohibit a catastrophe, particularly a natural disaster, from happening and lasting. Reduce susceptibility to or boost resistance to the consequences of the unavoidable catastrophes to which a nation is predisposed are the goals of mitigation strategies and actions. In general, preparation and catastrophe mitigation go hand in hand. As an example, disaster preparation is putting mitigation measures in place to make sure that current infrastructure can endure the effects of catastrophes or that people can react in their communities while also protecting themselves. The nation's, people's, and government's collective ability to handle severe risks or adversities when they arise is an indicator of how well-prepared they are overall. Mitigation is critical under local conditions and due to a history of catastrophe propensity, but preparation is even more crucial.

Disaster preparedness entails preparing local residents and key service providers for the steps they will take in the event of calamities. If this is the case, attention must be paid to how the official responders, police, fire, emergency medical services, and military personnel—prepare for disaster response. To stop the spread of catastrophes' impacts that would further endanger lives and ruin property, for instance, the staff in these response organizations may need to learn how to handle new equipment, treat illnesses, or provide services. According to the International Federation of Red Cross and Red Crescent Societies (IFRCRCS, 2005), individual, national, communal, and global contributions are needed for disaster preparation. Disaster preparation includes any actions that will increase the efficacy, efficiency, and impact of local and national emergency response systems to disasters. The following matters a lot in particular:

1. To reduce the possibility of fatalities and property damage, warning systems should be constantly developed, tested, and prepared for.

2. Authorities and the vulnerable people should be informed about and given disaster response training.

3. Prepare teams for emergency response and first aid.

4. After a crisis, establish emergency response rules, standards, organizational setups, and operational plans that emergency personnel and other response organizations will adhere to.

Others believe that disaster preparedness should be particularly "community-based" through national or international initiatives that will strengthen community-based disaster preparedness by educating, preparing, and assisting local populations and communities in their ongoing efforts to reduce risks and prepare their own local response mechanisms to handle disaster emergency situations [4].

Reduced Risk of Disaster (DRR):

Natural catastrophes are not always caused by natural dangers. When the general public is aware in advance of the nature and likelihood of such threats, preventive action is particularly feasible. Human vulnerability is the relative inability of an individual or group to foresee, manage, fend against, and recover from the effects of a danger. Rapid urbanization, population expansion, and a lack of information about how to successfully combat catastrophes and poverty are all factors that make people more vulnerable to them. Of all the contributing elements, poverty may be the main reason why the majority of people are so susceptible to the effects of most dangers. Understanding human susceptibility helps us comprehend the relevance of whatever physical precautions should be prioritized under diverse conditions.

The foundation of disaster preparation, or the action plan to be used before, during, and after catastrophes, is disaster risk reduction (DRR). What exactly is risk minimization then? The defines risk reduction as taking practical steps to lessen infrastructure's susceptibility to natural disasters and its exposure to them, as well as to offer coping and adaptive infrastructure. Following are some DRR suggestions for nations without comprehensive disaster preparation plans:

1. Disaster management policy, planning, and capacity development

2. Physical protection, such as the construction of sea barriers to fend off storm surges or flood shelters for when floods occur

3. Building institutional and systemic capabilities for disaster readiness

The country will continue to function at all levels thanks to the above policy and planning of physical measures intended to reduce risks. For instance, food, potable water, and health care will continue to be provided, and there will be less damage to infrastructure. The following is a collection of DRR examples that nations might include into their planning and policy. Planning effectively to reduce floods in flood-prone regions and alternative infrastructure for supplying food and clean water. providing elevated flood shelters similar to those built in Bangladesh. the development of rural water delivery infrastructure to offer enough drinkable water during droughts or floods. As an illustration of how to improve the ability to handle floods, consider the building and operation of drainage pumps. Increase community-based preparation for disasters by emphasizing the responsibilities of women more. Enhance wireless connectivity with integrated electronic and manual system support. As a catastrophe preparedness measure, teach farmers to diversify their food crops. Create an MOU on a local and international level to cover the purchase of resources that could be depleted or become rare due to a catastrophe.

Emergency Operations Plan:

An Emergency Operation Plan (EOP) must be created at the federal level to outline the range of operations necessary for community readiness and response. It must state what the community can really accomplish. The EOP must be adaptable to be useful in actual and anticipated crises. It involves responders in the short-term recovery and enables the community to address risks. The administrative plan, the mitigation strategy, the long-term recovery, and the Standard Operating procedures are not included in EOPs since they are broad in nature. Separate papers cover each of the disaster management topics [5], [6].

Making and Composing the EOP:

The EOP tries to guarantee that things are done methodically within the confines of the current organizational structures. The foundation of what the EOP intends to undertake is currently enacted law and other memorandums of understanding. The EOP primarily consists of a promulgation/broadcast statement signed by the Chief Executive Officer authorizing the Plan, an explanation of the planning process, an abstract of the contents, implementation, a table of contents, instructions for using the Plan, the goals of its sections, and information about how to access it.

Arrangement of the EOP:

The EOP is structured specifically as follows:

i Statement of Purpose: The Plan aims to benefit residents in this way.

ii Situation and Assumptions: Describe the emergency occurrences, both real and possible, as well as the warning procedures and any odd or exceptional circumstances in the community.

iii Organization and responsibility assignment: This section clearly addresses how the jurisdiction will allocate the emergency functions to implement the Plan through roles of local authorities in the emergency management system.

iv Concept of Operations - This part outlines the responsibilities and connections between public and private sectors, as well as how they interact.

The management of resources, general support needs, and the availability of services and assistance for all emergency management stages, as well as the policies put in place to enable these activities happen, are all part of administration and logistics.

vi Plan creation and maintenance operations include updating the plan to reflect changes brought about by emergency management experiences, evolving disaster scenarios and presumptions, and changes to the community's demographics.

vii Authorities and references: These authorities and references are applicable to any emergency-related legislation, executive orders, rules, and formal agreements.

viii Definition of terminology: This ensures that everyone involved in communication, direction, and control during catastrophes has a common understanding of the terminology that will be used [7], [8].

Technical Annexes:

If an EOP lacks functional annexes that include detailed instructions and information on operations as well as the roles and duties of responders, it is not comprehensive. The annexes provide general terms as well as suggestions for measures that not only guarantee a good response but also help prepare responders for crises and catastrophes. Direction and control (who is in charge), communications (information sharing), early warning (warning the public), and public information (orders of evacuation, mass care, health and medical services, and resource management) are all topics covered by EOPs. The EOP takes into account many tasks that must be carried out in order to handle a catastrophe, such as damage assessment, search and rescue, emergency services, aircraft operations, transportation, and other ad hoc services.

Applying the EOP:

Response agencies put EOPs to the test by using them. The drills are preceded by training that helps orient workers to any processes they would need to be familiar with in order to function in an emergency. A tabletop simulation that primarily focuses on familiarizing responders with their roles and duties in the emergency management system is another method of evaluating an EOP. Responders complete exercises by talking their way through situations while seated around a table in the tabletops.

More sophisticated drills, such practical drills that take place in an enclosed space decorated to seem like an Emergency Operations Center (EOC), are undertaken when familiarity with the EOP's contents increases. They include intricate simulations using speech, writing, communicating over the phone, and radio. Exercise scenarios include messages that mimic real-world occurrences, to which participants must react. Field drills, which simulate real-world situations, are performed when players carry out the work order in some of the current specialized facilities, such the EOC and the communications center. The full-scale exercise, which combines a field drill with a functional exercise, is the last kind. All participants in this exercise react to the emergency with the same tools and assistance as they would in a real crisis. Injured victims may sometimes be represented by members of the public.

Making the Plan Public:

Public awareness campaigns are used to spread awareness of completed EOPs throughout communities. In this instance, they help to make residents more aware of catastrophes or calamities. You may learn more about the EOP by consulting your local news outlets, government agencies, community discussion groups, and handouts and pamphlets.

Inventory of Resources:

For its activities, the EOP needs a lot of resources, including personnel, machinery, systems, and supplies. These resources are required for both emergency response and the social comfort of the staff that work there for lengthy periods of time during catastrophes. Resources are allocated from the public, corporate, and community sectors in order to implement the Plan. To determine flaws, strengths, and requirements, resource evaluations are usually necessary.

Integrating Gender And Child Protection Into Emergency Planning:

It is past time for women to actively participate in the creation of mitigation measures and initiatives in order to mainstream gender concerns. Sometimes women are underrepresented in positions of power. Experts concur that include women expands the variety of concepts put out for and integrated into efforts for disaster planning and produces plans that are more catastrophe-resilient. Making preparations for disaster preparedness requires mapping out the current manifestations and root causes of gender inequality in each setting. This is known as gender mainstreaming. In order to ensure responsibility in execution, it is also vital to incorporate women's organizations rooted in the community that represent underrepresented groups in planning for preparation, relief, and rebuilding.

In addition, by giving kids the chance to participate more actively in disaster situations, we stop acting as interpreters of their needs and ideas and start working with them to develop appropriate actions and strategies that improve their ability to reflect, contribute, and direct their own developmental processes. This raises the likelihood of long-lasting educational initiatives on catastrophe preparedness. It also aids in the democracy process by producing young leaders with vision and development expertise. Resource management is essential to preparation because it guarantees that the appropriate people, resources, and equipment are on hand and prepared to be used in the event of a catastrophe. This abstract emphasizes the value of managing inventories, coordinating logistics, and forming alliances with other agencies and organizations. It also underlines the need of routine equipment and facility maintenance and testing to guarantee their operational preparedness [9], [10].Building capacity is a continuous process that improves people's knowledge, talents, and capacities in responding to and recovering from disasters. The importance of training efforts, public education campaigns, and the creation of specialist reaction teams are all covered in this abstract. The need of fostering a culture of readiness via community involvement and public awareness campaigns is also emphasized.

CONCLUSION

This research looked at catastrophe mitigation as it related to emergency preparation. History has shown that risks, particularly natural ones, cannot be completely eliminated, but it has also demonstrated that the more prepared a population is for a risk, the more probable it is that the risk will not turn into a tragedy. The term "preparedness" is defined, and steps to take to obtain it are provided. In nations with inadequate disaster management, the unit also offers suggestions for disaster risk reduction (DRR). The Emergency Operation Plan (EOP) and its significance are examined, along with gender and child protection-related problems. In summary, the goal of the preparation phase of the disaster management cycle is to improve readiness and response capabilities. An overview of the goals, essential elements, and significance of readiness in fostering resilience is given in this abstract. Societies may successfully lessen the impact of catastrophes, save lives, and promote a more effective and coordinated response and recovery process by performing risk assessments, creating emergency plans, managing resources, and investing in capacity development.

REFERENCES:

[1] R. Z. Farahani, M. M. Lotfi, A. Baghaian, R. Ruiz, and S. Rezapour, "Mass casualty management in disaster scene: A systematic review of OR&MS research in humanitarian operations," *European Journal of Operational Research*. 2020. doi: 10.1016/j.ejor.2020.03.005.

[2] N. Srivastava, N. Bharti, B. Tyagi, S. Saluja, S. Aslam, and V. Aggarwal, "Effects of various disaster management approaches: an evidence summary," *Soc. Sci. Res. Unit*, 2017.

[3] A. K. Anam, S. Winarni, and A. Winda, "Upaya Perawat Dalam Fase Mitigasi Bencana Gunung Kelud Berdasarkan Icn Framework, The effort of nurse in disaster mitigation phase on Kelud Mountain base on ICN Framework)," *J. KEPERAWATAN Terap.*, 2018.

[4] U. Pernice, P. Salvati, F. Fiorucci, C. Bianchi, and F. Guzzetti, "Approaches to communication in response to geo-hydrological risk: The European FP7 LAMPRE project and the Italian POLARIS web initiative," in *Proceedings of the 5th International Disaster and Risk Conference: Integrative Risk Management - The Role of Science, Technology and Practice, IDRC Davos 2014*, 2014.

[5] J. Post *et al.*, "Tsunami prevention and mitigation necessities and options derived from tsunami risk assessment in Indonesia," *EGU Gen. Assem. 2009*, 2009.

[6] G. Wolbring, "A Culture of Neglect: Climate Discourse and Disabled People," *M/C J.*, 2009, doi: 10.5204/mcj.173.

[7] W. Lestari, "Pengaruh Pelayanan Promosi dab Syariah Terhadap Minat Nasabah Dalam Memilih Asuransi Syariah (Studi pada PT.Asuransi Takaful Keluarga Cabang Palembang)," *J. Chem. Inf. Model.*, 2019.

[8] Menkes RI, "A Systematic Literature Review on Causes of Natural Disaster," *Sustain.*, 2019.

[9] S. Chopra *et al.*, "Disaster Causes and its Management" No. 544 October 2016," *Appl. Energy*, 2016.

[10] A. Harrington *et al.*, "A Review Paper on Disaster management," *Procedia - Soc. Behav. Sci.*, 2015.

CHAPTER 12

DISASTER MANAGEMENT CYCLE: RESPONSE AND RECOVERY

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ABSTRACT:

The important process of disaster management is designed to lessen the effects of catastrophes and speed up the recovery of impacted areas. The stages of the disaster management cycle are readiness, response, and recovery. In particular, the reaction and recovery stages are the focus of this research. Actions are made right away during the reaction phase to take care of the urgent requirements and guarantee the safety of the impacted people and communities. The reaction phase's essential elements include emergency services, search and rescue operations, medical aid, and the mobilization of resources. A prompt and effective response is made possible by effective coordination among several parties, including government agencies, non-governmental organizations, and community volunteers. The recovery phase starts after the first reaction phase has passed. Restoration of the impacted regions and aiding the afflicted populace in starting over again are the main objectives of this phase. In order to recover, one must first determine the amount of the harm, create long-term goals, and then put those plans into action. In order to ensure the resilience of the impacted populations and their general well-being, the recovery phase also focuses the social, economic, and psychological components of rehabilitation. Effective communication, teamwork, and the involvement of all stakeholders are essential for a successful reaction and recovery process. Lessons from previous catastrophes, cutting-edge technology, and the inclusion of risk mitigation strategies in recovery plans all help to provide more effective and long-lasting recovery results.

KEYWORDS:

Disaster Management Cycle, Response, Environment, Governmental Organizations, Medical Aid.

INTRODUCTION

The activities individuals and institutions do in the face of a tragedy are collectively referred to as a disaster response. These activities start when a dangerous occurrence is foreseen, or when it really happens if there is no foreseen event. As more long-term and sustainable solutions are sought, the emphasis throughout the response and recovery stages of the disaster management cycle is on providing for the fundamental requirements of the populace. All phases of the catastrophe management cycle take developmental factors into account. The promotion of sustainable livelihoods and their preservation and recovery during crises and catastrophes is one of the key objectives of disaster management and one of its strongest ties with development. Where this objective is met, individuals are better equipped to cope with calamities, and their recovery is both quicker and more sustained. The goals of a development-oriented approach to disaster management are to reduce risks, avert catastrophes, and be ready for crises. After finishing this lesson, you will be able to [1].

1. Explain catastrophe recovery and response.
2. List the objectives of disaster relief.

3. Describe common catastrophe response procedures.
4. What makes contemporary and traditional responses different?
5. List some contemporary techniques.
6. Describe the steps involved in catastrophe recovery.

Warning:

A development or stage in social, economic, or political progress or advancement toward a better way of life. Transfer from one dangerous location to another that is secure. The process of advancing human wellbeing, particularly through eradicating pain and suffering. The area of civil defense or organization responsible for purchasing, maintaining, and moving equipment, people, and facilities. Following a setback or loss, the restoration of structures and infrastructure to their original condition. People who are momentarily suffering from the impacts of a tragedy and are at the time utterly powerless are given private or state assistance in the form of money, food, clothes, shelter, or medication. Sending funds to cover the cost of supplies or services to aid those in need following a tragedy. A neighborhood or building that has undergone reformation or restoration after a catastrophe or other danger. To better or more fully repair the state of a structure or a section of a town. Actions made in response to a catastrophe or other risks. Safety precautions that provide a feeling of security against damage or loss caused by disasters or unforeseen occurrences. The use of volunteers, particularly in programs and organizations that focus on disaster relief or community service. Advice to be cautious of looming danger provided to someone or others.

Disaster Management:

Emergency response's major goal is to provide quick help to the afflicted people in order to save life, enhance health, and boost morale. This support may take several forms, from giving targeted but limited relief, such helping refugees with food, housing, and transportation, to building temporary but semi-permanent settlement in camps and other places. Initial infrastructural repairs may also be necessary. The goal of the reaction phase is to fulfill the people's immediate needs while searching for longer-term, more sustainable solutions [2]. During this stage in the cycle of disaster management, humanitarian groups are often quite active. Humanitarian organizations are often requested to handle quick reaction and recovery after a catastrophe. These organizations need qualified employees, trained leaders, enough transportation and logistical support, suitable communications, and emergency response procedures in order to be able to react in an effective manner. The humanitarian organizations won't be able to assist those in need right away if the essential preparations haven't been done. The primary disaster response efforts are included in this section. A system of rules and procedures, usually under the direction of a lead agency, control each action (officially or informally). In the end, a variety of government institutions, international and national agencies, local entities, and people carry out disaster response operations, each with their own duties and responsibilities.

To guarantee the highest number of victims' survival and maintain their best condition given the conditions. To promptly re-establish self-sufficiency and critical services for all demographic groups, paying particular attention to the most vulnerable and impoverished individuals whose needs are the highest. To rebuild viable economic activity and repair or replace destroyed infrastructure. To do this in a way that advances long-term development objectives and lessens exposure to possible threats that might repeat in the future. In times of civil or international war, the goal is to safeguard and aid the civilian population while adhering to international treaties and working closely with the International Committee of the

Red Cross (ICRC). The goal in situations involving population relocation (due to any kind of calamity) is to identify long-lasting solutions as soon as feasible, while making sure protection and support are provided as needed in the meantime.

DISCUSSION

Response to Disaster Activities:

Warning:

Information on the nature of the threat and impending catastrophic threats is referred to as a warning. Government representatives, institutions, and the general public in the regions at immediate danger must get warnings as soon as possible so that the right steps, such as property security or evacuation, may be done to limit additional harm. The warning might be broadcast on radio, television, in the printed press, over the phone, and on mobile devices.

Migration and Evacuation:

A population must be relocated from disaster-prone areas to safer areas during an evacuation. The preservation of communal life and prompt care for individuals who may be hurt are the main priorities. Although evacuation is most often connected with tropical storms, it is frequently necessary with industrial or technical threats. Evacuation must to be able to [3]:

1. A reliable and timely warning system,
2. Clearly marking the evacuation routes
3. An established rule that calls for everyone to leave the area when ordered,
4. A campaign to educate the general public about the idea.

People moving from the area where they are at danger to a safer place during a slow-onset catastrophe, such as a protracted drought, is called crisis-induced migration rather than evacuation. The majority of the time, this movement is a spontaneous reaction to the migrants' impression that they may find food and/or protection elsewhere rather than being planned and directed by the government.

SAR, or Search And Rescue:

Finding catastrophe victims who may be trapped or isolated and transporting them to safety and medical assistance is known as search and rescue (SAR). SAR often involves finding trapped flood victims who may be in danger from rising water following tropical storms and floods and either taking them to safety or giving them food and first aid until they can be evacuated or brought back to their homes. SAR often concentrates on finding persons who are wounded or trapped in fallen structures following earthquakes.

Post-Disaster Evaluation:

Providing a clear, succinct image of the post-disaster condition, identifying relief needs, and developing recovery plans are the main goals of assessment. It chooses choices for providing humanitarian aid, how effectively to use already available resources, or how to formulate requests for further aid.

Input and Relief:

There can be no delays when a calamity has happened; reaction and aid must happen right away. Therefore, it's crucial to have backup plans in place. Relief is the giving of tangible help and urgent medical attention on a humanitarian basis required to save and protect human lives. Families are also able to satisfy their fundamental requirements for food, including the means to make food, housing, clothes, and water. In the days and weeks immediately after a severe calamity, relief goods and services are often offered gratis. Emergency aid may be required for a long time in cases of developing slow-onset emergencies and population displacements (refugees, internally and internationally displaced persons).

Supplies and Logistics:

Emergency assistance delivery will need logistical resources and capability. For managing the receipt, storage, and delivery of relief materials for distribution to catastrophe victims, a well-organized supply service is essential [4].

Management of Communication And Information:

The aforementioned tasks need communication to be completed. In times of crisis, communication has two facets. One is the technology required for the transmission of information, such as radios, telephones, and the repeater, satellite, and transmission line networks that support them. The other is information management, which is the protocol for tracking who tells whom what information and how it is distributed and understood.

Response and Coping Of Survivors:

It is simple to ignore the true needs and resources of the survivors in the haste to prepare and carry out a relief effort. Existing social coping strategies that do not need outside support must be considered in the evaluation. On the other side, catastrophe survivors could need new or particular social services to assist them cope with the stress and disruption the disaster produced. Healthy recovery depends on people and community groups being involved in the disaster response process. The best way to create effective coping skills is via these.

Security:

Immediately after an unexpected incident, security is not often a top concern. Usually, civil defense or police agencies are in charge of it. The preservation of human rights and the security of displaced people and refugees, however, may be of the utmost significance and need international supervision. Without some kind of emergency operations management, none of the aforementioned actions can be carried out. Prior to the crisis, policies and procedures for management needs must be implemented.

Rehabilitation:

Following a catastrophe, rehabilitation include taking steps to restore essential services, support victims' attempts to rebuild their own homes and communal infrastructure, and promote the recovery of economic activity (including agriculture). The goal of rehabilitation is to help the afflicted populations families and local communities resume their roughly pre-disaster routines of living. It might be seen as a period in between (i) quick alleviation and (ii) more extensive, long-term repair and the pursuit of continued development.

Reconstruction:

Reconstruction include the long-term building up of or replacement of badly damaged physical buildings, the complete restoration of all local infrastructure and services, and the revival of the local economy (including agriculture). Future catastrophe risks must be taken into consideration when reconstruction is fully included into continuing long-term development plans. It must also take into account the potential for lowering such risks by incorporating suitable mitigation strategies. It's possible that damaged facilities and services won't be rebuilt in exactly the same way or at the same place. Any temporary arrangements made as part of the emergency response or rehabilitation may be replaced as part of it. Reconstruction and rehabilitation may not be possible during a battle, however. Activities in restoration and rebuilding may need to wait until peace permits them, obviously for reasons of safety and security [5].

Traditional and Modern Methods Of Disaster Response:

Depending on the kind and extent of the crisis, reactions may use a combination of conventional and contemporary strategies, switching back and forth between them. The following ways that catastrophe scope has affected responses:

1. (Aid provided to alleviate misery and agony),
2. (Money sent to victims) Remittance
3. Relief supplies (food, medicine, and tents),
4. Contacting groups, or networking
5. Volunteering (both internal and external organizations providing assistance or a community-based strategy) and
6. Mutual help contracts (contracts in advance to provide resources).

People impacted by catastrophes sometimes need outside help in order to live and heal as long as disasters continue to happen. Depending on how much aid is given to those affected by the tragedy, a response might be either contemporary or traditional. The help may be given in-kind, such as food aid, housing supplies, seeds, or blankets, or it can be given in cash, allowing recipients to choose what they most need and purchase it from local marketplaces. Remittances, in which individuals living outside the disaster region send large quantities of money or products across great distances to those impacted, have been a remarkable method of disaster relief. Most people understand the phrases used to describe this reaction to relate to transfers between migrants and their areas of origin. The Community Emergency Response Team (CERT), created in communities to work closely with the local government and the community members themselves to determine community needs and priorities for any crisis event, has been the community-based approach to emergency response in many nations.

Other Instances Of Responses:

Local Partnerships:

When families in a community experience a crisis, they turn to one philanthropic organization (World Vision) because of its extensive network of local partnerships with churches, community groups, and governmental organizations. Local political offices and police precincts often request assistance from World Vision during a disaster.

Gifts-in-Kind:

Charitable organizations actively ask business partners to give new items that are in high demand to help catastrophe survivors recover, and they then oversee the distribution of these things.

Every Storehouse should have an ongoing supply of emergency supplies that may be given at any time, according to their plan. Water, blankets, medical supplies, latex gloves, and kits with enough hygiene and other goods to last a family of four up to four days are just a few of the items that will be available.

Civil Service:

World Vision, one of the charitable organizations, strives to be a voice in the community by participating in planning committees for the Red Cross, Salvation Army, Office of Emergency Management (OEM), FEMA, National and State Volunteer Organizations Active in Disasters (VOAD), and Habitat for Humanity (H4H). Through these connections, organizations are able to represent the needs of the families and children they assist and act as a bridge to the community.

Specific Requirements:

Families have a variety of requirements after an emergency. World Vision is able to provide for these particular needs as a result of the wide range of gifts it receives and distributes. Its distinctive offers include new clothing, shoes, beds, furniture, school supplies, construction supplies, and cleaning goods, to name just a few. Modern catastrophe response techniques are dicussed as herein. The following new technologies may be extremely effective and valuable tools in disaster response:

Cell phones may be a very helpful warning tool. The receivers of brief communications might be alerted about the impending danger of tropical storms, wind storms, or any other extreme weather likely to cause harm. Using satellite photos to provide spatial information. The potential of mapping technologies like geographic information systems (GIS), remote sensing (satellite images), and global positioning systems (GPS) to enhance emergency response operations is well known in the emergency management field.

Geographic technologies are being used more often for both hazard mitigation and response activities. These include mapping the incident and the impacted regions, damage assessments, search and rescue operations, risk assessments, risk perception, and risk communication. More details are available on the function of technology in disaster management. Social networking and social media may be used as a method for communicating during emergency situations. Social networking sites like Facebook and text messaging services like Twitter may be utilized as channels of communication during disaster relief.

The following are some examples of recommended uses for social media and social networking:

1. Use blogs to quickly spread the word about the need for aid funds.
2. To record damage, create geo-tagged picture collections.
3. Promote volunteers who are willing to offer their knowledge of rehabilitation.
4. Use map-based mashups (website data combinations) to show pertinent regional data.
5. Right away, impart "lessons learned."
6. Social networks and volunteer directories should be integrated to make information exchange simpler.
7. Use techniques that allow for geographic targeting when distributing weather information.
8. Encourage companies that will probably participate in recovery efforts to share resource information.
9. Utilize the application procedure for assistance as the foundation for voluntary information exchange across impacted groups.

Emergency Recovery:

The Plan for Recovery:

The afflicted populace is capable of carrying out an increasing number of tasks meant to restore their life and the infrastructure that supports them as the situation is brought under control. The transition from urgent assistance to recovery and ultimately to long-term sustainable development is not well defined. During the recovery phase, there will be several possibilities to improve preparation and prevention, hence lowering vulnerability. A seamless transition from recuperation to ongoing growth is ideal [6].

Recovery efforts continue until all systems are improved or back to normal. Short- and long-term recovery strategies include restoring essential life-support services to minimal operational levels, finding temporary housing, educating the public about health and safety, rebuilding, offering counseling programs, and conducting economic impact analyses. Data gathering for rebuilding and recording lessons learned are examples of information resources and services.

For people who have been displaced by the tragedy, food and shelter may also be necessary. There are two categories of recovery activities: short-term and long-term. Emergency action was done throughout the reaction to restore essential functioning while putting preventative measures in place to avoid further harm or damage.

A short-term recovery happens right away and often coincides with a reaction. The officials repair seriously damaged structures or destroy them after restoring utility services that were disrupted and cleaning up the roadways. For people who have been displaced by the tragedy, food and shelter may also be necessary.

Despite being referred to as short-term activities, several of them might endure for weeks. Depending on the degree and scope of the harm done, long-term healing could entail some of the same actions but might go on for many months or even years. For instance, it can include completely rebuilding destroyed sections. The objective is for the neighborhood to rebuild in a way that is superior to what it was before the calamity.

This is the perfect opportunity to put new mitigation strategies into place so that the neighborhood is better equipped to handle potential dangers and does not expose itself to the same setbacks as in the past. One of the most significant duties throughout the recovery phase is assisting the community in taking new mitigation measures. It's crucial to establish a broad strategy for recovery that should be attached to emergency operating plans, and the recovery process should be understood properly.

The plan's main goal is to outline the crucial procedures for managing effective rehabilitation. You will also identify important partners, their responsibilities, and the measures necessary to mobilize them for each phase. The strategy should include at least these seven steps.

1. Compiling fundamental information
2. Planning a recovery
3. Allocating resources to aid in recovery
4. Providing treatment
5. Controlling recovery

Coordinating Efforts to Promote Recovery:

Assessing Recovery:

The majority of the time, local communities can provide the support required for recovery after a tragedy. However, it could be required to get support from the government and other sources in the event of a big calamity. As a result, if a severe tragedy happens, plans must be taken to ask for outside assistance. This will need educating and persuading decision-makers, particularly those who are located outside of the impacted region. The easiest approach to do this is to record the disaster's impact. Documentation entails presenting proof of what took place. Uncontestable proof is provided by photos of the damage. Photograph the damage, the repairs, and the finished restorations. There is no such thing as too many photos. If the next five easy steps are taken, a decent documentation may be produced:

1 Document repairs and damage using photos. More is always preferable than less. Private citizens might provide you with better photographs than you do.

2 Keep track of any damage and repairs. Once again, more is preferable than too little. If you have a lot to write down at once, dictate your thoughts into a tape recorder to be subsequently typed up.

3 Clip and organize newspaper studys. Do the same if you can get video footage from the television channels.

4 Carefully track all purchases and retain all invoices and receipts.

5 Ensure that anybody representing the jurisdiction follows suit.

Disasters as Opportunity For Actions to Promote Development:

Disasters may serve as a Launchpad for important development initiatives. Damage and disruption's political repercussions have the potential to be a serious change agent. There are many ways that disaster-inspired development projects are affected, but two factors stand out as being particularly significant. First, catastrophes may draw attention to specific weak spots, such as those where there has been a significant loss of life or when the economic damage is out of proportion to the severity of the effect. This generally has the effect of highlighting the overall degree of underdevelopment. Second, for a few weeks or months, the political climate might favor a significantly higher rate of economic and social change than before, particularly in areas like land reform, new job training, housing improvements, and economic base restructuring.

However, keep in mind that this might require a transfer of resources from other sectors and areas. Even if the quantities are often rather minor in comparison to the overall loss, the value of direct foreign help offered in the wake of catastrophes may somewhat compensate for economic losses. A disaster-induced dramatic reorganization of the economy could potentially have longer-term advantages. For instance, tiny island economies that were once reliant on a single crop may diversify their economy, sometimes with support from elsewhere. Donor investment policies for emergency loans are often a constraint or other effect on the degree to which development prospects may be pursued following a catastrophe [7], [8].

The emphasis of the disaster response is demonstrated to be on providing prompt medical care and survival help to catastrophe victims in order to save lives. Disaster response is a part of disaster management that considers activities that may be done in the short and long term to benefit the people affected before, during, and after catastrophes. These activities include acts of recovery and self-sufficiency, rebuilding, and rehabilitation. Evacuation, early warning, search and rescue are a few examples of mitigation tactics that have been used as part of disaster response to lessen the effect of catastrophes on people. To demonstrate the significance of their usage in disaster management, they have been emphasized. In order to show how individuals deal with and survive catastrophes, relationships between the disaster response and resources, security, and communication are emphasized in disaster management. Depending on the scope and magnitude of the disasters experienced by communities and the resource assessment made, disaster responders may choose to use different methods of humanitarian, remittance, networking, volunteerism, and mutual aid agreements. The modern versus traditional methods of responding to disasters are contrasted in order to highlight differences and commonalities between them.

In the rehabilitation phase, communities are rebuilt holistically, taking into account all aspects physical, social, economic, and psychological. Communities may rebuild stronger and more resilient infrastructure and systems via thorough damage assessments, the creation of recovery plans, and the use of sustainable practices. Additionally, addressing the social and psychological needs of those who are impacted helps to create community cohesiveness and a feeling of optimism throughout the healing process. To improve future disaster preparation, it is crucial to include risk reduction strategies into recovery plans and learn from prior catastrophes.

CONCLUSION

The recovery period may be used as a chance to rebuild better and lessen vulnerabilities to future catastrophes by adopting new technology, including all stakeholders, and encouraging community engagement. Communities' ability to respond effectively and recover depend ultimately on the dedication and cooperation of all levels of governmental entities, organizations, and people. Societies may improve their capacity to resist and recover from disasters, guaranteeing the safety, well-being, and resilience of their people, by acknowledging the significance of the response and recovery phases within the larger Disaster Management Cycle. In conclusion, the Disaster Management Cycle's response and recovery stages are crucial to the overall management of catastrophes. These stages are essential for reducing the immediate effects of catastrophes and promoting the resilience and long-term rehabilitation of impacted populations. The quick and coordinated actions of emergency services, relief agencies, and community volunteers are essential during the reaction phase for saving lives, delivering urgent aid, and reestablishing stability. The effectiveness of response actions is largely dependent on effective resource mobilization, teamwork, and communication.

REFERENCES:

[1] M. A. Islam, D. J. Paull, A. L. Griffin, and S. Murshed, ‘Spatio-temporal assessment of social resilience to tropical cyclones in coastal Bangladesh’, *Geomatics, Nat. Hazards Risk*, 2021, doi: 10.1080/19475705.2020.1870169.

[2] K. Kim and L. Zhao, ‘Filtering facepiece respirator supply chain management framework in a disaster such as covid-19’, *Societies*, 2021, doi: 10.3390/soc11040136.

[3] B. M. Faturahman, ‘Diskursus Manajemen Bencana Era Covid-19’, *Madani J. Polit. dan Sos. Kemasyarakatan*, 2021, doi: 10.52166/madani.v13i1.2291.

[4] P. Aznar-Crespo, A. Aledo, J. Melgarejo-Moreno, and A. Vallejos-Romero, ‘Adapting social impact assessment to flood risk management’, *Sustain.*, 2021, doi: 10.3390/su13063410.

[5] I. H. Sawalha, 'A contemporary perspective on the disaster management cycle', *Foresight*, 2020, doi: 10.1108/FS-11-2019-0097.

[6] F. Coccolini *et al.*, 'COVID-19 the showdown for mass casualty preparedness and management: The Cassandra Syndrome', *World Journal of Emergency Surgery*. 2020. doi: 10.1186/s13017-020-00304-5.

[7] N. O. Chong and K. H. Kamarudin, 'Disaster risk management in Malaysia: Issues and challenges from the persepctive of agencies', *Plan. Malaysia*, 2018, doi: 10.21837/pmjournal.v16.i5.415.

[8] K. Beek, A. McFadden, and A. Dawson, 'The role and scope of practice of midwives in humanitarian settings: A systematic review and content analysis', *Human Resources for Health*. 2019. doi: 10.1186/s12960-018-0341-5.