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ADDRESSING THE RECURRENCE OF NATURAL DISASTERS IN KERALA: AWARENESS, CONSEQUENCES, AND PRECAUTIONARY MEASURES

Dr. Aranya K. Sasi
Assistant Professor, Department of History, Sree Narayana College, Varkala, Kerala, India

Corresponding Author: Dr. Aranya K. Sasi

Abstract

Disasters have significantly impacted human societies since the beginning of time, with their severity often measured by the extent of damage they cause to human life and property. Beyond the immediate casualties, disasters also lead to substantial economic and financial losses, disrupting key infrastructures such as buildings and communication systems. These disruptions have far-reaching effects on the economic development of affected regions. This paper explores the general awareness of disasters in Kerala and their consequences, with a focus on the necessary precautions that need to be taken in response to the state's vulnerability. It is essential to acknowledge that Kerala has increasingly become prone to recurring natural disasters. Adapting to this reality requires careful analysis and honest assessments of the situation. Kerala's geographical and climatic conditions – marked by its coastal location, the steep gradient along the slopes of the Western Ghats, and its dense population – make it highly susceptible to natural disasters. The Kerala State Disaster Management Plan identifies 39 hazards, categorized into naturally triggered and anthropogenically triggered hazards. Given these challenges, the state must respond proactively and positively to mitigate the risks and reduce the impact of such disasters. This project aims to provide a comprehensive analysis of these issues, emphasizing the importance of awareness, preparedness, and effective response strategies in safeguarding Kerala's future.

Keywords: *Disaster, Flood, Earthquake, Drought, Tsunami, Cyclone*

Introduction

In the southwestern coast of India lies Kerala, a land renowned for its lush greenery, serene backwaters, and vibrant culture. Yet, amidst its natural beauty, Kerala has also grappled with a tumultuous relationship with nature. From devastating floods to relentless landslides, the state has faced an array of natural disasters that have left lasting scars on its landscape and people. This introduction sets the stage for a closer examination of Kerala's tumultuous history with natural calamities, delving into the causes, impacts, and responses to these events. Through understanding these challenges, we gain insight into Kerala's resilience and the imperative for proactive disaster management strategies.

Analysis and Interpretations

A Natural Hazard is a natural process and event that is a potential threat to human life and property. A disaster is a hazardous event that occurs over a limited time span within a defined area. Criteria for a natural disaster are (1) 10 or more people are (2) killed, 100 or more people are affected (3) a state of emergency is declared, and (4) international assistance is requested. If any one of these applies, an event is considered a natural disaster. A natural disaster is the highly harmful impact on a society or community

following a natural hazard event. Some examples of natural hazard events include: flooding, drought, earth quake, tropical cyclone, lightening, tsunami, volcanic activity, and wildfire. A natural disaster can causes economic damage in its wake. The severity of the damage depends on the affected population's resistance and on the infrastructure available. Scholars have been saying that the term natural disasters are unsuitable and should be abandoned. Instead, the simpler term disaster be abandoned. Instead, the simpler term disaster could be used, while also specifying the category of hazard. A disaster is a result of a natural or human – made hazard impacting a vulnerable community. It is the combination of the hazard along with exposure of a vulnerable society that results in a disaster.

In modern times, the divide between natural, human – made and human accelerated disasters is quite difficult to draw. Human choices and activities like architecture, fire, resource management and climate change potentially play a role in causing natural disasters. In fact, the term natural disaster was called a misnomer already in 1976.Natural disasters can be aggravated by inadequate building norms, marginalization of people, inequities, overexploitation of resources, extreme urban sprawl and climate change. The rapid growth of the world's population and its increased concentration often in hazards environments has escalated both the frequency and severity of disasters. Extreme climates and unstable landforms, coupled with deforestation, unplanned growth proliferation and non-engineered constructions create more vulnerable interfaces of populated areas with disaster – prime natural spaces. Developing countries which suffer from chronic natural disasters, after have ineffective communication system combined with insufficient support for disaster prevention and management.

An adverse event will not rise to the level of a disaster if it occurs in an area without a vulnerable population. Once a vulnerable population has experienced a disaster, the community can take many years to repair and that repair period can lead to further vulnerability. The disastrous consequences of natural disaster also affect the mental health of affected communities, often leading to post-traumatic symptoms. These increased emotional experiences can be supported through collective processing, leading to resilience and increased community engagement.

Kerala's Natural Calamities: An Overview

Natural disasters occur due to natural causes. Sometimes a natural disaster may be the result of human activities. One aspect of natural disasters we highlighted earlier was the fact that they, or at least some of them, can be predicted with modern technological tools. We also classified natural disasters under some subheads based on their genesis, like geological meterological, hydrological, medical disasters etc. These are not water – tight classifications as one disaster may originate from another source as well.

Earthquake in Kerala

Seismic activity in the recent past has occurred in clusters along the border with Tamil Nadu, primarily in the districts of Idukki and Palakkad. A number of faults have been identified in Kerala out of which a few, like the Periyar Fault are active. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes.

Seismic Hazard: The Seismic hazard map of India was updated in 2000 by the Bureau of Indian standards (BIS). There are not major change in the map with respect to Kerala. All districts in the state lie in Zone III. The maximum intensity expected in these areas would be around MSK VII. It must be noted that BIS estimates the hazard, based in part, on previous known earthquakes.

Largest instrumented earthquake in Kerala & the Lakshadweep Islands: A light earthquake struck the Kottayam region in Kerala, India on 7 January 2001 at 08:25 AM local time resulting in two deaths and some damage to property in parts of central Kerala. It had a magnitude of MW=4.6 and was felt for close to 27-seconds in parts of the states of Kerala and Tamil Nadu.

Tsunami in Kerala

The infamous Indian ocean tsunami hit three states of India – Tamil Nadu, Pondicherry and Kerala, as well as the Andaman and Nicobar Islands. Tamil Nadu was the worst hit state. The Tsunami hit the Kerala coast at about 11am, 26 December 2004. By then, many people were aware of its impending arrival through television broadcasts and ran away from the coast, an act that saved considerable lives.

In Kerala's Kollam district, Alappad 132 persons died, while 39 persons died in Alappuzha district, Aratupuzha Village. Considerable property was destroyed in other districts and villages, but there was no loss of life. Fishing boats, nets, houses, shops and other establishments were destroyed or severely damaged along the coast. Four thousand houses were reconstructed in Alappad and 1500 in Aratupuha. When the Tsunami hit, communist party cadres visited the affected areas in Kerala, promising that when they come to power they will assist the survivors in every way. While the communists did in fact come to power soon after the tsunami, they did nothing for the people.

Flood

Flood is an overflow of water that submerges land that is usually day. In the sense of "flowing water", the word may also be applied to the tide. Floods are an area of study of the discipline hydrology and are of significant concern in agriculture, civil engineering and public health. Human changes to the environment often increase the intensity and frequency of flooding, for example land use change such as deforestation and removal of wetlands, changes in water way course or flood controls such as with levees, and larger environmental issues such as climate change's increased rainfall and extreme weather events increases the severity of other causes for flooding, resulting in more intense floods and increased food risk.

A flood is the rapid burst of water that submerges land. Flood may arise as an overspill of water from water bodies such as a lake, river, etc. it may also occur due to an accumulation of rainwater on the ground in and flood. Flash floods are caused by rapid and excessive rainfall that raises water heights very quickly. It might be influenced by several factors including encroachment of flood. Flash floods are caused by rapid and excessive rainfall that raises water highest very quickly. It might be influenced by several factors including encroachment of flood plains and other natural factors, reservoir storage, land usage etc. The climate change at the global level has made a severe effect on the flood situation in the state and thereby results in more intense and extreme rainfall. Deforestation, emission of greenhouse gases etc are also the reason behind this flood. The first flood in Kerala occurred in 1924 and after a long gap, the flood again takes place in 2018. And it was sustained to happen in successive years 2019, 2020 and 2021.

Drought

Kerala State in India, which is the first area of the country to experience the southwest monsoon, has a moist and wet climate. Kerala is in the extreme southwestern part of the Indian subcontinent; it borders Karnataka State in the north, Tamil Nadu in the east, and the Arabian Sea in the West. The entire state is one of the 35 meteorological subdivisions in India. Kerala's climate is tropical monsoon and tropical *savarna*, according to Koppen's climatic classification. The state normally experiences excessive seasonal rainfall, with hot summers. The three main reasons of the state are the hot season (March – May), Southwest monsoon season (May – September) and north east monsoon season (October – February).

The annual rainfall of the state varies from 3800mm over the north to 1800mm in the extreme south. The potential rainy season for Kerala is the southeast monsoon period, which contributes more than 80% of the annual rainfall. Kerala had severe dry spells and droughts in 1983, 1985, 1986 and 1987, even though the state has a wet climate. Damage due to drought was particularly significant in Kerala in 1987. About 1500 villages in 14 districts were affected, and 9.82 lakh hectares of cropland and 6 lakh were also affected. During January – May 1987, the entire Kerala region was affected by drought. About 30% of the rabi season paddy crop was lost and cash crops like coconuts, area nuts, cashews and bonanas were damaged, resulting in a loss of Rs.1000 crores.

Earthquake

An earthquake-also called a quake, tremor or temblor- is the shaking of the surface of earth resulting from a sudden release of energy in the lithosphere that creates seismic waves. Earthquakes can range in intensity, from those that are so weak that they cannot be felt, to those violent enough to propel objects and people into the air, damage critical infrastructure and wreak destruction across entire cities. The seismic activity of an area is the frequency, type, and size of earthquakes experienced over a particular time. The seismicity at a particular location in the earth is the average rate of seismic energy release per unit volume. The word tremor is also used for non-earthquake seismic rumbling.

At the earth's surface, earthquakes manifest themselves by shaking and displacing or disrupting the ground. When the epicenter of a large earth quake is used to describe any seismic event-whether natural or-caused by humans-that generates seismic waver. Earthquakes are caused mostly by the rupture of geological faults but also by other events such as volcanic activity, handslides, mine blasts, fracking and nuclear tests. An earthquake's point of initial rupture is called its hypocenter or focus. The epicenter is the point at ground level directly above the hypocenter.

Tropical Cyclone

A tropical cyclone is a rapidly rotating storm system characterized by a low-pressure center, a closed low level atmospheric circulation, strong winds, and a spiral arrangement of thunderstorms that produce heavy rain and squalls. Tropical cyclones typically form over large bodies of relatively warm water. They derive their energy through the evaporation of water from the ocean surface, which ultimately condenses into clouds and rain when moist air rises and cools to saturation. This energy source differs from that of mid-latitude cyclonic storms, such as nor easters and European winds storms, which are powered primarily by horizontal temperature contrasts. Tropical cyclones are typically between 100 and 2000km in diameter.

The primary energy source for these storms is warm ocean waters. These storms are therefore typically strongest when over or near water, and they weaken quite rapidly over land. Climate change can affect tropical cyclones in a variety of ways: an intensification of rainfall and wind speed, a decrease in overall frequency, an increase in the frequency of very intense storms and a pole ward extension of where the cyclones reach maximum intensity are among the possible consequences of human – induced climate change.

Lightning

Lightning is a natural phenomenon formed by electrostatic discharges through the atmosphere between two electricity charged regions, either both in the atmosphere or one in the atmosphere and one on the ground, temporarily neutralizing these in a near – instantaneous release of an average of between 200 mega joules and 7 giga joules of energy, depending on the type.

Human have deified lighting for millennia. In diomatic expressions derived from lightning, such as the English expression "bolt from the blue", are common across languages. At all times people have been fascinated by the sight and difference of lightning. The fear of lighting is called astraphobia. The first known photograph of lighting is from 1847 by Thomas Martin Easterly. The first surviving photograph is from 1882, by William Nicholson Jennings, a photographer who spent half his life capturing pictures of lightning and proving its diversity. There is growing evidence that lighting activity is increased by particulate emissions. However, lightning may also improve air quality and clean greenhouse gases such as methane from the atmosphere, while creating nitrogen oxide and ozone at the same time. Lighting is also major cause of wildfire, and wildfire can contribute to climate change as well. More studies are warranted to clarify their relationship.

Wildfire

A wildfire, forest fire, bushfire, wildland fire or rural fire is an unplanned, uncontrolled and unpredictable fire in an area of combustible vegetation. Depending on the type of vegetation present, a wildfire may be

more specifically identified as a bushfire, desert fire, grass fire, hill fire, peat fire, Prairie fire, vegetation fire or veld fire, some natural forest ecosystems depend on wildfire, Wildfires are distinct from beneficial human usage of wild land fire, called controlled or prescribed burning, although controlled burns can turn into wildfires. Modern forest management often engages in prescribed burns to mitigate risk and promote natural forest cycles.

Naturally occurring wildfires have beneficial effects on native vegetation, animals and ecosystems that have evolved with five. Many plant species depend on the effects of fire for growth and reproduction. Some natural forests are dependent on wildfire. High-severity wildfires may create complex early seral forest habitat, which may have higher species richness and diversity than an unburned old forest. Human societies can be severely impacted by fires, effects include the direct health impacts of smoke and fire, destruction of property, economic and eco system services losses and contamination of water and soil.

Hailstorms

Hailstorm consists of irregular lumps of ice from 5 to 150mm in diameter. This is a form of solid precipitation, Hail formation occurs in thunderstorm conditions, with strong upward movement of air and freezing conditions at lower attitudes. Hailstorms can cause injuries to all life forms and are particularly harmful to crops. They can be predicted and tracked using weather satellites and satellite imagery. The size of the hail stone governs its damaging effect. It can cause injuries. Weather service agencies generally issue hail warnings when the size of hail stones is larger than a particular size. While nothing can done to save crops over large areas, people can be warned to be indoors when the hailstorm is severe and large – sized hail is expected. Preventive action is to stay indoors during a hailstorm.

Famines

A famine is declared when there is severe scarcity of food resulting in malnutrition and even death. A famine can happen due to many factors like

- Crop failure and damage to food grains due to various factors.
- Poor crop management pattern resulting in crop failure
- Large increase in population without corresponding increase in production
- Hording by unscrupulous traders.
- State policies that cause harm to the economy

While famine is not very common now-a-days, it has happened in every country of the world some time or the other in the past.

Many regions in India have referred from famine conditions, this is not the case now, Food security is given priority and a huge stock of food materials is available in government warehouses. Any crop failure can be dealt with by utilizing this stock. We need to ensure proper storage of the grain stock to ensure their availability in time of need.

Causes

1. Geographical Vulnerabilities

- **Monsoon Rains:** Kerala experiences heavy monsoon rains from June to September, which can lead to severe flooding. The Western Ghats, a mountain range that runs parallel to the coast, adds to the complexity, as it funnels rainwater into rivers and streams, leading to flash floods and landslides.
- **Coastal Erosion and Cyclones:** Kerala's long coastline is vulnerable to erosion and the occasional cyclone. While cyclones are less frequent than in the eastern coast of India, when they do occur, they can cause significant damage due to storm surges and strong winds.

- **Topography:** The state's varied topography, from high mountains to low-lying coastal plains, makes it susceptible to different types of disasters simultaneously. For instance, while the mountains are prone to landslides, the plains can experience severe flooding.

2. Historical Natural Disasters

- **2018 Kerala Floods:** One of the most devastating floods in recent history, the 2018 floods were caused by unusually high rainfall during the monsoon season. Nearly all the dams in the state were opened, leading to widespread flooding that displaced over a million people and caused significant loss of life and property.
- **Landslides:** Landslides are common in the Western Ghats, particularly during the monsoon. The 2019 landslides in Wayanad and Idukki districts were particularly severe, leading to numerous fatalities and loss of homes.

3. Human Impact and Climate Change

- **Urbanization and Land Use Changes:** Rapid urbanization and deforestation have exacerbated the impact of natural disasters in Kerala. Unplanned construction, particularly in ecologically sensitive areas, has increased the likelihood of landslides and flooding.
- **Climate Change:** Changes in climate patterns have made rainfall more erratic, leading to both droughts and floods in different parts of the state. The increasing frequency of extreme weather events is a significant concern for Kerala's future.

4. Disaster Management and Response

- **State Government Initiatives:** Kerala has a relatively well-developed disaster management framework, with the Kerala State Disaster Management Authority (KSDMA) playing a key role. The state's approach includes early warning systems, community awareness programs, and disaster preparedness drills.
- **Community Participation:** Kerala's high literacy rate and active civil society have facilitated community participation in disaster management. Local self-governments, NGOs, and community groups often play a crucial role in disaster response and recovery.
- **Resilience Building:** Post-disaster rebuilding efforts in Kerala have increasingly focused on building resilience. This includes adopting sustainable construction practices, restoring natural ecosystems like mangroves, and integrating disaster risk reduction into development planning

Challenges and Future Directions

- **Sustainable Development:** Balancing development with ecological conservation remains a key challenge. Policies that promote sustainable land use and reduce environmental degradation are essential to mitigate the impact of natural disasters.
- **Climate Adaptation:** Kerala needs to continue enhancing its climate adaptation strategies, focusing on vulnerable communities and integrating traditional knowledge with modern science.
- **Infrastructure Resilience:** Strengthening infrastructure, particularly in flood-prone areas, is critical. This includes building resilient roads, bridges, and drainage systems to withstand extreme weather events.

Conclusion

Disasters are catastrophic events that cause significant loss of life and property. While modern technological tools allow for the prediction of some natural disasters, they cannot always be prevented. Key terms in disaster management include hazard, risk, vulnerability, and capacity. Kerala's history is

marked by various natural disasters, such as floods, landslides, cyclones, and earthquakes. These events have had profound social, economic, and environmental impacts on the region. Despite these challenges, Kerala has shown remarkable resilience through community support, disaster preparedness, and innovative solutions. Looking ahead, continued efforts in risk mitigation, early warning systems, and sustainable development practices are essential to minimizing the impact of future disasters. These steps will help build a safer and more resilient Kerala for future generations.

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