Chapter I
Introduction

1.1 Nature and Size of the Problem

Natural disasters are estimated to have claimed about 3 million lives around the world since 1960, as well as severely affecting the livelihood of about 1 billion people. The damage caused to property is assessed at well over US $ 400 billion. The Asia Pacific region has been one of the worst hit regions of the world. It is estimated that nearly 50 per cent of the world’s major disasters occur in Asia and the Pacific. Since the international Decade for Natural Disaster Reduction began in 1990, number of deaths from natural disasters in Asia and the Pacific has exceeded 2,00,000. The estimated damage to property was about US $ 50 billion until the Kobe earthquake and very heavy flooding in China took place in 1995. Damage now is estimated at US $ 120 billion. The national economies of developing countries in Asia and the Pacific are significantly affected by the loss of scarce resources that could otherwise have been used for social and economic development. In many cases the development process has been set back by years or decades. The frequency and intensity of adverse natural phenomena and the extensiveness and severity of the damage they cause seem to be increasing over time.

Floods, droughts, cyclones, storm surges, earthquakes, landslides and volcanic eruptions periodically affect a large number of countries in the region, causing great loss of life and extensive damage to property and infrastructure. In many coastal areas of Asia prone to damage by tropical cyclones and storm surge, the population is growing rapidly, together with the pace of economic development.

The most common of the water-related natural disasters in Asia are floods. Almost all of the countries in Asia frequently experience severe flooding. Although floods today do not claim as many lives as the storm surges, they affect
both urban and rural residential areas, as well as agricultural areas and cause the greatest damage to property. In some areas floods trigger landslides and mudflows claim a significant number of lives. Floods are the most frequent and thus the most destructive natural hazard affecting the region.

Most of the great disasters associated with tropical cyclones have been caused by storm surges in Asia. Storm surges occurring several hours in advance of the landfall of a tropical cyclone can hit a coastal area while people are still being evacuated and can therefore cause extremely high loss of life and material damage.

Droughts may affect large parts of the population, causing human misery in the region, particularly if remedial measures are not taken in advance. Although droughts generally occur in semi-arid or desert climates in Asia, they may also seasonally severely affect areas where the average rainfall levels are reasonable.

The main geological hazards that affect Asia are the earthquakes, tsunamis, volcanic eruptions and landslides. The region covers many areas of high seismic activity and volcanism. It has been estimated that during the last 300 years, over 2.5 million have died around the world as a result of earthquakes and that nearly 75 per cent of these fatalities occurred in Asia and the western Pacific. Volcanic eruptions in large island countries of Asia located at the western Pacific Rim have also claimed a considerable number of lives. Tsunamis are among other hazards that affect these countries.

Earthquakes are rather difficult to predict and when such prediction can be made, there is usually little time to issue adequate warnings to the people. However, timely predictions of volcanic eruptions in the countries of the region have enabled the concerned authorities to evacuate the people from danger zones before any harm was sustained.
In many countries of the region, it is gradually being recognized that the initial and most vital response to disaster must be at the local level and that the community must be well informed about disaster preparedness measures and be made alert at the time of disaster.

In Asia and the Pacific, natural hazards cause a high number of lives to be lost, and relatively small property losses in least developed and developing countries. In contrast, in the relatively developed countries where disaster prevention and mitigation measures are adequately established, the loss of lives is relatively small, but the damage to property is high. Losses may vary within a country itself. This is mainly due to the fact that the countries of region are at different stages of institutional development with regard to natural disaster reduction activities. Some countries have long established frameworks for responding to the requirement of the country. Others, particularly with the advent of the International Decade for Natural Disaster Reduction, have either strengthened their existing institutional mechanisms or are in the process of forming a framework.

In order to develop the appropriate systems and measures to mitigate the effects of natural hazards, it must first be studied how such hazards become disasters. Vulnerability of an area to a natural hazard or the probability of its occurrence defines the possible risk of exposure to a natural hazard at that place. A natural phenomenon is considered to be a natural disaster only when it causes both loss of life and considerable damage to property.

Natural hazards produced by the forces of the nature, upon which human society can have very limited control, are the main causes in the creation of natural disaster. Besides the usual natural forces, there is the extremely important human factor which amplifies the level of destruction and thereby transforms events of natural hazards into disasters.
Rapid population growth in the region is one of the main elements in increasing of vulnerability to natural hazards causing natural disasters. In the first place, the higher rate of population growth directly results in high population density and higher level of physical infrastructures. High population densities almost inevitably result in high death tolls, and high property values unavoidably result in high losses if appropriate preventive measures are not undertaken beforehand. Increasing population pressure in the countries of the region causes habituation of hazard-prone lands. The ever declining land-people ratio eventually forces people to inhabit hazard prone marginal lands in increasing numbers. The other effect of rapid population growth, which has a direct bearing on natural disasters, is the haphazard development and enlargement of urban areas. The main feature of urban growth driven by these factors in the region is the increasing emergence of slums and squatter areas at the outlying areas. These are the most vulnerable areas with high disaster risks where natural hazards often reach disaster proportions. The flood plains of South Asia support some of the highest densities of population in the world and the heavy density of population in the coastal environment is exposed to risks of flood disaster through cyclones, typhoons and tsunamis.

Poverty is also one of the major underlying causes for the inappropriate types and poor quality of building materials, substandard planning and building code regulations and, most importantly, weak enforcement of safety codes and provisions.

Another factor that exacerbates the effects of natural hazards is environmental degradation. The damage from natural hazards is higher in countries where environmental degradation is rampant. Deforestation, erosion, overgrazing / over cultivation and incorrect agricultural practices and degradation of natural buffers amplify the effects of natural hazards. Environmental degradation may eventually contribute to climate change, exposing areas to droughts and possibly triggering famines.
The impact of natural disasters is much higher in the developing countries than in the developed countries, and it is usually the poor who are most affected. In the catastrophic cyclone of 1991 in Bangladesh, for instance, most of the casualties were persons striving to eke out a living along the coastal flatlands. Natural disasters, particularly those repeatedly affecting certain areas, have an adverse impact on investment in those places, as well as on the non-formal economic sector.

The level of disaster preparedness is a major factor in the mitigation of natural disasters, with the available technology. Most natural disasters, particularly cyclones, floods, and droughts, can be forecast in advance. However, in most of the developing countries, disaster preparedness measures, especially the early warning systems, are inadequate. Not all of the people can be warned in time, and in many places there are not enough disaster preparedness measures such as adequate number of easily accessible cyclone shelters and evacuation equipment.

1.2 Global Overview

Disasters have been mankind’s constant though inconvenient companion since time immemorial. The fury of nature can be as disastrously beautiful as the gifts of nature received gratis. Natural disasters continue to strike unabated and without notice and are perceived to be on the increase in their magnitude, complexity, frequency and economic impact. These hazards pose a threat to people, structures or economic assets, and assume disastrous proportions when they occur in areas of dense human habitations. Increasing population and various other socio-politico-economic considerations have forced people to live in areas that are considered uninhabitable like flood-prone areas of major river systems and the low lying areas along the sea and islands, which are often inundated.

Since 1960, natural disasters have resulted in the loss of three million lives and affected many more at global level. Their economic costs are on the rise in
alarming proportions: compared to the 1960s, the economic loss due to disasters has increased by a factor of 8, discounting inflation.

Ninety per cent of natural disasters and 95 per cent of disaster related deaths worldwide occur in developing countries.

The problems of disaster management in developing countries are unique due to the seemingly competing needs between basic necessities for people and economic progress. The environment has borne the brunt of this competition for resources with rapid increases in population due to the development process itself. The constant use of the environment and its resources has inevitably resulted in changes in the ecology and with changing environmental conditions, the nature and intensity of natural disasters has assumed newer dimensions.

It has often been pointed out that most of the world's worst disasters tend to occur between the Tropic of Cancer and the Tropic of Capricorn. Coincidentally, this is the area that is inhabited by the poorer countries of the world. A major significance of this is that such countries find themselves facing repeated setbacks to progress in addition to mounting pressure on ecology and environmental conditions due to rising population. Indeed, some countries seem destined to remain in the category of developing nations primarily on account of the severity and magnitude of such disasters. Seen in this backdrop, therefore, disasters can be a strong aggravating factor widening the differential between the wealthy nations and poor nations.

The fact that the more the nations develop aggravates the complexity of the problem; and the more assets they build up, the more vulnerable they become to disasters. This applies to all countries, rich and poor alike, and it underlines the need for all countries to try to develop and maintain an effective disaster management capability appropriate to their needs. It also underlines the necessity for coordinated international action in order to strengthen all aspects of disaster management to the extent possible.
Unless disasters can be mitigated and managed to the optimal extent possible, they will continue to have a dominating effect on the future. Since, the political, economic and social stability of the world depends significantly on bridging the gap between developing and developed nations, the mitigation and containment of disasters in the developing nations has to be taken up as an issue of prime importance.

It is strange but true that along with global socio-economic advancement, there has been a rapid rise in the toll of human lives and economic losses due to natural calamities all over the world. In India, the frequency of natural disaster has increased considerably in the last few decades, which has necessitated the strengthening of response mechanism of the existing civil administration system.

1.3 National Scenario

India is one of the world’s oldest civilizations with a rich cultural heritage. It covers an area of 32,87,590 square kilometers, extending from the snow-covered Himalayan heights to the tropical rain forests of the south. Planning considerations begin with a review of the geography.

The seventh largest country of the world, India is well marked off from the rest of Asia by mountains and seas, which give the country a distinct geographical entity. Bounded by the Great Himalayas in the north, it stretches southwards and, at the Tropic of Cancer, tapers off into the Indian Ocean between the Bay of Bengal on the east and the Arabian Sea on the west.

It has a land frontier of about 15,200 kms and a coastline, including the Andaman and Nicobar Island and the Lakshadweep, of 7,516.6 km.

The rivers of India could be classified as (i) himalayan rivers, (ii) peninsular rivers, (iii) coastal rivers, and (iv) rivers of the inland drainage basin. The Himalayan rivers are perennial as they are generally snow-fed and have reasonable flow throughout the year.
The climate of India may be broadly described as tropical monsoon type. There are four seasons: (I) winter (January-February), (ii) hot weather summer (March-May), (iii) rainy southwestern monsoon (June-September), and (iv) post-monsoon, also known as the northeast monsoon in the southern Peninsula (October-December). The climate is affected by two seasonal winds – the northeast monsoon and the southwest monsoon. The north-east monsoon, commonly known as winter monsoon, blows from land to sea whereas the south-west, monsoon known as summer monsoon blows, from sea to land after crossing the Indian Ocean, the Arabian Sea and the Bay of Bengal. The south-west monsoon brings much of the rainfall in the country. With improvements in meteorology, it is now possible to make forecasts about the monsoon rains.

Geologically, the Indian subcontinent is divided into three principal segments. These are the:

- Himalayas and their extension to the east and the west;
- Indo-Gangetic plains to the south
- Peninsular India

India’s population, according to the 2001 census, stood at 1027 million. The second most populous country of the world, India is home to 16 per cent of world’s population even though the country has only 2.42 per cent of the world area. The United Nations Population Fund in its The State of World Population, 1998 has stated that India is rapidly climbing the population ladder and, with a higher birth rate, it would overtake the most populous country China by 2050 AD. The world population, according to the Report, is growing by over 80 million a year with India contributing about one-fifth to that growth.
1.3.1. Vulnerability

The unique geo-climatic conditions of India make this region particularly vulnerable to natural disasters. Disasters occur with unfailing regularity and despite better preparedness to meet all such contingencies; the economic and social costs on accounts of losses caused by natural disasters continue to mount year after year.

Among all the disasters afflicting the country, river floods are the most frequent and often the most devastating. Floods are most frequent in the Ganga-Brahmaputra-Meghna basin, which carry 60% of the nation’s total river flow.

Earthquakes are considered to be amongst the most dangerous and hazardous, their impact being sudden with little or no warning, making it almost impossible to predict or make preparations against its onslaught. Though about 50-60 per cent of total area of the country is vulnerable to seismic activity of varying intensities, most of the fault lines and resultant vulnerable areas are located in the Himalayan and sub-Himalayan regions, and in the Andaman and Nicobar Islands.

Drought is a perennial feature in some states of India. Sixteen per cent of the country’s total area is drought prone and approximately 50 million people are annually affected by droughts. The drought of 1987-88 was one of the worst of the century.

India has a long coastline of 7516.6 km, which is exposed to tropical cyclones arising in the Bay of Bengal and the Arabian Sea. Latest episodes of cyclones in Andhra Pradesh (1996), Gujarat (1998) and the Orissa super cyclone (1999) are examples of the worst cyclones in recent memory bringing colossal damages to life and property.
In India, out of 32 states and union territories, 23 states are vulnerable to natural disasters like floods, droughts, cyclones and earthquakes. Only one state (West Bengal) faces all four types of disasters, six states face three types of disasters, nine face two types of disasters and six face one type of disaster. It is not uncommon to experience more than one or two types of disasters affecting the country at the same time in different geographical regions.

Of India’s 25 States and 7 Union Territories, the following 23 states (plus one Territory) are particularly vulnerable to the types of disasters indicated here.

<table>
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<tr>
<th>State / Union Territory (UT)</th>
<th>Drought</th>
<th>Flood</th>
<th>Cyclone</th>
<th>Earthquake</th>
<th>Total</th>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

Totals: 14 18 5 14

It is observed that since last couple of years the vulnerability status of some of the states for certain disasters has changed. Now Gujarat and Andhra Pradesh are become more vulnerable to cyclones. Same way Gujarat, Maharashtra and Madhya Pradesh are more prone to earthquakes. So India’s vulnerability is something beyond shown in the table.

1.4 Disaster Management

Disasters pose serious threat to normal life as well as to the process of development. These strike with sudden violence, tearing bodies, destroying lives, families and structures apart. Natural disasters are both sudden and powerful. Human vulnerability to them is an age-old phenomenon.

A disaster is the result of an immediate situation or the result of a long set process, which disrupts normal human life in its established social, traditional and economic system. This is due to destruction of the environment, which is caused by extraordinary natural destructive phenomena or human induced hazards resulting in human hardship and suffering beyond recovery unless external aid is brought in.

The term ‘disaster’ owes its origin to the French word ‘Disaster’ which is the combination of two terms, ‘des’ meaning ‘bad’ or evil and ‘astre’ meaning ‘star’. In earlier days a disaster was considered to be loss due to some unfavorable star. Nowadays, the concept has changed and the term ‘disaster’ is commonly used to denote any odd event, be natural or manmade, which brings about sudden and immense miseries to humanity.

A disaster has always been defined in terms of loss whether it is life or property or both.

These are different definitions of disasters:

1) Disaster is a sudden or great misfortune, calamity. (Concise oxford dictionary)
2) Disaster is a sudden calamitous event producing great material damage, loss and distress. (Webster’s dictionary)

3) Disaster is a natural or human caused event which causes intense negative impacts on people, goods, services and/or the environment, exceeding the effected community’s capability to respond (International Glossary to Disaster Management, DHA- Geneva, December.92)

1.4.1 Concept

Disasters are conditions, which disrupt normal functioning of the community, and cause widespread human material and economic losses that cannot be controlled and prevented by locally available resources.

Disasters bring misery to people and seriously affect the development process of the community. However, they always stimulate changes, which invariably help the process of human adjustment, and development and that are why we shall accept them as a challenge to transforming threats into opportunity. If a pre-warning system is evolved and if we properly prepare action plan by learning from experience from disasters in the past, we can overcome these threats by reducing mortality, morbidity and financial losses by providing immediate rescue, relief, rehabilitation and reconstructive services.

This means that at every level all disasters and relief services need to be documented in terms of time, duration, affected areas, population, type of effects, magnitude of effects, community and Government responses and outcome, and the disaster preparedness plans and relief services need to be evaluated to understand the shortcomings and for updating and preparing more effective and realistic preparedness plan.

Disaster management means planned and systematic approach towards understanding and solving problems in the wake of disasters. Practical experience has proved beyond doubt that commitment of resources to disaster preparedness
in the community yields better results both in terms of economy and effectiveness compared to sinking resources in an ad hoc manner in rescue and rehabilitation. It is unfortunate that when a disaster strikes people, organizations / administration are not prepared for disaster relief plans. They do not prepare action plans or do not carry on drills and be in readiness to meet the disaster situation to mitigate the resultant damage. Only after a disaster strikes to particular area, the community and the administration in that area become sensitive and start planning. Till that they believe that worst will not come to them, and when the worst comes, they feel helpless and face losses in terms of human lives and physical destruction of properties, crops and entire developmental process.

1.4.2 History

Disaster management is an old age phenomenon that we could see from our scriptures. Our Hindu scriptures like Vedas are thousands of years old. Out of these four Vedas Samved, Atharvaved, Yajurvaved and Rigveda, the atharvaved gave us Ayurveda Science. Charaksanhit is the book of Ayurveda science, which is derived from Atharvaveda. Some shlokas of Charksanhit are regarding disaster management. Those are in the Vimansthanam (Chapter III) of Charaksanhhita as shlokas 4(1), 4(2), 4, 6, 7(1), 7(3), and 10 as under:

4-(1) दृष्यन्ते हि खलु सौम्य ! नदालक्रिंगणवन्दृसूर्यिनिलानलाना दिशा
चाणक्षतिमृतानामृतैः सैकालिकां भाषा; अविराहिदी भूरिपि च न
यथाबृंहस्वेदिभिधिप्रभावमोषीनां प्रतिरेववात्तमं, तद्वियोगाचात्तंक्रायता नियता।

O, gentle one! Behold the stars; the planets, the moon, the sun, the wind, the temperature and the quarters are presenting their abnormal aspect, thus portending abnormal seasonal fluctuations. As the result of this abnormality the earth will fail to produce the herbs having the right qualities of taste, potency, post-digestive effects and specific action. In consequence of this failure there will ensue of necessity a marked prevalence of diseases.
Therefore, well before such calamities occur and well before the earth has lost her savour. O, gentle one! Collect the medicinal herbs while yet their taste, potency, post-digestive effects and specific actions remain unvitiated.

Nor indeed, O, gentle one! Are counter-measures to epidemics that destroy populations a difficult matter, provided the medicinal herbs are properly culled, properly prepared and properly administered?

The factors that affect a people in common are — the winds, the waters, the country and the seasons.

Of these, the wind, if of the following description, is to be known as disease-inducing; viz., unseasonable, totally becalmed, violently blowing, exceedingly rough, intensely cold, intensely hot, excessively dry, excessively humid, fearfully clamorous, blowing from contrary directions and clashing with itself, extremely rotatory (whirlwind), and charged with unwholesome odours, moisture, sand dust and smoke.
The country of the following description is to be known as unwholesome; having colour, odour, taste and touch that are unnatural; excessively damp; abounding in serpents, beasts of prey, mosquitoes, locusts, flies, mice, owls, birds and animals such as the jackal and abounding in woods of weeds and Ulupa grass; abounding in creepers where crops have either fallen, withered or been destroyed in an unprecedented manner; where the winds are smoky; where the sound of birds is unceasing; where the baying of dogs always assails the ears; where herds of animals and flocks of birds of various kinds are always in a state of alarm and pain; where amidst the people, morality, truth, modesty, custom, character and virtue have either declined or been given up; where the waters are always agitated and up heaving; which is frequently subjected to the incidence of meteorites, thunderbolts and earthquakes; where nature is full of menacing sounds and sights; where the sun, the moon and the stars are frequently covered by dry, coppery, ruddy and gray clouds and which lastly is as if full of constant alarm and lamentation, crying, fright, and darkness as if visited by gnomes, and as if abounding in sounds of lamentation.
The man of understanding will know that the water is more important than wind, and country more important than the water, and season yet more important than country by virtue of their degree of indispensability⁷.

1.4.3 “Crunch Diagram”

The extent of damage from a disaster depends on:
1. The impact, intensity and characteristics of the phenomenon
2. How people, environment and infrastructure are affected by that phenomenon

The relationship between hazard and vulnerability is best represented in the pressure and release, or “Crunch Diagram”.

\[
\text{Disaster Risk} = \text{Hazard} + \text{Vulnerability}
\]

The complex nature of many disasters can also go beyond secondary effects. In some cases the interaction of differing hazards and processes of change may set in a chain reaction culminating in disastrous political and economic consequences. An example of this can be seen in many African famines; lack of rain and subsequent drought does not always turn into a famine. However, when combined with failed market systems, political discord and internal conflict, drought can easily become a famine, which in turn compounds the negative effects of these other factors⁸.
Reference:

1. Reading Material Natural Disaster Management Cell, Sardar Patel Institute of Public Administration, Ahmedabad. *Imperatives in Natural Disaster Reduction*, 18-21


6. Study Material of *Certificate in Disaster Management* by Indira Gandhi National Open University, New Delhi, CDM – 01, Block-1, Unit – 1. Page

7. Charaksanhita, *(Vimansthanam - Chapter III)* which is derived from Atharvaveda.