Useful for Researchers, Students of Geography & Disaster Management

PRACTICAL DISASTER MANAGEMENT

Colonel P. P. Marathe (Retd)

Diamond Publications

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ACKNOWLEDGEMENTS

After my first book was released, I was never sure whether people would ever accept it. Clouds of doubt that existed in my mind were cleared by Mr. Dattatray Pashte who assured me that the book would be well received and that I should write another book on the same subject, purely for the benefit of students and teachers of schools and colleges. I am grateful to him for the reassurance.

For any one to write two books on the same subject is quite boring and I was dragging my feet over it. But the reason came by way of an exhibition that 'Disaster Management and Research Foundation' had organized in Pune on 26th January 2006. Though the crowd was very miniscule, each visitor spent a long time listening intently to the volunteers who had poured their hearts into the subject of Disaster Management. The visitors had gone away fully satisfied, expressing their frank opinions that the exhibition was indeed informative and most of them felt that such exhibitions should be held more frequently and reaching the masses more vigorously. These suggestions made me think again about writing this book in the simplest form, keeping it less technical. I thank these visitors sincerely. After all, this book is meant for them and their desires have to be honored.

Mr. Gopalrao Patwardhan, a "Bhishmacharya" in the field of journalism, came in my contact during the publication of my previous book on the subject. We happened to meet a few times thereafter. I realised that his love for the society's well being is so deep seated that even at this age he is full of vigour when it comes to the uplift of the masses. He has been very articulate in expressing that it was upto the people of our country to get what they richly deserved - a safe and secure life. Little did he realize that through his casual expressions of ideas he was sowing the seeds of a movement in the society. Through this book I am only joining this movement of spreading awareness among the young generation to make this nation a safer and more secure place to live in. I am grateful to Gopalrao. May God give him a long life to continue to inspire young people like me !

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PREFACE

India boasts of forward movement in technology, economy, education and social uplift. One aspect that has been neglected over the decades is that of managing actions against disasters. The awareness, technical know how and an urge to make our environment safer has to be initiated in the early stage of a human's life. The government's efforts towards including the subject of Disaster Management, as part of the curricula in schools and colleges, is laudable. This book is a small effort towards achieving this National aim.

Disaster Management is fast emerging as a mega disciplinary subject. Its applications are huge and it also has the capacity to build up value systems in the society. It encompasses philosophy and faith and structured study of causes and effects of many aspects of social, economic and environmental issues. Any effort towards studying this subject would certainly enlighten a student to start thinking holistically. Through this book, I am attempting to generate a social movement and for that to happen, it is important that the teachers study this subject and generate a deep interest in the minds of their students. They would be thus doing a great duty towards Nation Building.

Colonel P. P. Marathe (Retd)

DEDICATION

This book is dedicated to my deep sense of love for the humanity that pervaded my life all the time and stayed with me wherever I traveresed, be it through shrubs and meadows, the crowded streets and deserted stretches of landmass; shivering on the hill slopes and clinging to me under scorching sun or heavy downpour as well as through clear starry nights. It gave me the required warmth, radiating from within me a true, selfless and unflinching desire to rise up to every possible occasion to give a helping hand to those who needed it. It also motivated me and re-kindled my resolve to write this book.

CHAPTER 1

DISASTERS GENERAL - CAUSES, EFFECTS AND CHARACTERISTICS

General View

1.1 In this world, disasters have been occurring since time immemorial and will continue to occur. Though human is desperately trying to grapple with the disasters, he has not been able to make any significant progress in that field as yet. In fact, the stage has become more complex due to uncontrolled development everywhere. Humans are the main culprits for upsetting the ecological and environmental balance in this world. Obviously, the imbalances result in crossing thresholds of normalcy and end up into disasters.

1.2 Disaster : A Distaster is defined as ***an occurrence or event that causes sudden great loss.*** It is not that every disaster occurs suddenly. Today, technology has provided many tools to us to predict disasters. However, it is still not possible to accurately predict most of the natural disasters and almost all the man-made disasters. Thus, the occurrence of a disaster is quite sudden most of the time. Even when warning of a disaster is available, the loss is quite sudden because predicting the exact point of occurrence and also the accurate time, intensity and its encompassment is still quite difficult. Another reason is that our society is yet not fully aware of the connection between development and disasters. When development takes place without due considerations to environmental and geological factors, effects of disasters enhance greatly.

1.3. Connection Between Disasters & Development. Disasters cause great losses. However, disasters also prove to be beneficial in the longer run. The benefits of disasters accrue because of human's ability to learn from the experiences and put them to a better use for the benefits of those who survive. But, for those who suffer wrath of any disaster, ill effects are multifarious.

1.3.1 III Effects of a Disaster.

1.3.1.1 Loss of Life.

1.3.1.2 Destruction of natural and manmade structures.

1.3.1.3 Destruction of material, economic products and infrastructure.

1.3.1.4 Adverse effects on business and processes.

1.3.1.5 Health problems leading to deaths or disabilities.

1.3.2 Good effects that arise from disasters. Humans have learnt to rise from the disasters and grow better. Like, trimming of a rose plant makes the plant grow better, the humans have learnt to rise up from the throngs of disasters and grow better. The good effects are -

1.3.2.1 Land becomes fertile.

1.3.2.2 Stronger structures get built.

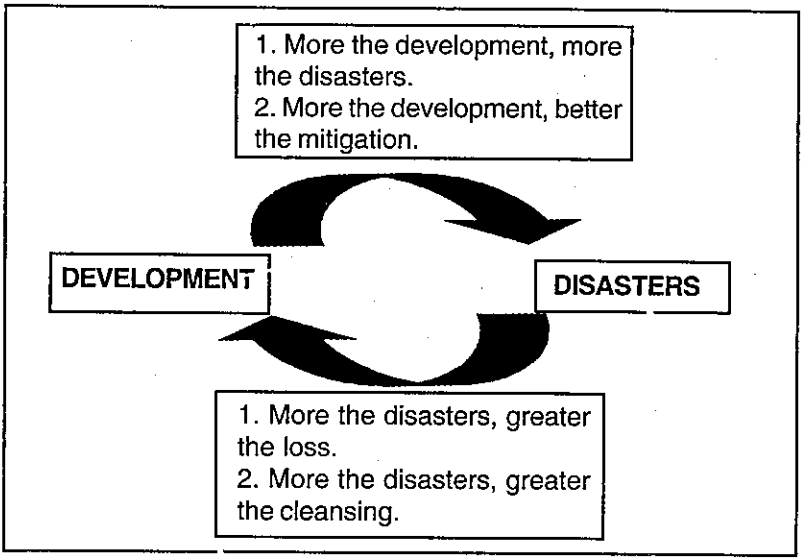
1.3.2.3 New systems get introduced which help more efficient management of subsequent disasters.

1.3.2.4 More vigorous development takes place in the area that is destroyed.

1.3.2.5 Brining people together, forgetting their past differences.

The following diagram sums up the connection.

Diagram showing connection between disasters & development



Types of Disaster

1.4 Disasters are categorized into "natural and man-made" disasters. The types in each category are :-

Natural Disasters.

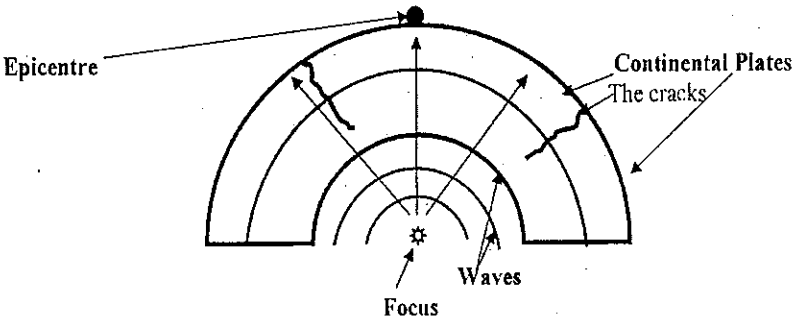
1.5 These occur due to natural geological and environmental phenomena. However, the disasters do become complex due to human interventions. These disasters are :

Earthquakes, tsunamis, Floods, Cyclones, Draughts, Landslides, Forest Fires, Excessive Precipitation and Epidemics.

1.6 Earthquakes. Earthquakes are caused due to sudden release of great amount of energy that is trapped below the earth's crust. There are 14 continental plates that were formed during formation of the continents. These plates are in a continuous motion, ranging from 2 to 10 cm per year. They either move towards, away or astride one another. Whatever be the nature of the movement, it results into disturbances on the surface of the earth causing damages. The energy trapped

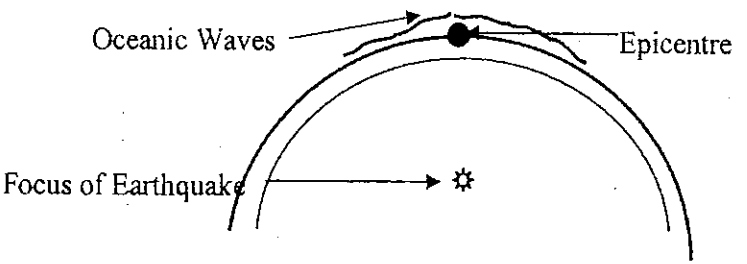
under the crust gets released at a speed ranging from 800 to 900 km per second. The point of release of this energy below the crust is called the **Focus** and the point vertically above the focus on the surface of the earth is called the **Epicenter.** The strength of the quake that is experienced on the surface depends upon the depth of the Focus and the structure of the crust above the focus. See the diagram below :

Diagram Showing Earthquake



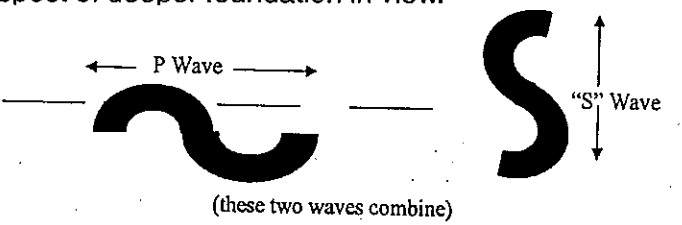
Apart from the continental plates, there are hundreds of faults and thousands of fractures in the earth's crust. The faults and fractures are the weak areas in the crust that are susceptible to the release of the energy trapped under the crust. (e.g. There is a major fault at St Andreas, United States). The effects of earthquakes are in terms of changes in the surface structure of the earth, destruction and damages to the man-made structures leading to loss of life, landslides, changing of river courses, creation of high grounds and depressions or cracks and at times discharge of molten matter of the 'Mantle' below the crust. There are secondary effects also. Earthquakes are characterized by sudden discharge of energy that traverses at great speeds. Prior to a quake, tremours are felt. Change in chemical composition of subsurface water and changes in water levels are also caused. However, technology has not yet made it possible for the humans to accurately predict the time, intensity and point of release of the energy.

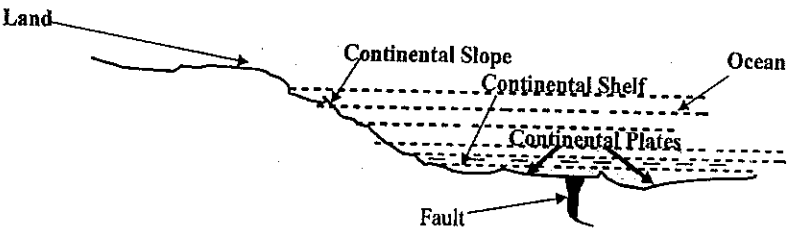
1.7 Tsunami. When earthquakes occur below a large water body like an ocean, the quake waves that hit the water surface cause waves in the water body. These waves traverse great distances at an average speed on 800-900 km per hour. Because of elastic nature of water, these waves slow down. These waves have disturbances of two types - a horizontal disturbance and a vertical disturbance. When the wave is created at greater depths, the vertical disturbance, called the 'S' wave is low. This waveform is flatter when the depth of the ocean is great. The horizontal disturbance is called 'P' waves. These have a greater speed and larger wavelength. When the waves traverse closer to the shore, the depth at the continental slopes being lesser, a reactive force makes the 'S' waves taller. The height of these waves is known to be as much as 30 metres or more. See the diagram below :



The tsunami waves strike a coast at great speed and the waves being tall, engulf almost upto 1 km of coastal belt. This depends on the ground at the coasts. There may be one or more waves. The force of the waves is so great that it destroys structures within its wake. The wave recedes with a great force and washes off the destroyed and weakened structures. This receding wave is called the 'Suction Wave'. Characteristics of tsunami that hit eight countries in Asia on 26th December 2004 was that the people observed sudden recession of seawater just before the giant wave arrived. This could be explained as a process of water being sucked while the 'S' Wave was getting formed on the continental slope. Today, warning systems are available and it is possible to warn people

at least a few hours or minutes before the wave reaches a coast. The tsunami waves have been seen to be spreading inside coastlines upto a distance of 1 to 2 km. Thus, during warning time, people who can go beyond this line are sure to be saved. The receding wave is responsible to wash off the sand around and over the foundations thereby weakening the foundations and leading to collaps of structures. Thus, while constructing of houses along coastlines one needs to keep the aspect of deeper foundation in view.





1.8 Floods. Floods are regular phenomena in many countries. In Indo-Gangetic plains, the floods occur every year. In Bangla Desh, 83% of the riverine terrain gets flooded each year. Each country has a natural lay of the ground and the natural slope helps draining of water of rivers and streams. These water channels create natural river basins. Rivers and streams bring down a lot of silt with them as they flow down streams. The soils quality decides the percolation of this water in the ground. Ground within each river basin has a fixed absorption rate. Similarly, natural slopes cause specific rates of discharge of water. When rivers confluence, the lower riparian area is more at risk because of volume of water that is discharged and absorbed. The place where a river confluences a sea or an ocean (an estuary) is subjected to reverse flow during high tides, as the sea water enters the mouth of the river and does not

allow free discharge of river water through the estuary. During monsoons, when the rate of accumulation of water surpasses the rate of discharge and absorption, excess water starts overflowing banks and starts spreading in low laying areas around. We call that a flood. Irrigation channels and dams help in flood control to some extent. However, many times, the rate of preciptation (Rainfall) is so great that the rate of accumulation causes pressure on the dams and water has to be discharged at greater rates. This causes floods. In cities where rainfall is heavy, natural ground slopes are few and artificial drainage systems are ill-conceived, local flooding takes place. Adhoc constructions and development affect the natural drainage of a city and blocking of gutters disallows the rainwater to get discharged. Mumbai suffers from this syndrome regularly. In July 2005, the unprecedented heavy rains (944 mm in 24 hours) caused havoc in Mumbai.

1.8.1 Characteristics. Floods do not occur suddenly. Precipitation being seasonal, prediction of floods is possible and with well installed monitoring systems and control mechanisms, it is possible to take precautionary measures. However, on the lower reaches of hilly regions, where rivers flow onto the plains, flash floods occur. These occur without warning and are quite violent. They recede as fast as they occur and the reaction time is generally restricted. In India, Himachal Pradesh, Uttarnchal and some portions of UP and Bihar face this syndrome alomost every year. After effects of any flood last for a longer time.

1.8.2 Effects. Flood waters cause destruction of weak structures, wash off property and crops, drown living beings and cut off communications marooning people for a few days. Secondary effects are felt in the form of epidemics and also electrocution through short circuiting or breaking of high-tension wires.

1.9 Volcanic Eruptions. When pressure develops over the molten magma under the earth's crust, emissions occur to release the pressure through the cracks in the earth's crust. Lava flows out along with sulphur dioxide, nitrogen and water

vapour. The lava and ash solidify to make layers, over a million of years and forming volcanic mountains. Every volcano has a chamber of molten lava underneath it. Thus, the active volcanoes keep erupting time and again. Recently, a dormant volcano in Andamans has been seen to become active. Volcano eruptions affect the areas around them, burning the area around and covering habitation with ash, which is quite harmful. Warnings are available through initial small eruptions and the administration is expected to evacuate people around the volcano in quick time.

1.10 Cyclones. Cyclones are a regular occurrence on the East coast of India, Eastern and Wstern coasts of North America and the Far East Asia. Cyclones are named differently in different continents. In America, they are called 'Hurricanes', In China Sea they are known as 'Typhoons' while in North West Australia they are known as 'Willy-willies'. Cyclones also threaten Gujarat, Andhra and Tamil Nadu coasts of India. Cyclones occur so frequently in different parts of the world that they are identified by specific names. 'Katrina' and 'Rita' had taken a great toll in New Orleans, Texas and Florida in 2005. Tamil Nadu in India was also affected by cyclones in December 2005. The only cause of a cyclone is the climatic disturbance created due to temperature and pressure variations.

1.10.1 How is a cyclone created. There are various theories regarding causes and behaviour of cyclones. When air remains stationery over a land or water mass for a longer duration, that portion of air acquires almost identical temperature and humidity conditions throughout its layers. When such uniform air gets created, it is called an 'Air Mass.' The air masses may be warm or cold and may be dry or humid, depending upon temperature and moisture content. Such air masses move across huge water bodies and continents. When two air masses of different characteristics meet at any place, they do not mix easily. They have a boundary zone called 'Front.' At the fronts, these air masses exert different pressures. The temperature, moisture and pressure differences lead to creation of low or high-pressure

areas and around these the air masses revolve. The low or high pressure central region of this air is called 'Eye' of a cyclone and the air either rotates clockwise or anti-clock wise. In Northen hemisphere, a low-pressured 'Eye' creates a cyclone that turns the air in Anti-clock wise direction whereas in Southern hemisphere, the air rotates clockwise. When the 'Eye' has a high pressure, it is called an 'Anti-Cyclone' and it rotates clockwise in the Northern hemisphere and Anti-clock wise in the Southern Hemisphere. The entire cyclone or anti-cyclone moves at high speeds and the lateral shift also combines with vertical movement of air current as the two different air masses try to exert pressures mutually.

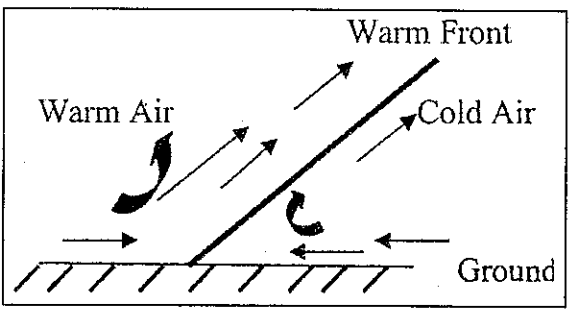


Diagram showing effects of air masses

A cyclone is said to be formed when minimum wind velocity is of 119 km per hour. Below this scale, the high wind condition is only called a 'storm' or a 'Tomado'. As a cyclone hits a coastal belt, it has two major effects - the wind pressure itself is destructive and coupled with it the oceanic waves rise up and invade landmass causing a flood condition. Thus, a cyclone is also a double trouble like the earthquakes and floods. However, in case of other disasters, one condition becomes effective first and then the second condition sets in. However, in case of a cyclone, effects of wind and waves are felt simultaneously at the coastal areas. A cyclone need not necessarily form over water bodies. Cyclones could be formed at the junctions of temperate and cold regions too. However, those formed over water bodies have a greater moisture differntial and the strength of such cyclone has been known to be greater. A cyclone is



Diagram showing a cyclonic movement



Diagram showing anti-cyclonic movement

graded based on its strength - wind velocity being the major factor to decide. A grade 5 cyclone is supposed to be the strongest one anticipated with wind velocities higher than 156 miles per hour.

1.10.2 Gradations. Weather scientists Saffir and Simpson have devised a scale on which the cyclones are graded for their strengths.

SAFFIR - SIMPSON HURRICANE SCALE

CATEGORY	WIND SPEEDS	LOWEST AIR PRESSURE
	Milles / hr K Km / hr : Knots / hr	
1	74-95 : 119-153 : 64-82	980+
2	96-110 : 154-177 : 83-95	989-965
3	111-130 : 178-209 : 96-113	964-945
4	131-155 : 210-249 : 114-135	944-920
5	156+ : 250+ : 136+	Below 920