UNIT4 FLOOD: CASE STUDIES

Structure

4.0 LEARNING OUTCOME

After studying this Unit, you should be able to:

- understand the nature of severe flood disasters *of* different types based on typical case studies selected from recent events in India;
- appreciate the gravity of the situation both in the short-tenn and long-term perspectives and thereby understand the importance of appropriate flood disaster management;
- discuss the various aspects related to floods in these specific cases like their causes, location, intensity, and extremely adverse impacts on life, property and the entire socio-economic fabric of the society;
- describe the immediate actions taken by the public and the Government agencies; and
- highlight the lessons learnt.

4.1 INTRODUCTION

No two disasters are similar, especially so in terms of their adverse impacts on the affected community or region. This is even more true for flood disasters where the cause and consequences can be widely different. India is particularly vulnerable to severe floods because of its variety of geographical and climatological conditions. We know that water is the root cause of floods. In India, the flood causing water could be coming from the skies or rivers or sea. The terrain and other conditions on the ground aggravate the floods. If the affected region happens to be densely populated or particularly active commercially or industiially or strategically, the blow is all the more severe. Recovery takes long time with severe strain on scarce resources of money and material and puts the development process on hold. Unfortunately for India, the country has to bear the bmnt of severe flood of one type or the other in some area or the other almost every year. Thus we have riverine floods, coastal floods due to cyclones or tsunami, flash floods in mountains, or floods anywhere due to very heavy monsoon rains. Even in the few years of the present century, India has suffered from floods of unprecedented dimensions. Here in this Unit, we shall describe and discuss three typical

cases; one of widespread riverine floods in the Gangetic Plain and the other of the flood devastation in the commercial capital of the country due to extremely heavy monsoon rains. In the third case, a brief reference will be made to the coastal flooding due to tsunami but that case will be discussed in detail in a later Unit in the context of earthquakes because it is the causative factor in tsunami floods.

4.2 CASE STUDIES

Three case studies are presented here to facilitate a clear understanding of the highly variable nature of the dynamics of different types of flood disasters in India. These have been specially selected from among recent events. These typical case studies will enable visualisation of the problems posed both in the short-term and long-term and will bring out the enormity of the challenges in spite of considerable scientific, technological and organisational progress. The first case study relates to the floods that devastated the Goralthpur district and the surrounding region of Uttar Pradesh in 2000, while the second briefly mentions the devastation on the east coast in 2004 due to tsunami, which will be discussed in detail in a later Unit. The third case study describes the calamity that befell Mumbai due to the unprecedented and totally unexpected monsoon deluge in 2005.

4.2.1 Gorakhpur Floods, 2000

Profile of the Region

One of the main districts of east Uttar-Pradesh, Gorakhpur lies in the north-eastern corner of the State and comprises a large stretch of country lying to the north of the river Ghaghra, also called Saryu. Inhabited by more than 37.8 lakh people, the geographical area of the district is estimated at 3321 sq. km. though the area of the district is apt to change from year to year due to the fluvial action of river Ghaghra.

The topography of the district presents a diversity of terrain. The outermost foothills are about a few kilometres distant from the northern borders. Below the outer hills is a dry boulder-strewn tract where the bulk of the moisture contributed by the rainfall and the small streams is absorbed by soil, to reappear through seepage in a damp and unhealthy tract, known as "Terai", that is, intensely cultivated. In the south of Terai is a stretch of forest land, which extends southwards in patches up to the centre of the district. The plains form a level tract, which slopes gently from west to south-east. Higher elevations appear at places where the general flat-surface is broken by irregular ranges of sandhills. The most clearly defined ridge of this nature starts in Maharaj Ganj and runs in a winding course almost to Deoria. It presumably marks the long abandoned channel of river Gandak or some other river since throughout its length it is bordered by a chain of depressions and "jheels" and in several places pebbles and boulders have been encountered in sinking shafts or wells. In contradistinction to the high ridge are the low and often broad valleys of the rivers known as 'kachhar'. The valleys of the larger rivers are not only depressed well below the general level of the countryside, but are also of considerable width. Thus, there is a wide area of low land, which is inundated in the years of heavy rain.

The main river system known as the Rapti system is confined to the West Side of Gorakhpur city. The valleys of the Ghaghra, the Rapti, Rohini and the Ami in their lower reaches are broad at places and sufficiently depressed below the general level of the district and confine their floods within the limits of the high on either side. The tributaries of the Rapti are numerous and important ones include Ghanghi, Rohin, Tura and Gaura, Pharenda Nala, Ami and Taraina. The Ghaghra river system consists of Kuwana river apart from Rapti. Great Gandak and chhoti Gandak Nadi are the other two important rivers notorious for flooding. Apart from these, a number of lakes and "tals" exist in the district, which form an inalienable past of the river system of the district. Some

important "tals" are, Ramgarh Tal, Narhai Tal, Domingarh Tal, Karmaini Tal, Nandaur Tal, Amiar Tal, Bhensi Tal, and Chillua Tal. The drainage of the entire district, excepting that carried off by the Great Gandak, is discharged into the Ghandar. In many places the drainage is not perfect, specially in the basin of the Rapti and its effluents.

The Disaster – Causes and Impacts

The main causal factor for the floods in Gorakhpur district lies in the excessive rainfall during the monsoon season (June to September). Floods become catastrophic when other subsidiary factors like shifting of the course of river, synchronisation of the flow of two or more than two rivers, accentuate the situation. Growing occupancy by the people in the floodplains has also become an important factor in making floods calamitous.

In post-independence times, floods have become an annual affair in the district. Here, we will discuss the catastrophic floods of the monsoon season of 2000. Excessive rainfall in the upper reaches of the rivers Rapti and Ghagra resulted in a sudden rise in the water level of these rivers as a result of which the whole district of Gorakhpur was affected. The Rapti rose to a height of about 77 metres above the sea level near Sahjanwa while the Rohin at the Chillua Tal bridge rose even higher. As the water level of the Rapti rose rapidly, extraordinary efforts were required to prevent the water sweeping over Azamgarh road and flowing back into the city. Not withstanding the enormous area covered by the floods, the loss of lives was relatively few. The grazing grounds were under water for a long time and there was widespread loss of fodder to overcome which some of the reserved forest blocks were thrown open to free grazing.

It turned out to be a prolonged flood and so became all the more devastating because much of the flood waters of Rapti remained stationary for quite a long time and caused excessive damage to the low lying kachhar tracts. They also damaged the crops of about four hundred villages of Sadar Tehsil. Some damage was also done to the villages of Bansgaon tehsil also. Moreover, a number of villages were almost totally washed away. On the other hand, the swift rise in the Ghaghra river caused inundation in the areas of Dhuriapar and Chillupar paraganas. The cumulative impact of all these was huge suffering for the people of the district. The damages to property included not only the washing away of the moveable and immovable properties (like houses) of the people but also substantial damages to the civil constructions like the roads, rail and bridges. As a matter of solace very few lives of man and animals were lost. The long duration of the standing of flood-waters led to the outback of diseases like malaria, diahhrea, and encephalitis.

Overall impact of the floods of the monsoon season 2000 was felt in the whole district of Gorakhpur and the surroundings. However, the chronically affected areas like Laxmipur Phasenda, Brajmangani, Jangal Kauriha, Pipraich, Khara war, Sahjanwa, Bansgaon, and Gola Uhawa were heavily affected. Rest of the areas like Nautanwa, Dhani, Caimpeyar Gaon, Pali, Chargawan, Bhathat, Brahmpur, Khajani, Kauriram, and Belaghat also suffered but to a lesser extent.

Response

The State Government's response to the floods of 2000 was modeled, by and large, on the Relief Manual of the Government. The Manual lays down the guidelines for flood relief work in three stages. In the initial stage, when the water is high and is still rising, saving of lives is the primary task in hand. It may also be necessary to rescue the cattle as well. Human beings and their cattle may have to be removed by boat to high land areas. Next, when the emergency rescue work is under control, relief work has to be organised systematically at this stage by setting up relief centres at appropriate places. There is scope at this stage to associate non-official agencies. At the final stage, when the flood has subsided and water has started receding, rehabilitation and reconstruction have to be planned and executed while continuing relief support to the worst affected people. This is done on the basis of the reports from revenue officers and the reports of special field surveys.

The magnitude of the floods in Gorakhpur in 2000 was such that the civil administration needed the assistance of the Army and Air Force almost from the beginning of the floods. Right from the onset of the disaster, the army authorities had swung into action rendering most valuable service. About 60 army boats were deployed and a good number of trucks were sent out with around 300 army personnel who started assisting the district administration under very difficult situations in the worst flood affected areas. As the surface transport system had almost completely broken down, immediate relief could be reached to most of the affected areas by air dropping from IAF helicopters and small planes. For a couple of days, even the helicopter service could not be operated due to bad weather conditions.

With their houses washed away or under swirling floodwaters, over four million people had all of a sudden .become homeless refugees without food and shelter. The obvious choice at many places was high railway and road embankments and bridges. Community centres, schools, hospitals, health centres and other public buildings were thrown open for make-shift shelters. By air, river and road transport, dry food and tarpaulin were rushed to the worst affected blocks and several interior spots. Sanitation and Medical supplies were rushed to relief camps and shelters. Temporary feeding arrangements were made by opening a large number of kitchens, which were operated by voluntary agencies and the Government.

Although preventive actions were undertaken to avoid outbreak of epidemics, by late August the district was suffering from an outbreak of waterborne diseases viz. malaria, gastroenteritis and encephalitis which are otherwise also endemic in Garakhpur region.

The Army and the Air Force rendered yeoman service at the most critical stage of relief operations.

4.2.2 Tsunami Floods, 2004

The early morning hours of 26 December 2004 brought sudden, unprecedented and unexpected flood disaster to the coastal areas of many countries of southeast and south Asia including India. It was a tsunami triggered by avery severe earthquake that occurred about 155 km off the northern tip of the Indonesian island of Sumatra at 07.59 A.M. local time i.e. 0629 A.M. Indian standard time. The earthquake was of very severe magnitude (measuring 9 on the Richter Scale) and raised the flood of the ocean in a violent burst of energy. The resultant forcing of the ocean water upwards generated a series of waves rushing outwards and racing across the ocean surface in all directions. While the highest of the ocean waves was about one metre near the place of the origin but these rushed outwards at tremendous speed of about 700 kmph. While travelling on the high seas, the speed slows down and the height of the water waves also comes down drastically with the result that the ships on the high seas are not affected. But us the tsunami waves approach a coast where the sea is shallow, the wave height increases tremendously due to the rapidly accumulating seawater brought in by the tsunami. This wall of sea water– 10 metres or more in height and coming in with a speed of about 40 kmph destroys everything in its way and inundates the coastal areas with salty and corrosive seawater. Once tsunami hits the coast, some energy is deflected back into the sea giving rise to "edge waves" that travel back and forth creating further destruction. Thus as far as the coasts are concerned, they encounter a sudden-onset flood disaster of tremendous proportions.

In the case of the 26 December, 2004 tsunami disaster, the maximum brunt was borne by the people in the islands of Indonesia where almost 50,000 human lives were estimated to have been lost, But that was not all. The tsunami lashed across 13 countries leaving about 1.5 lakh persons dead or missing and making millions homeless. In fact these are mere estimates because entire communities were washed off and nobody would ever be able to compile the complete contours of this tsunami generated coastal flood.

The outreach of the tsunami was of intercontinental dimensions. The waves hit Thailand (about 1000 km away from the place of origin of the tsunami in Indonesia) within two hours killing about 2000 persons. All the countries of the Bay of Bengal were affected. Sri Lanka took a heavy toll of 22000 dead. Continuing their journey westward swamping Maldives enroute, the waves travelled to the east coast of Africa in about seven hours and took a toll of more than 200 lives, majority of them in Somalia.

India also paid a very heavy price. The killer waves reached the east coast of India around 0900 IST, about 2½ hours after the event occurred in Sumatra (Indonesia). By this time, the normal activities had started. Fisherman were already out on the sea or back with their catch; beaches were bustling as usual, small shopkeepers and stall owners had opened up; youngsters came with their cricket kits; and then, two walls of water silenced it all.

Tamil Nadu took the worst hit with 6500 dead or missing. Nagapattinam, Cuddalore, Kanyakumari and Chennai were the worst hit. Andaman and Nicobar lost 3000. Their low population density, hilly terrain and perhaps some traditional coping mechanisms wee responsible for the comparatively low toll. Even the small Union Territory of Pondicherry lost 500 lives. Kerala lost 162 and Andhra Pradesh about 100. In all, the coastal and Island areas of India lost at least 10,000 precious lives without any forewarning. The actual numbers will perhaps never be known.

The experiences of the rare lucky survivors were horrifying. In Car Nicobar, the IAF Officer was still sleeping in his first flood bedroom with his wife and two children when an enormous water wake crashed through the window and he found himself in water clutching a broken windown while his wife was carried on to a tree. The two children were just washed away. At Cuddalore, the sea rose to the hight of palm trees in 10 minutes flattening everything in the way. People tried to clutch to anything and every thing but to no avail because the great water wall knew no stopping. Boats were found lying in paddy fields where bodies of the dead were strewn around. The story all along the coast was similar. On the coasts, everything was washed away. Inland, there were two pushes – one by the incoming water from the sea and the other by the receding waters which swathed the houses, or what remained of them after the first push, in mud thus destroying the remaining belongings.

The tremendous flood was so sudden that evesybody was taken aback including the administration. It took time to understand the reality and to react to it in conditions of marooned or destroyed infrastructure. Nevertheless, the relief work started on its usual course – first to look for survivors and then take care of the injured, sick, old and the children. The nagging fear was that there should be no epidemics or widespread outbreck of diseases. Sanitation steps and health precautions were taken in all the affected States and Union Territories. Fortunately, there was no epidemic that usually follows floods. Perhaps the brackish waters of the sea did not support mosquitoes and it was not potable.

Defence Services played a yeoman role. Not only they pitched in within the country, but the Indian Naval Ship with medicines and doctors was the first to reach Sri Lanka and start relief work perhaps even before Sri Lanka could put its act together.

In case of these tsunami floods of December 2004, one serious problem that confronted the relief agencies, governmental as well as non-governmental, was the preponderance of rumours and the chaotic panic that these generated. There were rumours of revisit by a tsunami and such rumours started and spread a number of times during the days following the disaster. These did create problems but the quick action by the Central and State Governments to control the rumours by giving out the right facts, and the ready cooperation by electronic media helped to manage and control the situation.

Any disaster of such proportions affectingsuch large segment of the population in so many States and Union Territories will definitely have the usual long-term effects such as loss of earning members, unemployment, malnutrition and migration. But this disaster had some very unusual socio-economic impacts. To given an example, an anthropological study, made by the Anthropological Survey of India in the Great Nicobar Islands about six months after the disaster, indicated that about 50 percent of the female population was wiped out and about 35 percent of children died in the tsunami floods. Not only that a major part of the next generation was lost but the sex ratio (number of females versus males) of the present generation has been affected very adversely. The ratio was 98011000 before the tsunami disaster and it has now slumped to 850/1000 i.e. 850 females against 1000 males. The loss of 50 percent women and 35 percent children in the disaster and the resulting sex ratio of 85011000 will lead to "delayed generation" as the experts call the situation in technical terms. This means that when the present generation of adults ages, the next adult generation will arrive late by several years. This will have long-termsocio-economic effects. It will affect the economic activities adversely. Fewer women in the society will slow down the reproduction rate thus carrying the effect to the subsequent generations. Such repercussions will be tragic for any community but it is much more so with already reduced and impoverished tribal communities such as that inhabit the Great Nicobar Islands in the Union Territory of Andaman and Nicobar.

It would thus be seen that the tsunami tragedy ended as a tremendously destructive flood disaster of international dimensions. But the scientificfact remains that this great coastal flood's origin was in a seabed earthquake. Therefore, this tsunami disaster also deserves to be studied from the point of view of the earthquake phenomenon because all seabed earthquakes do not generate tsunami. We shall study the phenomenon of tsunami again in a subsequent Unit.

4.2.3 Murnbai Floods, 2005

The Profile of Mumbai

Mumbai, the 438 sq. km. metropolis of almost 2 crore population, is not only the largest city of India but its commercial, industrial and financial capital. Mumbai's airport handles 40 percent of India's intenational and 25 percent of the domestic passenger traffic. Mumbai's seaports dominate the country's international trade. Its municipal corporation, established in 1872, is the richest civic body of the country and its budget surpasses that of several states in thecountry. Mumbai contributes the highest in the tax revenues of the nation. Mumbai is the home of the Nuclear establishment of the country and some of the top-notch academic and research establishments are located there. The defenceforces in general and the Indian Navy in particular have their important bases there. Mumbai is the home of the country's most prominent business houses like Ambanis, Tatas, Wadias, Godrej and others.

Physically speaking, Mumbai is a group of small coastal islands on the Konkan coast with connectivity to the mainland. Most of the modern day Mumbai is built on land reclaimed from sea. **A** small river, the Mithi, flows through and down to the Arabian Sea. Mumbai had, and still has some, wetlands, wastelands, mangroves and salt-pan lands which act like sponges to take the pressure out of the high tide or heavy rainfall.

Climatically speaking, Mumbai is dominated by a tropical maritime regime peculiar to its location between the Arabian Sea and the windward side of the mountain range of the Western Ghats. However it is the southwest monsoon, which is the prime climatic characteristic of Mumbai and the surrounding region, The southwest monsoon sets over Mumbai in the first half of June and continues for 4 months during which Mumbai receives about 90 percent of its annual rainfall normally.

The Disaster – Causes and Impacts

The potential for a serious flood disaster in Mumbai is embedded in its unique combination of large population and very heavy rainfall regime in the monsoon season. Among the *20* cities in the world with populations in excess of 10 million each, Mumbai occupies the third position with a population of 18 million *(200*1 Census). But it has the highest annual rainfall among the 20 most populous cities. Mumbai has two main observatories – one at Santacruz in North Mumbai and the other at Colaba in South Mumbai. These two weather stations are about 25 km apart as the crow flies. But their annual rainfall normals vary widely. While the annual nonnal rainfall of Colaba is 213 cm that for Santacruz is 240 cm. Thus Mumbai normally expects annual rainfall of around 220 – 240 cm of which about 200 cm rain may be expected during the 4 month monsoon season (June to September). The megacity of around20 million inhabitants and its administrative infrastructure have learnt to deal with rainfall of this order bearing with the problems to which they seem to have become accustomed year after year.

But what happened during mid-weeks of the monsoon *2005* was for which nobody was prepared. In fact, nobody had foreseen in their wildest dreams that the city which receives around 200 cm of rain in the wholemonsoon season of4 months wouldreceive almost 100 cm rain within 24 hours on 26 July 2005 or would dump about the same quantity of rain more on Mumbai during the next seven days. The exceptionally heavy and prolonged spell of monsoon rain was the root cause of the unprecedented flood disaster that Mumbai had the misfortune to face in 2005. While it was not asudden onset flood of the type caused by a dam burst, but it was no less either because skies seemed to have burst over Mumbai in an unprecedented and unexpected manner and the pouring rains continued for almost a week. And all this water could not flow out to the sea surrounding Murnbai because the drainage system could not cope with it. The concursent high tide of about 4.5 metres aclded to the accumulation of water and delay in draining out to sea.

The very heavy rains were not confined to the city of Mumbai only. These covered the entire State of Maharashtra and large part of Karnataka. Thane and Kalyan, the districts adjoining Mumbai, were in equally bad condition especially Thane.

The impact of the deluge on Mumbai on 26 July 2005 became all the more grave because the downpour began in the afternoon. The day had begun like any other usual day of the monsoon season. It was raining no doubt but that is expected in Mumbai in the rnonsoon season. **As** the morning hours advanced, lakhs of men, women and children left their homes for their workplaces and schools. The markets were filling up with customers and so were the places of worship, hotels, and even the hospitals. Local trains and buses were fast delivering their passengers at their destinations for their intended work schedule of that tuesday.

By the afternoon, water levels on the streets started to rise and it rose fast. With water swirling knee-deep on streets and rain pouring down incessantly, people got apprehensive and began leaving their workplaces in large numbers to go home. Thousands of school buses were on the streets carrying children home after school. The roads were packed by buses, cars and heavy vehicles. In many areas water level reached shoulder high. The entire suburban train network stopped and remained inoperative for a few days due to the tracks being under water. The air services were already stopped as the runways were under deep water. Telecommunications and the electric supply systems were the next to be cut off. All activity in Mumbai seemed to have come to a grinding halt and it was still raining very heavily not only in Mumbai but in the neighbouring districts of Maharasthra. By 7 p.m., Mumbai was practically cut off from the rest of the world.

Those who were trying to return home including children in school buses were stranded on the roads, which had turned into canals, Bus passengers caught in the rising water sought refuge on

the roofs for 12 to 18 hours. Thousands remained stranded at their workplaces or schools or even in cars for similar durations. A large number, who decided to reach home in any case, had to walk 10–15 km. risking their lives and limb while attempting to traverse waist deep waters not knowing where their next footstep would take them.

The statistics of the damage or the impact may never be known fully. The preliminary estimates compiled in the first week of August 2005 told the following tragic tale which is reflected in table 4.1.

Table 4.1 Impact of Mumbai Flood of July 2005

Damage Impact	Loss (figures)
Lives lost in Mumbai	435
Lives lost in Maharasthra	1362
Loss to industry in Mumbai	4000 crore
Loss to Pharma Industry alone	1000 crore
Suburban trains damaged	55
Auto rickshaws damaged	37000
Taxis damaged	4500
Other commercial vehicles damaged (Buses, trucks, vans etc;)	10,000
Non-life insurance claims	Rs. 2000 crore

And these were very preliminary estimates. One would perhaps never know about the death and damage in low lying areas where overflowing and gushing waters washed away everything that came in the way. To make matters worse, a landslide at Sakinaka in northwest part of Mumbai on July 27 killed 65 persons and made hundreds homeless. This occurred in the evening hours when the continuing downpour, flooded streets and lack of illumination due to electricity failure made the excavation work (to extricate the trapped persons and to salvage the buried belongings) very slow and time consuming.

Areas worst affected by floods in Mumbai

Kurla and Kalina were prominent among the worst flood affected areas in the city. Both these suburbs are on the banks of Mithi river that passes through the city and falls into the Arabian Sea at Mahim – another suburb of Mumbai over the years, the river's flood plains have been encroached upon and land reclaimed for building activities thus narrowing the river which intensified the floods in the area.

In Kalina, near the runway on the other side of the airport, the residential colonies of Air India and Indian Airlines were under 4 metres (over 12 feet) of water. Employees could not reach home for 2 days and those stranded at homes had to take shelter on the upper floors and remain confined. They had to manage without food, electicity and potable water for four days. Further north in Vasai and neighbourhood, the area was inaccessible as water did not recede even after 4 days. It was estimated that at least one-third of the city area was seriously flooded. There was death, destruction, and misery all around. Floating bodies could be seen around; carcasses blocked the airport runway; children suffered dehydration while stranded in schools or in buses; flood waters entered the upper decks of buses and first floors of homes; shanties and slum dwellings were just washed away; vulnerable areas suffered landslides, In all, this was a colossal disaster indeed.

Disaster **Compounded** by **Rumours**

While the floodwaters were yet to recede from the marooned areas, situation started getting complicated because rumours began. It all began early on 28 July (i.e. just 2 days after the deluge on 26 July) when a rumour started in the flooded and electricity-less eastern suburbs that the Powai dam had burst. As soon as they came to know about the rumour, the Police made announcements through loudspeakers and the electronic media but thousands of people were already on the streets in a state of panic. By the time they realised that no dam had burst, another rumour started around evening in the western part of the city. The people in the Nehru Nagar slum area in Juhu somehow got the obviously false information that Dharavi slum was flooded and themselves came to the conclusion that a tsunami was coming. With the memories of tsunami havoc on the east coast still fresh in memory, residents were hysterical and ran helter-skelter in the dark. This chaotic reaction to a false rumour resulted in a stampede killing many and injuring still more.

But this was not the end of rumours. On the 29th July, which was not only a Sunday but also the first sunny day of the week, the south Mumbai areas (which had not suffered that much because of less rain and better infrastructure) were gripped by rumours of an impending cyclone. Incidentally, the monsoon season (June to September) is not the cyclone season. This shows how baseless a rumour can be.

And suddenly, the city faced a severe shortage of a medicine called Doxycycline because rumour spread that the city could be facing an epidemic of Leptospirosis due to the flood waters in the streets being contaminated by rat carcasses, and Doxycycline could prevent leptospirosis. Many organisations distributed the medicine to their staff thus creating supply shortage and the fact remained that there was no epidemic of leptospirosis,

However the special point to note was that none of these rumours were spread by trouble mongers or unsocial elements. These were not motivated rumours. These evolved out of fear and panic and the message was carried fast forward in a highly apprehensive and tense public, The modern technology such as cell phones and SMS assisted by the electronic media helped in quick communication. The aftermath of Mumbai floods suffered from misinformation, not disinformation but it showed clearly that misinformation also travels faster than information and that misinformation is also as harmful as disinformation.

Response

In any disaster situation, the community is always the first responder and the course of events, after the disaster has struck, is determined largely by the first response from the survivors and sufferers. The first response indicates the level of understanding and awareness in the society and brings out the strength of character of people in the face of adversity.

If the Mumbai floods of July 2005 were the worst disaster faced by the city, it also brought out the resilience and the spirit of cooperation among the people of Mumbai. Disasters of this magnitude are great levellers, both physically and figuratively since they bring misery to all sections of society – rich or poor, men or women, old or the young. People lost their kins and saw their life's earnings go down the drain in front of their eyes. In the face of all this tragedy and stress, the society stayed civil. There were no riots, no looting, no assaults, no law and order problems worth mention. Ordinary citizens opened their homes to strangers: People provided food and water to the stranded. Small shopkeepers distributed biscuits and other snacks.

It took the city Police, Fire Services, the Municipal cooperation and the State Government almost 24 hours to realise the gravity of the situation before they made attempts to come to grips with the emergency. Electricity was cut off as a safety measure and it took 3 to 10 days to restore if in the entire city. This hampered the relief work. Absence of electricity also meant lack of potable water,

About 60 percent of Mumbai's population i.e. almost one crore are in urban poor category and this large segment was utterly helpless. Relief assistance was hampered by continuing rains, flooded streets and absence of electricity and water. At this stage, as expected, voluntary organisations pitched in, providing shelters, food, water and clothing. All housing societies were ordered to add chlorine tablets or powder to their water tanks. There were cases of gastroenteritis and other water borne diseases including some cases of leptospirosis but no epidemic broke out.

To cite just one example of the public response, a public meeting was convened on **30** July at the initiative of an MP and a newspaper group Foundation. In this meeting, a workable "citizen-official" action plan was prepared. Several NGOs and organisations like the Rotary and the Lions clubs joined bringing to the effort their experiences of community work particularly in the areas of relief, health, sanitation and medical assistance. This was indeed a very good initiative in public-official partnership in disaster response.

It would be the useful to refer here that Mumbai has a dual governing structure. The Municipal corporation, the Revenue administration and the Commissioner of Police manage the most populous city and the financial capital of the country on the day-today basis. However the State Government is the higher authority on most matters concerning the city. In this case, the State Government had disaster news coming in from all around Mumbai as well. The initial statistics indicated 1,87,000 houses damaged in the state of Maharashtra, 27,424 sq. metres of state roads buried in landslides, 18,362 km. of roads destroyed and needing to be rebuilt at an estimated cost of Rs. 4100 crores. Very large number of schools, dispensaries and water supply projects were destroyed or rendered unusable. The hands of the State Government were full with problems in the face of this unprecedented disastec

The Central Government responded immediately. The Parliament was in session and took note of the situation. The Prime Minister visited Mumbai and announced an immediate Relief of Rs. 500 crore, which was doubled within a couple of days realising the enormity of the requirement. Relief assistance was also provided from the Prime Minister's National Relief Fund. The Central Ministry of Home Affairs, being the Nodal Ministry of Government of India, swung into action. The response of the defence services, especially the Indian Navy, was quick and effective.

With each passing day, new aspects of the problems of relief, rehabilitation and reconstruction came into focus and there is no doubt that it will be a long haul process requiring massive investments, imaginative planning and dedicated execution.

The disaster was indeed unprecedented and sudden. But the commercial, industrial, financial and strategic prime-mover such as Mumbai has to be capable (or needs to be made capable) of facing the worst. There are lessons to be learnt, as we shall discuss in the next section.

4.3 LESSONS LEARNT

The three specific case studies discussed in the previous sections teach us some important lessons, which need to be taken note of.

The devastating floods in east U.P., Bihar and other states have become almost an annual feature. The rivers in state tear through embankments and bunds (small earthen dams) causing breaches that often become tens of metres long. As it turns out, the areas neighbouring these "protective" measures suffer the most because even when the river subsides, the water which overflowed the embankments remains there for long period. Therefore it is essential that the embankments, bunds, elevated railway tracks and even elevated potions of roads should have adequate outlets for drainage such as culverts. Even with regular recurrence of riverine floods in these vulnerable

areas, there is apparently a lack of preparedness on the part of all stakeholders viz. public, officials and the media. This needs to be corrected.

The Tsunami floods brought to our attention the fact that India, with its long coastline open to vast sea areas on three sides, is also very vulnerable to this disaster which we never experienced in this severity but there is no guarantee that such an episode will not recur. Consequently, we have to be prepared for it. Given the nature of the origin and spread of tsunami, the hope lies only in a quick early warning system of the type that is operational in the Pacific Ocean rim countries including Japan.

That torrential rains could inundate and paralyse Mumbai, which is a set of islands open to drainage to the Arabian Sea and accustomed to receive rains of the order of 200 cm in the 4 months of monsoon season, is something that the country cannot afford to experience again because too much is on stake in Mumbai, The lesson is loud and clear. Rain, unprecedented in intensity and duration was indeed the root cause but not the only cause of misery heaped on Mumbai in July 2005. Unfettered encroachment on creeks, mangroves, flood plains, water bodies and open lands in the name of development was equally, if not more, culpable. The choked drainage system and blockages to natural flow of rainwater completed the disastrous scene. Mumbai has to correct this situation if future disasters of this nature are to be averted. Mumbai is in the thick of monsoon territory and excess rains will occur in some year or the other. It may not be 94 cm in 24 hours, soon again, but who knows!

Apart from these specific lessons that flow from the three particular case studies discussed in this Unit, there are some general lessons to be learnt about flood situations.

There is an urgent need to evolve an integrated strategy of flood management with emphasis on preparedness on the part of the people, NGOs and the administration. Only then we would be able to mitigate the damages caused due to flood disaster and save lives, property and livelihood of the people.

Another lesson learnt from the management of previous floods relates to shifting of emphasis from the structural to non-structural measures of floodmanagement. Since the start of the National Flood Control programme in 1954, the prominent stress of flood control measures had been on structural measures to modify the floods and flood protection works. However, with unabated rise in the damages caused due to flood in spite of structural measures such as embankments, it has been realized that floods can be better managed through the non-structural measures like modifying the susceptibility to flood damages and modifying the loss burden through the methods of flood plain management, flood proofing, disaster preparedness, flood forecasting and warning and flood insurance.

Moreover, it has also been realised that flood should not only be looked at as cruelty of gushing water. It is a natural hazard, which turns into disaster with the man's unfettered interference in the normal course of the rivers or water drainage channels due to various developmental activities. Flood management should, therefore, be seen in the broader perspective and integrated with the overall water resources development as well as the economic development of the particular region.

Another precious lesson learnt relates to the inevitability of ensuring active participation of the people in all the processes of floodmanagement including formulation of the policy, its implementation and evaluation. Along with this, adequate institutional arrangement should be made for training and research activities in the field of flood disaster management.

In case an impending flood disaster is imminent, the following Do's and Dont's should be followed:

Do's

- Do listen to radio for advance information and appropriate advice. .
- In anticipation of the flood water entering the house, do unplug all electrical gadgets and move them to safer places. Switch off the electric mains if water enters the building.
- Do move all movable goods to the highest level in the house or neighbourhood.
- Do shift all animals to safer places or leave them untied.
- Do remove all insecticides and pesticides along with other toxic goods to safer and isolated places.
- Do lock all doors and windows before leaving the house.

Dont's

- Don't wander around in the inundated area.
- Don't enter the floodwaters on foot unnecessarily.
- Don't spread rumours in order to create panic among the people. Scotch the rumours to the best of your ability.'
- Don't allow children to stray out in the flood waters.

4.4 CONCLUSION

It is evident from the case studies presented in this Unit that floods can have different ramifications in different regions of the country. That is why typical cases have been taken in this unit representing three different regions of the country in each of which the flood generating phenomenon was different. The cases have been discussed in fair detail including the response that was generated in each case. The lessons learnt, specific as well as general, have been brought out.

4.5 KEY CONCEPTS

Back Flow : Reverse movement of water in a drain from the point of discharge towards the point of origin.

Drainage Congestion : Blockage in the free flow of water due to inadequate drainage provision or narrowing of the drainage channel.

Monsoon (or Southwest Monsoon) : The principal rainy season in most parts of India comprising the four months (June to **September).**

Richter Scale : An open ended scale to indicate the magnitude of an earthquake.

Vulnerability : The potential degree of Ioss to a community due to a hazard.

4.6 REFERENCES AND FURTHER READING

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4.7 ACTIVITY

1) On the basis of your study, enlist the problems arising due to floods in your area. Suggest the best management strategies and techniques of flood disaster management.

2) Is your community or area susceptible to flooding? Explain the types of floods you are facing and the best possible risk reduction measures, which are being used in disaster management.

3) Discuss the effectiveness of the actions taken by the Government in disaster management and the various components of post-flood rehabilitation measures.

4) If your neighbourhood is threatened by floods, what "Do's and Don'ts" would you adopt?