Unit - 3 ❑ Assessing Disaster Risk

Structure

3.1 Disaster Risk

In many regions of the world the threat of natural or man-made events such as volcanic eruptions, earthquakes and tsunamis, hurricanes and tornadoes, extreme rainfall, droughts or forest fires are permanently present. People living in these regions are exposed to these natural hazards, but they may be able to prevent themselves from the grave consequences (e.g. earthquake-resistant building, a dyke or a good insurance policy). People who are unable to protect themselves sufficiently against the adverse effects of a natural event are particularly 'vulnerable' to disaster. The probability of harmful consequences, or expected loss (of lives, people injured, property, livelihoods, economic activity disrupted or environmental damages) results from interactions between natural or human induced hazards, and vulnerable / capable conditions. The disaster risk (of a region, a family, or a person) is therefore made up of two major elements viz. hazard and vulnerability.

As discussed in section 2.4 of the previous module, we know that:

$$\text{Disaster} = \text{Hazard} \times \text{Vulnerability}$$

Thus if the intensity (i.e. damaging potential) of a particular hazard and vulnerability is low, the disaster is of moderate dimension. On the other hand if either the hazard or the vulnerability of the elements concerned is high then the dimension of the disaster is also large. Again, if both the intensity of the hazard and vulnerability of the hazardous terrain are high then the magnitude of the disaster is very large leading to devastation. So these factors lead to risk of disaster. Risk identification starts with identifying the hazards and then followed by assessment of the core vulnerability, i.e. the possible repercussions in the event of occurrence of a natural phenomenon.

Therefore, disaster risk designates the extent of the damage and loss a natural event is expected to cause. In other words, disaster risk is the combined effects of the extent of damage and loss resulted from a natural event. It is determined as the product of the factors hazard and vulnerability. Hazard includes the probability and the magnitude of the anticipated

natural event; vulnerability comprises a number of political-institutional, economic, socio-cultural and geographical factors.

However, that is not the full description of disaster risk pertaining to a particular hazardous event. People who occupy comparatively weaker positions within the social fabric or have limited access to social services have a lessened capacity to absorb or avoid the impact of hazards. These differences in capacities are exemplified in risk analysis. Its effects are seen to be directly proportionate to the poverty-gap and poverty- intensity in the society/location as it is this group who normally live in high concentration in marginal areas (unstable slopes, flood plains) with little infrastructure and fewer resources to cope with such disasters. So disaster risk is inversely proportional to capacity.

The equation for disaster risk may thus be visualized as:

$$\text{Disaster Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

In this equation, disaster risk is the ratio of the product of hazard and vulnerability to the capacity of the community to overcome the effects of disaster. Therefore, it is clear that a disaster risk exists only if there is vulnerability to the hazard posed by a natural event. For instance, a family living in a highly earthquake-resistant house would not be vulnerable to an earthquake of 6 on the Richter scale. So, they would not be at risk of the earthquake. Being earthquake resistant means the building has the capacity to resist damages due to earthquake. So with increasing capacity, disaster risk goes on decreasing. Again, if the hazard approaches zero, because, for example, buildings have been constructed in areas far away from continental plate subduction zones and tectonic faults, a house built with maximum precautions will be a safe place for the family, because they would only be vulnerable to very extreme events.

Beyond expressing a probability of physical harm, it is crucial to appreciate that risks are always created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.

Risks are present in every sphere of the society. It exists within the society but the people do not understand the extent of the risk and the reasons for such risks. Risk is a technical concept, which is used by engineering and management specialists to arrive at an estimation of losses in the event of a disaster and the expected probability of its occurrence. Risk is precisely defined by ISDR as "the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural and human-induced hazards and

vulnerable conditions". Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Risk is different from threat. Threat is a more abstract concept while risk is an expression of perceived threat in specific terms. Threat is a danger that has an extremely low probability of occurrence.

3.2 Damage Potential of disasters

Case studies:

Introductrion

India, with its unique geophysical setting and socio-economic conditions is highly vulnerable to disasters. The country is prone to disasters due to number of factors, both natural and human induced, including adverse geo-climatic conditions, topographic features, environmental degradation, population growth, urbanization, industrialization, flawed development practices, etc. As far as the geographic dimensions of the country are concerned, the five distinctive regions of the country i.e. Himalayan region, the alluvial plains, the hilly part of the peninsula, and the coastal zone have their own specific problems. While on one hand the Himalayan region is prone to disasters like earthquakes and landslides, the plain is affected by floods almost every year. The desert part of the country is affected by droughts while the coastal zone is susceptible to cyclones and storms. If we analyse the layers of vulnerability statistically, out of 35 States and Union Territories in the country, 27 of them are disaster prone. Almost 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity; over 40 million hectares (12 per cent of land) are prone to floods and river erosion; of the 7,516 km long coastline, close to 5,700 km, is prone to cyclones and tsunamis; 68 per cent of the cultivable area is vulnerable to drought.

On account of its multilayered vulnerability, the country has witnessed an increase in the frequency and intensity of disasters in the past resulting in widespread devastation. This inference is drawn only on the basis of disasters which have been reported. Many of the disasters, particularly in remote areas, go unreported because local administration lack the technical and human resources for community-level disaster monitoring and are not able to fully identify or map potential local hazards or develop the appropriate disaster management plans. Losses from low-intensity, but more extensive disaster events continue to affect housing, local infrastructure, and large numbers of people. These disasters at the local level are so frequent that many communities accept them as an integral part of their existence and, with varying degrees of success, learn to live with them.

During the year 2011-12, 14 States and one Union Territory reported damage to various disasters like cyclonic storms, heavy rains, floods, landslides, earthquakes, etc. in varying degrees. These states were Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Odisha, Punjab, Sikkim, Uttar Pradesh, Uttarakhand, West Bengal and Union territory of Puduchery. The provisional extent of damage in the country, as indicated by the Ministry of Home Affairs, is as follows: (Source: Ministry of Home Affairs, New Delhi).

The year 2011 started with a stampede in Kerala on January 14 in which 102 Sabarimala pilgrims were killed at Uppupara on the Pullumedu-Vallakadavu forest route in Idukki district. The event took place when thousands of devotees were returning after holy darshan at the shrine of Lord Ayyappa on Makar Sankranti day. The two month long pilgrimage, which had started in November 2010, had been mostly incident-free before this mishap.

In mid-September, heavy monsoon rains resulted in widespread flooding in Odisha. Within two weeks, a second round of floods resulting from a tropical depression in the Bay of Bengal inundated 19 of Odisha's 30 districts. In response to heavy rainfall and to prevent breakage, authorities released water from the Rengali dam on the river Brahmani, exacerbating flooding in low-lying areas. Although the death toll was 45 in number, but the floods resulted in affecting over 3.5 million people and caused extensive damage to crops and infrastructure.

This was followed by 6.9 magnitude earthquake which hit Sikkim Nepal border region at 6.10 pm on September 18. It was widely felt in north-eastern states of India, West Bengal, Bihar, Uttar Pradesh, Haryana, Rajasthan including the capital city, Delhi. Subsequently, two more aftershocks of 6.1 and 5.3 at 6:21 pm and 6:42 pm respectively were also felt. The earthquake killed 60 people, affected 719 persons and caused substantial loss of livestock. The strong tremor caused significant building collapse and mudslides. As the earthquake occurred in the monsoon season, heavy rain and landslides added to the woes of the affected community and made the rescue work more difficult.

During the south west monsoon period from June to September, in September 2011 rainfall was the second worst event in south interior Karnataka since 1971, and in north interior Karnataka, third worst event since 1971. Failure of monsoon during September caused lateseason drought of rare severity. The dry spell in interior Karnataka during September continued till October in many districts; 77 talukas recorded deficit rainfall during the period October 1st to October 14th. Ultimately Government of Karnataka declared 99 talukas as drought affected.

As we all know, in India, disaster management is essentially a state subject. However, when the state government is not able to meet the exigency, it can request the Central Government for assistance. In this report, we have discussed some major disasters for

which the state governments had requisitioned the Central Government for supplementary support. In addition, few disasters like the stampede in Sabarimala pilgrimage and fire breakout in hospital in Kolkata. have also discussed in detail due to the unique nature of these disaster events themselves and the large number of lives lost in the catastrophe.The list of disasters in which 10 or more human lives were lost is annexed at the end of the report. The list has been drawn from the daily disaster update compiled by the National Institute of Disaster Management for the reported disasters in 2011. The Ministry of Home affairs is the nodal agency for management of disasters in India.

Sikkim Earthquake

Overview

Sikkim is a mountainous state which is crisscrossed by narrow valleys and steep cliffs. It has a fragile ecology being the steepest and the highest state in India, and the third highest landscape globally. It is located in the highest seismic zone and has weak geological formations, comprising of sedimentary and low grade metamorphic rocks which are prone to landslides. The State also experiences heavy monsoons with an average rainfall to the tune of 2800 mm. Cupped in the lap of eastern Himalaya, the north eastern State of Sikkim falls in high seismic zone (Zone V). The region has experienced relatively moderate seismicity in the past, with 18 earthquakes of Magnitude 5 or greater over the past 35 years within 100 kilometres of the epicentre of September 18 event. The largest of them was of Magnitude 6.1 in November, 1980. The last significant earthquake in the region occurred in Febrauary, 2006 measuring 5.3 on Richter scale.

An earthquake measuring 6.8 on Richter scale occurred on September 18, 2011 at 18:10 hours in the Sikkim Nepal border region. The epicentre of the earthquake (27.7oN, 88.2oE) was located near the Sikkim-Nepal border, about 68 km northwest of Gangtok, Sikkim at a shallow depth of about 19.7 km. The earthquake caused strong shaking in many areas adjacent to its epicentre lasting for about 30-40 seconds. It was widely felt in all North Eastern states of India, West Bengal, Bihar, Uttar Pradesh, Haryana, Rajasthan including capital city Delhi. The Indian Meteorology Department recorded two aftershocks of M 5.7 and M5.1 within two hours and another of M 4.6 at 3:21 am on 19th September, 2011. The earthquake claimed 60 lives in Sikkim, including 16 at the Teesta Stage III hydroelectric power project site and injured 719 persons and caused extensive damage. The devastation caused by the earthquake was intensified by seasonal heavy monsoon rains that caused landslides, mud slides and also caused floods that destroyed thousands of homes, buildings and infrastructure. .More than 300 landslides occurred all over the state and disturbed the road connectivity to major towns like Mangan, Chungthang, and Lachung

and even NH31A, main route connecting Sikkim and West Bengal. It was followed by road blocks, falling boulders, lake bursts and flash floods with incessant rain which continued for over a week after the earthquake.

MAP showing the Earthquake Epicentre and Affected Areas:

At its location, the continental Indian and Eurasian Plates converge with one another along a tectonic boundary beneath the mountainous region of northeast India near the

Nepalese border. Although earthquakes in this region are usually interplate in nature, preliminary data suggests the Sikkim earthquake was triggered by shallow strike-slip faulting from an intraplate source within the over-riding Eurasian Plate. Initial analyses also indicate a complex origin, with the perceived tremor likely being a result of two separate events occurring close together in time at similar focal depths.

Impact

The north district of Sikkim, which mostly comprises of the tribal population was the closest to the epicentre and was badly hit. Extensive damage and loss of public infrastructure was reported in the following sectors all over the State:

1. Transportation infrastructure comprising of roads and highway networks, bridges, tunnels, culverts, retaining walls and village footpaths.
2. Energy infrastructure in the form of generation plants, electrical grid, substations and transformers
3. Water management infrastructure comprising of drinking water supply, drainage systems, irrigation systems and flood control systems.
4. Governance infrastructure of government offices at the village, block, district and state level, military infrastructure along with residential buildings.

Damage caused to various buildings in the Sikkim earthquake

5. Social infrastructure including the health care system, education and research system and social welfare system primarily ICDS.

6. Economic infrastructure comp rising of marketing hubs, manufacturing centers, agriculture, horticulture, animal husbandry, forestry and fisheries infrastructure.
7. Recreation infrastructure like community halls, playgrounds, sports complexes etc.
8. Cultural heritage infrastructure like historic monasteries, chortens shedas (monastic schools), archaeological sites, temples, churches etc .

The loss and damage from the Earthquake is depicted as the following :

Loss and Damage

Human Lives lost 60, Injured 710, Houses 34159, Government Buildings 1255, Cattle Lost 525, Sheep,Goats, Pigs lost 808, Agriculture crops 7500 Hectares, Roads Damaged 3230kms,Village footpaths 1596, Bridges/Culverts 8135

Water Supply schemes 1529,Minor Irrigation Works 204, Flood Control Management works 533, Power Infrastructure Major Damage.

Damage

Schools 759, Hospitals 377, ICDS (Anganwadi) 875, Historic Monuments, Monasteries and Religious Institutions 259

Gram Panchayat Offices 60, Village level co-operatives 49, Rural product Marketing Centres 8.

(Source: Memorandum submitted by Government of Sikkim)

The State estimated a loss to the tune of Rs 7425 crore and sought a relief from Rs 6890 crore.

Response

Heavy rain, fog and blocked roads prevented the rapid deployment of rescue workers in the initial phase of the earthquake response. Rescue teams experienced difficulties in accessing some of the remote worst affected areas in northern Sikkim State and in the eastern region of Nepal that borders the State. As heavy rains eased on 22 September, relief teams reached the worst affected areas in northern Sikkim State by Indian Air Force's (AIF) helicopters. Massive operations were launched to rescue the injured and trapped population from the buildings and houses by the state administration along with the army, ITBP, SSB, NDRF, central government and state agencies.

1Army and Indo-Tibetan Border Police personnel use Army jawans distributing food to the earthquake earthmoving equipment to clear the road at Bitu Village survivors after they were rescued from Chungthang in north Sikkim about 110 Kms from Gangtok.

About 103 relief camps were made operational in the entire four districts and 14360 members of the affected community were accommodated and provided with food, clothing and medical care. The relief camps were set up in almost every gram panchayat units. The State government declared an ex gratia payment of Rs 5 lakh each to the next of kin of the deceased while the central government announced an ex gratia payment of Rs 2 lakh. The central government also gave Rs 1 lakh for the injured persons while the state government gave Rs50,000/- to the families of each injured person.

Rehabilitation and Recovery

Several steps were taken at the central and state level to rehabilitate the affected community and to "build back better". The central and the state government worked together towards reconstruction and rehabilitation in such a way so as to mitigate any such future disaster. The Prime Minister Shri Manmohan Singh announced an assistance of Rs.1, 000 crore to the State of Sikkim to meet the requirements of relief and rehabilitation in the wake of the massive destruction caused by the earthquake. The central government assured the Sikkim government of "every possible assistance" to manage effectively the task of

reconstruction, rehabilitation and re-development". The Sikkim government was also advised to learn from its experience by using proper building technology and building by-laws so as to be better prepared in the event of recurrences of earthquakes. An expert's team on earthquake-resistant technology was sent by the Centre to assist the State in rebuilding its infrastructure and to make Sikkim a model State in earthquake mitigation and to show the way to other earthquake-prone States in the country.

The Ministry of Power had also asked the National Hydro Power Corporation (NHPC) to extend all possible assistance to State Government of Sikkim to bring normalcy to the earthquake affected areas near NHPC's Teesta Hydel Power Station and Rangit Hydel Power Station in the State. It was decided to avail the services of seismic experts from IIT Roorkee to analyse the earthquake data and conduct the earthquake impact study at the dam sites of NHPC in the region and more specifically those in Sikkim.Apart from this, an Expert Team of Geologists, Engineers and senior executives of NHPC from its Headquarters in Delhi were also asked to visit the site and submit report to the authorities. Power Supply position in Gangtok was also reviewed and Power Grid Corporation was

instructed to expedite restoration of power. North Eastern Electric Power Corporation (NEEPCO) was also asked to compile the seismic data collected from its power stations in North Eastern States for further analysis at Indian Institute of Technology, Roorkee.

Karnataka Drought

Overview

Karnataka covers an area of 1,91,976 sq km and comprises humid, sub-humid, semi-arid and arid climatological regions. The population of the State is 6.11 crores, out of which 66% are rural based and dependent on agriculture. Two thirds of the geographical area falls under semi-arid to arid conditions. Nearly 76% of the sown area is under rain fed agriculture and is vulnerable to the vagaries of the monsoon.

The Karnataka has experienced drought during the years 2001, 2002, 2003 and 2004 consecutively. During the year 2005, state was under heavy floods. During 2006, it experienced both flood and drought situations. During 2007, it repeatedly faced floods 4 times. For the years 2008 and 2009, there were both drought and flood in the State. During the year 2011 the monsoon started in time and all parts of the State, except Karavali and Malnad regions, experienced moderate rain during September 2011.

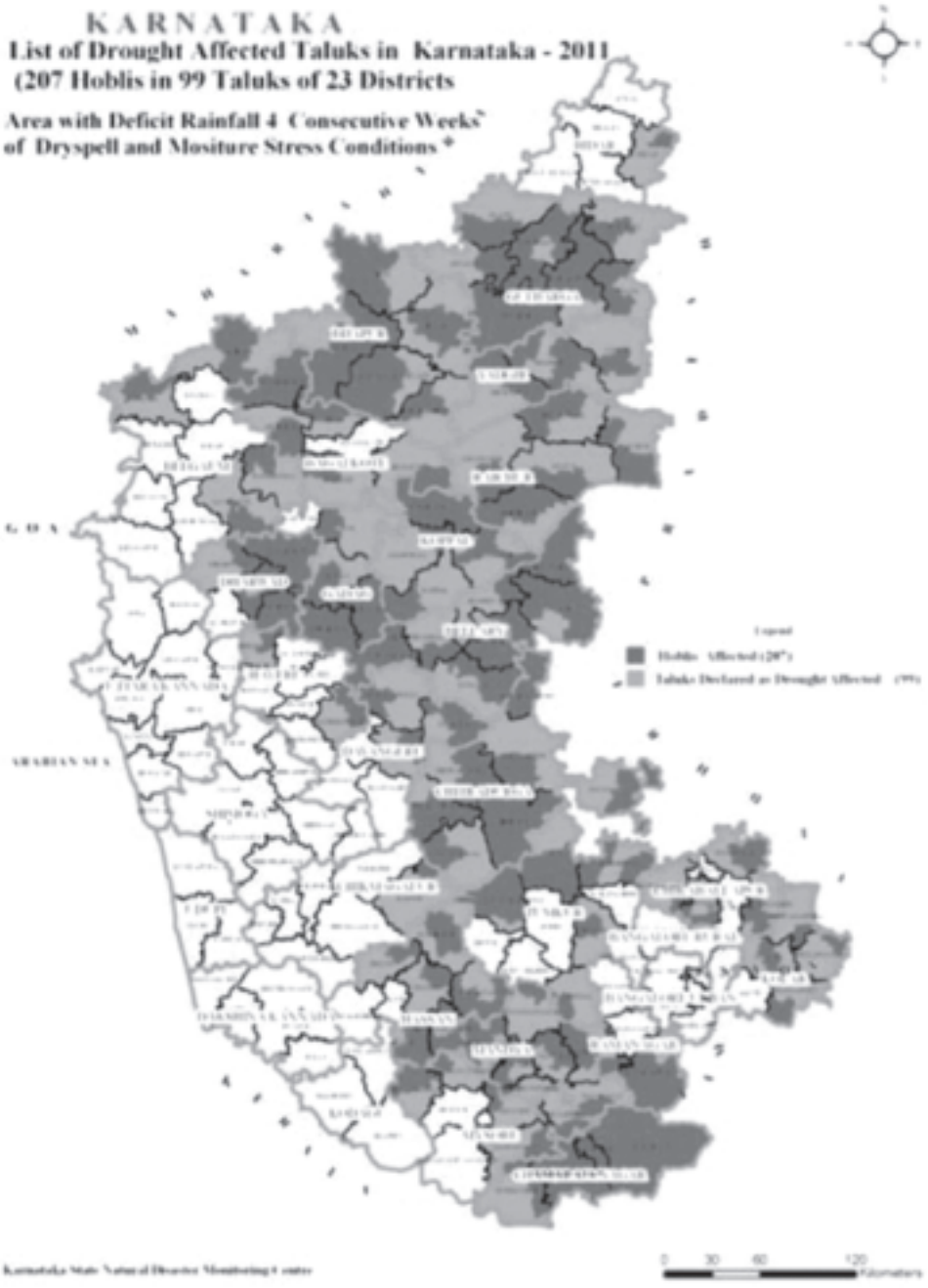
Rainfall during south west monsoon - 2011

During May-2011, the state as a whole recorded, 71.7 mm rainfall as against its normal rainfall of 85.2 mm, with departure from normal being (-) 16%. Out of 176 talukas in the State, 79 recorded deficit / scanty rainfall. The onset of monsoon over the southern part of State was on June 2nd and was on time. The progress of the monsoon trend was normal and covered most part of the State by June 10th, except parts of Bidar, Gulbarga, Yadgir and Raichur districts. Monsoon covered the entire state by June 15th. During June-2011 the State as a whole received actual rainfall of 200 mm as against its normal rainfall of 183 mm with (+) 10 % departure from normal. The interior parts of Karnataka received below normal rainfall but the rainfall was normal to excess in the districts of Malnad and coastal regions. During June rainfall was deficit in 58 talukas. During July, the state as a whole recorded 234 mm rainfall as against its normal rainfall of 266 mm with departure from normal being (-) 12 %. The districts of Chitradurga, Davanagere, Chamarajanagara, Mysore, Belgaum, Haveri, Dharwad, Hassan and Chikmangalur recorded deficit rainfall. However, during the month 72 talukas recorded deficit /scanty rainfall. The coastal, Malnad and South interior Karnataka regions recorded below normal rainfall. During August, the State received 230 mm rain as against normal rainfall of 196 mm with departure from normal of 17%. The rainfall was deficit during the month in the districts of Chitradurga and Bellary. The discussion indicates that the rainfall was more or less normal from May-August, 2011.

During September, the State witnessed scanty rainfall in 17 districts of interior Karnataka with departure from normal up to (-) 81%. The coastal and Malnad region received excess rainfall during the month. South interior Karnataka recorded only 44 mm rain during the month as against the normal rainfall of 134 mm. The North interior Karnataka region received 57 mm rainfall as against normal rainfall of 152 mm. September 2011 rainfall was the second worst event in South Interior Karnataka since 1971, and in North Interior Karnataka, third worst event since 1971. Failure of Monsoon during September 2011 caused late season drought of rare severity. The dry spell in interior Karnataka during September 2011 continued to October 2011 in many districts. 77 talukas recorded deficit rainfall during the period October 1-14 2011.(Fig.1)

Though the cumulative rainfall departure from normal for the State as a whole during June 1-14, 2011 was (-) 4% from normal, failure of monsoon during September and

October resultedin late season drought.(Fig.2 & 3) (Fig.1) (Soure : Memorandum, Government of karnataka)



Key drought Indicators during Kharif 2011:

The dry spell during the crop growth period causes agricultural drought. Agricultural drought occurs when soil moisture and rainfall are inadequate during the crop growing period causing extreme moisture stress and wilting. It thus arises from variable susceptibility of crops during different stages of crop development, from emergence to maturity. It is defined as a period of 4 consecutive weeks with a rainfall deficiency of more than 50 % of the long term average from mid-May to mid-October.

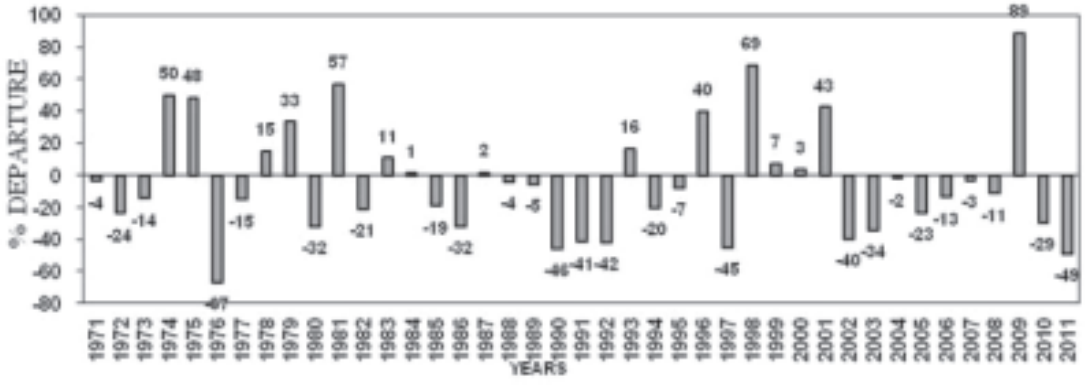
Drought Monitoring:

Karnataka has established institutional mechanism to monitor the drought indicators by setting up Drought Monitoring Cell way back in 1988. GPRS enabled Telemetric rain gauges have been installed and operational in all the 747 hoblis (villages) and 770 gram panchayats. GPRS enabled weather stations have been installed at 135 sites. Karnataka State Natural Disaster Monitoring Centre has taken a lead in monitoring the recurring drought situation on a scientific basis. The centre has made operational for various programmes on knowledge management and decision support system.

Moisture Adequacy Index:

Karnataka State Natural Disaster Monitoring Centre (KSNDMC) has developed moisture adequacy index based on rainfall, potential evopotranspiration, actual evopotranspiration, soil moisture condition, available water capacity of the soil and using soil water budgeting. Moisture adequacy index are classified into severe moisture stress (MAI < 25%), moderate moisture stress (MAI - 25.1 to 50%), agriculturally favorable (MAI - 50.1 to 75%) and Humid region (MAI >75%).

Fig.2 **Percentage departure of cumulative rainfall from normal for the period for 1st Sept to 14th Oct for North-Interior Karnataka**



(Soure : Memorandum, Government of karnataka)

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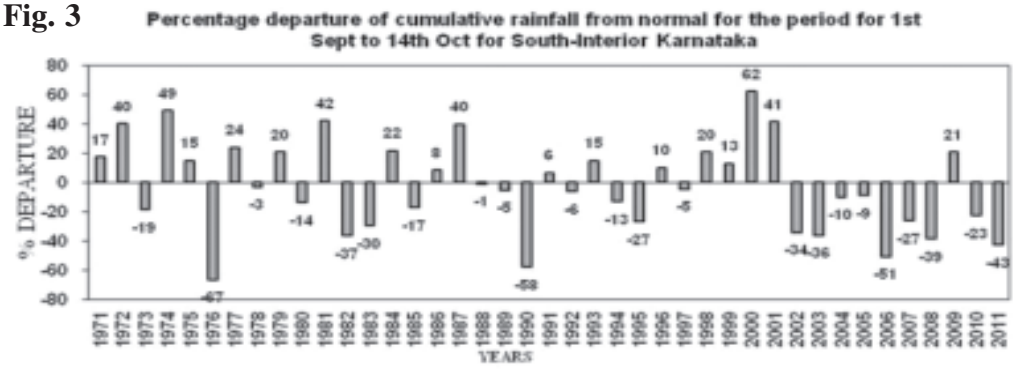
Fig.2: (Source : Memorandum, Government of Karnataka)

Fig. 3

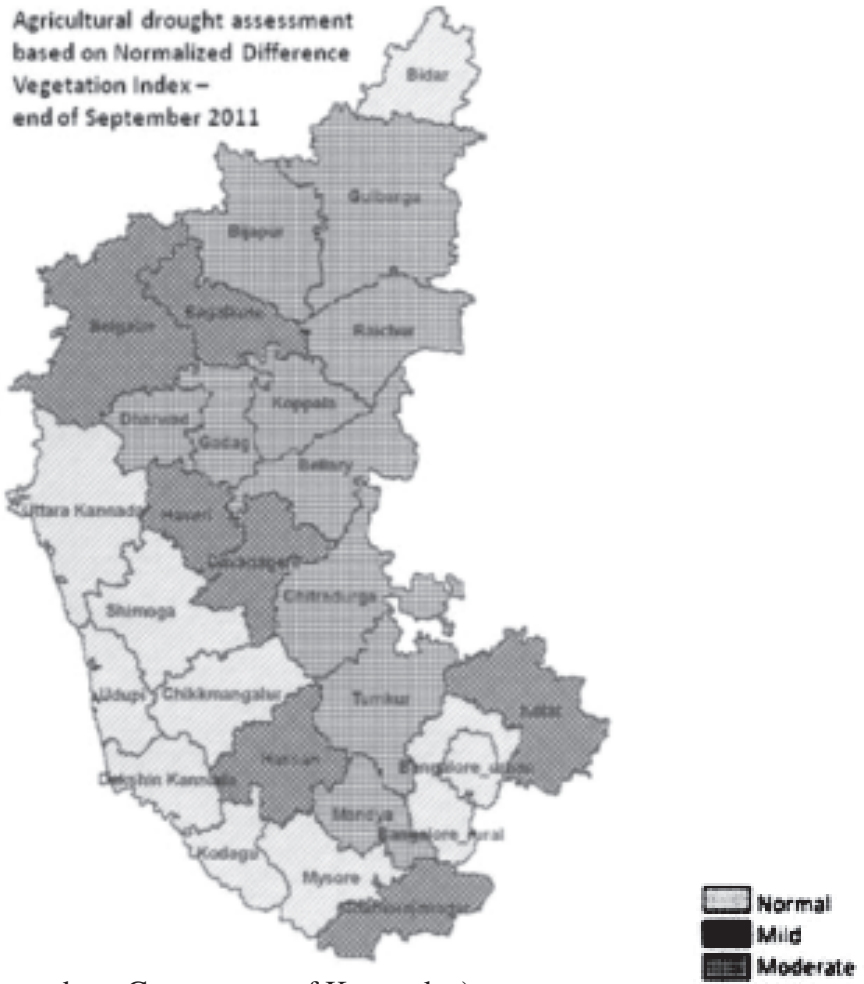


As on end of September 2011, 27% of the geographical area in the State was under moderate/severe moisture stress covering interior regions of the state. This indicator has assessed the moisture stress experienced by agriculture/ horticulture crops.

Normalized Difference Vegetation Index:

Assessment of agricultural drought and crop condition was carried out during Kharif 2011 by the State in association with National Remote Sensing Centre, Government of India. The report at the end of September has indicated drought condition prevailing in 20 districts of the Karnataka (Fig.4). It is also to be noted that out of 22 districts in the country under "Moderate drought", Karnataka had 11 districts under the category, which accounts to 50% of the total area in the country. Similarly out of the 49 districts in the country under "Mild drought", Karnataka has 11 districts falling under the said category constituting 22% of the total area of the country. Hence NDVI indicator had identified the drought situation in the State (Fig.4). Along with the above mentioned indicators, deficit rain, dry spell, moisture stress pattern were also vital indicators of drought.

Fig.4



(Soure : Memorandum, Government of Karnataka)

Declaration of Drought:

As per the recommendations of Cabinet Sub Committee in 2004, area with a continuous dry spell for more than 4 weeks period may be considered for declaring as drought affected. For declaring drought the following parameters were considered. 1) Continuous dry spell of 4 weeks or more. 2) Percentage departure of rain (-) 20% or more.

South West Monsoon drives the Kharif agricultural activities in the state of Karnataka. Generally September 30 2011 is the normal withdrawal of South West Monsoon in the state. Taking into consideration the drought indicators, deficit rain, dry spell/moisture stress prevailed in 70 talukas of the state and thus they were declared as drought affected on October 4 2011 and 14 talukas were declared as drought affected on October 7. The

situation was again reviewed on October 15 and 6 more talukas were declared as drought affected. With no respite in the situation, 9 more talukas were declared as drought affected on November 8. Thus in all 99 talukas were declared as drought affected in the State.(Fig.1)

Impact

The severe drought condition adversely affected not only agriculture, but other sectors like horticulture, livestock, etc. The summary of loss due to Drought during 2011, as per the memorandum submitted by Government of Karnataka, is presented below:

Summary of Loss due to Drought during 2011

(Source: Memorandum, Government of Karnataka)

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Item Estimated loss
Relief claimed as per CRF
Norms in crores

1. Agriculture Crop loss 4245.84 202.54
2 . Horticulture Crop loss 299.00 13.94
3 . Animal Husbandry
   a) Opening of Goshalas 23.92
   b) Purchase of Fodder mini kits 4.20
   c) Purchase of Fodder Banks 7.60
   d) Nutrient supply and Vety care 4.20

Total of Sl No 3 39.92

4. RDPR Dept
   a) Revival of PWS 24.42
   b) Revival of MWS 24.52
   c) Retrieval / hydro fracturing of bore-wells 18.23
   d) Drilling of new bore-wells 18.24
   e) Transportation of water 36.63

Total of Sl. No. 4 122.04

5. Additional funds under MGNREGS 4.80
6 .Additional funds under Health Sector 10.00
7. Additional funds under Power Sector 330.00

Grand Total of Sl. No. 1 to 6 4544.84 723.24

Follow up action taken:

The Government of Karnataka has been reviewing periodically the seasonal conditions of Agriculture crops at State / district levels. Agriculture Department was conducting periodic review of status of agriculture. Department was also in constant touch with taluka and District officials through weekly video conference to review the crop conditions. Contingent action plan was prepared by scientists of agriculture university and was executed in the affected districts. Nodal-officers were appointed in all the districts to review the seasonal crop conditions. "Bho-Chetana" scheme was extended to all the districts during the year. The scheme focuses on retaining / increasing soil fertility and micro nutrients of agriculture land and increase crop production. About 23 lakh farmers were covered under this scheme in the whole state. Seeds and fertilizer requirements in the districts were monitored constantly. Steps were taken to distribute seeds at subsidized rates for alternate crops. Close watch on Crop cutting experiments and special attention was paid to ensure none of the experiments will lapse. Micro and Macro irrigation programmes continued to cover more land under irrigation for less utilization of ground water. Scientists from university of agriculture, horticulture and fisheries were closely monitoring the seasonal conditions and advising farmers to improve crop conditions.

The villages, which were facing / likely to face shortage of drinking water, were identified and contingent action plan was prepared and implemented to tackle the issue. This mainly included - constant monitoring for effective implementation of on-going drinking water schemes, quick implementation of works approved during 2011-12, and repair and rejuvenation works, emergency supply of drinking water through tankers, purchase of more motor-pumps, extension of pipelines, effective implementation of flushing, deepening and hydro-fracturing works, functioning of control rooms at taluka level, drilling of bore-wells, steps to ensure effective supply of clean drinking water through tankers, etc. MGNREGS is one of the flagship programmes being implemented in all the districts of Karnataka. For the livelihood of rural people, who are poorest among the poor, are required to be provided employment in order to avoid migration. In order to combat the drought situation effectively, all the implementing officers were instructed to gear up the administrative machinery for providing employment to the people, by implementing the employment generation works, especially in the drought affected talukas. Further, circulars and guidelines have been issued to set-up goshalas, fodder banks, veterinary care centres, funds were released to the districts to purchase fodder mini kits to grow adequate green fodder in the affected areas. Health packages, including necessary medicines, vaccination, etc. were supplied to the affected districts for health-care of the cattle.

Sabarimala Stampede
Karnataka Drought
Overview

A stampede is a sudden rush of a congregated, active or polarized aggregate of people, resulting in many injuries and death from suffocation and trampling. The two major behavioural reasons of any stampede are anxiety and panic. It has been claimed that most of the stampede disasters can be prevented by simple crowd management strategies. The famous Sabarimala Sree Dharma Sastha Temple, dedicated to Lord Ayyappa, is situated on a hilltop (about 3000 feet above sea level), named Sabarimala in Pathanamthitta district of Kerala State. The uniqueness of the temple lies in the fact that it is open to all, irrespective of caste, creed or religion. However, the female between the age of 12 and 50 years are not allowed in the temple. It is open for worship only during the days of Mandalapooja Makaravilakku and Chitra Vishu. The temple attracts pilgrims not only from the southern states of Kerala,Tamil Nadu, Karnataka and Andhra Pradesh, but also from other parts of the country and abroad. It is said that the pilgrims have to follow fasting for 41 days to cleanse their minds before going to Sabarimala. The journey to the temple is to be taken through difficult paths in the forest as the vehicles can go only up to Pamba. To enter the Sabarimala temple, the pilgrim has to pass Pathinettampadi (holy eighteen steps).On January 14, a large number of pilgrims gathered to attend the Makarjyothi darshan, on the last day of a yearly festival which attracts millions of devotees, at a Hindu shrine in Pamba. After witnessing the Makarajyothi at Pamba, the pilgrims were returning and on way back around 8 p.m. the incident happened, killing 102 pilgrims and injuring at least 100 more.

Pilgrims gathering in sabarimala for worship makarajyothi (Soure: The times of india)

The preliminary report submitted by Idukki District Collector on Sabarimala stampede suggests that the tragedy occurred when an auto and jeep overturned. Both the vehicles were filled with the devotees. Initially, the fully packed auto overturned after it lost control. While the pilgrims were trying to lift the auto, the jeep overturned, triggering the stampede. The autopsy report also suggested that most of the pilgrims had died of injury to their internal organs due to the stampede at Pulmedu.

Policeman inspects the site of stampede

Recovery Measures

Stunned and jolted by the Sabarimala tragedy, cautious Kerala Government came up with a new footpath, a bridge and a slew of measures to decongest the route leading to the Sabarimala temple. Retired High Court Judge Shri M. R. Hariharan Nair, was appointed for enquiring into the Pulmedu tragedy in Sabarimala and to submit the report to State Government. Earlier, Shri Nair had submitted an interim report to Hon'ble Chief Minister of Kerala, Shri Oommen Chandy, recommending measures to prevent such accidents in future during the pilgrim season. Public Works Minister, Shri V. K. Ebrahim Kunju, who was discussing the interim report of Pullumedu tragedy, submitted by Justice Shri Hariharan, stated that the repair works of damaged roads to Sabarimala would be completed before the start of next season. 63.5 crores were sanctioned for this task. The report, which was submitted by Justice Shri Hariharan had been accepted by the State Government for follow-up actions.

On the recommendations of the Commission's report, following decisions had been taken to ensure safety of pilgrims:

- To ban private vehicles in the Vandiperiyaar- Vallakadavu route.
- To introduce KSRTC chain service on the Vandiperiyaar- Vallakadavu route.
- To construct two queue complexes and a bailey bridge at Sannidhanam before the commencement of next season.
- To provide better sanitation facilities from Pampa to Sannidhanam. For this task 5 crores allotted in the budget would be utilized.
- To organise a meeting with Devasom Secretaries of Andhra, Tamil Nadu, Punducherry and Karnataka at Kottayam, to discuss the preparations for the next season.
- To open an Information Centre at Nilakkal for the pilgrims from North India. It has also been decided that an integrated security and safety plan involving police, rapid action force and disaster management contingents would be put in place during the two-month long pilgrimage season of Sabarimala Ayyappa temple. The security system being evolved had factored in the recommendations in the interim report of the judicial commission that probed the Pulmedu stampede tragedy. Besides Kerala Police and its various specially trained units, services of police from the neighbouring states would also be utilised as part of the comprehensive safety plan. Apart from strengthening intelligence gathering, trained commandos, bomb detection squads, disaster management units and RAF contingents would be deployed at the base camp Pampa, "Sannidhanam" atop the hill shrine and other places connected with the event. In view of the Pulmedu tragedy, vehicular traffic along the Uppupara route had been banned. Security in the trekking route, used mainly by devotees from Tamil Nadu, would be stepped up and other facilities like lighting would be improved. The Travancore Devaswom Board, administering the shrine, was also considering bringing more routes under the coverage of accident insurance scheme. A high-level meeting held in Kottayam had decided to form a joint council of five southern states for inter-state co-ordination of the pilgrimage, which attracts over 30 million devotees a year, mostly from Tamil Nadu, Andhra Pradesh and Karnataka.

Case Study: Amri Hospital Fire

Overview

Health systems rely on a range of public, private and non-governmental health facilities to work together to serve the community. The importance of hospitals and all types of health facilities extend beyond the direct life-saving role they play (ISDR, 2008-09). These facilities are not only the lifelines of the communities but also the powerful symbols of social

progress and a prerequisite for stability and economic development. Therefore, special attention must be given to their robust physical and functional integrity in emergency conditions. However, globally there are countless examples of health infrastructures - from sophisticated hospitals to small but vital health centres - that have not been operational and sustained loss of lives and infrastructure, not only during disasters but have themselves inflicted disasters on the community due to its own vulnerability. Failure of hospitals and emergency services during a disaster can greatly affect public morale and a community's social and health capital, but, nothing can be more traumatic when hospitals themselves become disasters by failing to provide safety to its users. It is unethical to allow scope for a place meant to save lives to turn into a death trap.

As we know very well that many new hospitals are propping up in India, catering to a growing middle class and even some foreigners are looking for inexpensive and quality care. While India is gaining a good reputation for its medical talent, the construction codes and public safety regulations are lagging behind. There is a serious need to look into building safety codes and plan for fire while issuing the licenses for running the hospitals. In addition to the lapses in building, codes and fire exit strategies, the widespread corruption often makes it possible for code violations to be overlooked. This year witnessed a major fire accident in AMRI Hospital, which is located in a posh area of Kolkata.

AMRI Hospitals was co-founded by Emami & Shrachi Groups in 1996, two of Kolkata's developing groups, along with Government of West Bengal to expand health coverage options for consumers. The Emami Group has varied interests comprising personal and health care, hospital, bio-diesel, real estate, ball pen tips and retail, while the Shrachi Group has varied interests comprising Agro machinery, Engineering, Real Estate, Health Care, Finance Securities and information technology. AMRI hospital is a center for training the student of Institute of Radiology & Medical Imaging and is ISO 9001:2000 certified. It is a multi-storyed private hospital which turned into a towering inferno in the early hours of the morning, when a fire broke out in the hospital in Kolkata on December 9, 2011. The fire spread fast from the basement of the hospital, engulfing one ward after the other and trapping hundreds of people.

Impact and Response

The fire was first noticed by local residents at around 3.30 am, who rushed to the gates but were stopped by security guards. The hospital authorities reported to the fire stations after an hour or so. Firemen, who reached at 4.30am, broke through the double-paned glass façade of the hospital and rescued a few lucky survivors. Around 25 fire

engines were rushed to the spot. The fire fighters were seen using hydraulic ladders to rescue the patients and office staff by cutting opens the glasses with gas cutters. Many patients were lowered down from the upper floors in safety harnesses attached to ropes; others were wheeled out on stretchers. But by then, it was too late for a majority of the 150 patients admitted at AMRI. Though the cause of the fire has not yet been ascertained, Gopal Bhattacharjee, Director of the fire department, opined that it was most likely to be the result of an electrical short circuit in the basement car park, which was being used illegally as a store for combustible material like LPG cylinders, engine oil, PVC pipes, bedding, etc. The hospital authorities had been asked by the Kolkata Police to vacate the store in July. The fire didn't spread at all and was confined to the basement. But the thick black smoke went up through the AC ducts and carried it through the rooms and corridors of the seven-storeyed hospital located in a densely populated area. AMRI HOSPITAL FIRE

Patients being rescued by fire personnel

The devastating fire killed 91 patients including three hospital staffers in the incident. While many patients died of burns, most died due to suffocation caused by carbon monoxide accumulation in the building. Critical patients trapped inside the smoke-filled ICU were the biggest casualties. In a desperate bid to rescue them, windows were broken by the local residents as fire-fighters collapsed due to humongous smoke.

Follow up Action

Hon'ble Chief Minister of West Bengal, Ms. Mamata Banerjee, who also holds the health portfolio, cancelled the license of the hospital immediately. A judicial investigation into the entire catastrophic incident was ordered. Six members of the hospital board, including leading industrialist Shri S. K. Modi, were arrested on charges of culpable homicide and negligence.

The Calcutta High Court on February 24, 2012 granted bail to AMRI Director, Shri R. S. Agarwal, but rejected similar pleas of four other board members, including Shri R. S. Goenka, Shri Manish Goenka, Shri Prasant Goenka and Shri Ravi Todi of the hospital. Two renowned doctors of the hospital, Dr. Mani Chettri, the managing director, in whose name the hospital had the licence, along with another doctor Dr. Pranab Dasgupta were also arrested. In response to the arrests made, FICCI came and issued a public statement that it was important to fix the responsibility of those directly involved in managing the hospital and distinguish them from others. At the same time, those who are not found guilty and are not responsible for day to day operations of any business should be released immediately. Implicitly, FICCI condemned the arrest of board of directors and demanded their release immediately stating that it would spread negative sentiments within the domestic investor community and discourage future philanthropic activity under which more hospitals have been established.

Amri Hospital Fire
Relief

An ex-gratia grant of Rs 2, 73, 00,000 at the rate of Rs 3 lakhs per casualty was provided to the next of kin of the deceased in the AMRI hospital fire by the Government of West Bengal. A sum of Rs 1.5 lakhs was drawn from the State Disaster Response Fund and an equal amount was drawn from the State budget for the purpose. At the Central level, the Prime Minister sanctioned an ex-gratia relief of Rs 2 lakh each to the kin of the deceased and Rs 50,000 each to those injured, from the PM's relief fund.

The Government of West Bengal also decided to provide job to the next of kin deceased in the fire breakout. The government job opportunity was also extended to the next of kin of deceased who belonged to other states as well including Tripura, Jharkhand, and Kerala. Meetings were also organized between the administration and police department officials to discuss the establishment of six new fire stations at most fire-prone commercial zones, including Burrabazar, Garia, Parama Island and Tiljala.

Way Ahead

While insensitive and unacceptable patient care in India hospitals has been repeatedly talked about, the advent of high-end super-speciality hospitals with so called state of the art facilities has been shown as an answer to the lack of patient centric approach of the hospitals has proven to be an eye wash. While the patients have no choice but to surrender his life into the hands of such facilities, the governance should be proactive enough to make basic preventive mechanisms a regulation. Lack of regulations, awareness and trainings of the staff, poorly planned facility and unaccountable management of the hospital are the foremost reasons behind such tragedies. Disaster Risk Reduction in health facilities and hospitals is possible by including prescribed risk reduction measures in the design and construction of all new health facilities, and by reducing vulnerability in existing health facilities through measures such as demolishing the highly risky buildings and strengthening the important critical facilities.

Cyclone Thane

Overview

Cyclone is a natural hazard, which can neither be prevented from occurring nor can it be controlled or modified. Cyclone Thane made a landfall on the coast of Tamilnadu (Cuddalore District) and Puducherry in the early hours of December 30, 2011. The cyclone Thane was detected early and IMD issued warning much in advance. The first IMD warning was issued on December 25 2011.

There were precautionary alerts from IMD from December 25 onwards (five days in advance) and the cyclone movement was then closely monitored by administration of Cuddalore and Puducherry with the help of IMD. The district administration conducted an emergency meeting on December 29 morning at the respective districts. Specific tasks were assigned to district and sub district functionaries such as PWD, Electricity Board, Water Board, Fire, Police, etc. NDRF battalions were alerted on December 29 itself and it arrived from Arakonam in the evening to Cuddalore. The cyclone struck coastal region of Tamil Nadu and Puducherry in the early hours of December 30 causing huge devastation. The damage was more in the Puducherry town area, affecting the trees, roads, buildings, including inundation in some coastal areas along the beach road. Affected people had to be evacuated to nearby Government schools and community halls. People along the coast were shifted to the cyclone shelters, constructed by Government in 1985 and 2009, in Puducherry and Tamil Nadu. The administration, Cuddalore inspected coastal villages on morning of December 29 and alerted villages not to venture out to sea and not to sleep

in thatched huts during night hours and not to station their vehicles under tree. The administration also advised vulnerable population to stay in the earmarked shelters. The food and water was supplied to the evacuated people by the Government agencies as well by the community leaders. During the day the administration addressed gathering at various vulnerable villages taking the help of head men, religion heads, divisional officers, etc. The DC went on AIR Puducherry and Chennai and local TV channels on December 29 evening announcing various public safety measures. The administration mobilized 108 ambulance vehicles from neighbouring districts.

Impact:

The cyclone made a landfall over Cuddalore and Puducherry on the morning hours of December 30, 2011, with a wind speed of 145-150 km per hour, causing loss of 53 human lives (41 in Tamil Nadu and 12 in Puduchery) and massive property damages (details are given in the table below for Tamil Nadu and Puducherry). The Cuddalore district has a population of 26, 00,880 as per 2011 census. Approx. 7500 people in Cuddalore and 1760 people in Puducherry were provided shelter in community halls. Some of the people after seeing the intensity of the cyclone and high tides (storm surge) evacuated on their own to safe shelters near Chidambaram Taluk (Killai and Parangipettai areas). Transport provisions were arranged by District authorities for such evacuees. As a precautionary measure, the administration had cut the power supply on 29th evening both in Cuddalore and Puducherry, anticipating the damage and for preventing electrocution.

Most of the deaths during Thane cyclone were due to house collapses. The cyclone was accompanied by rains and gale that uprooted thousands of trees, knocking down electric poles, transformers, transmission towers, snapping power supply in several areas. National and State Highways were completely blocked. Power supply was severely affected. Water supply was affected mainly due to power failure. Fuels (petrol, diesel, etc.) shortages were reported on 30th itself due to power failure and short supply. Thatched houses were completely damaged mainly in the most affected region of Cuddalore, Panruti, Kurunjipadi and Chidambaram Talukas in Tamil Nadu. Semi concrete buildings and fully concrete were also damaged at some places in both Tamil Nadu and Puducherry. Massive damages to crops, mainly to cash crops such as cashew nuts, bananna, coconuts, sugarcane were reported from both Tamil Nadu and Puducherry. Severe damage to paddy and other crops was also reported.

Landlines (including fax) were not working at district head quarters, but mobile phones (including internet) were reported to be working, though the network was very poor.

Response and Relief Management

The priority task, of clearing the highways (national and state), was achieved by December 30 evening in Tamil Nadu. NDRF and police provided help in this task. Approx. 400 generator sets were mobilized in Tamil Nadu, from various agencies, both from Chennai and other districts, including private agencies and some of these were used for operation of petrol pumps. The technicians from IOC and BPL and some other agencies were roped in to operationalize filling stations. Long cues were reported on 30th but by 31st, the situation was brought under control. Some of these Gen sets were deployed for restoring water supply. Water tankers (70) were also mobilized from Chennai (Metro Water), and some from Neyveli Lignite Corporation, NOCL etc in Cuddalore district, Tamil Nadu. Local engineering colleges volunteered water supply from their bore wells. The corporate also participated in providing Gen sets and restoration of essential services. For urban water supply, a large Gen set was mobilized from Thiruvannmalai district, Tamil Nadu. Entire Tamil Nadu state machinery was supporting and DC was the coordinating officer. In Puducherry too it was done in the same way and the control room was operationalized the moment the cyclone was reported by the IMD. In Cuddalore, seven senior IAS officers (Secretary rank) were deputed to oversee the management. These officers looked after specific sectors such as Highways, Electricity, Water Supply, Law and Order, etc. The senior officers managed their respective sectors and DC coordinated the overall management process. Revenue officials were also deputed to ensure that there is no theft or untoward incidents. 2000 electricity board workers from other districts were engaged for power restoration in Cuddalore.

In Tamil Nadu and Puducherry ex gratia was paid to the family of victims who lost their lives (2 lakh each family). Immediate compensation was provided to fully damaged and partially damaged houses along with a relief kit comprising of 10 kg rice, saree and dhoti, kerosene and candles in Tamil Nadu. Restoration of power supply was the priority, as it caused many related problems such as water supply, sense of insecurity (theft), operation of essential service such as ambulances, health centres, etc. Milk supply was a major concern on 30th and AVIN (Government owned Milk Supply agency in Tamil Nadu) was roped in for filling the deficit. By January 2, 40% of power supply in urban areas, water supply and hospital services were restored. Rural water supply restoration took about a week in Tamil Nadu and Puducherry. By January 14, 2012 total power supply was restored in Tamil Nadu.

Way Ahead:

The cyclone "Thane" was reported timely, regarding timing and location of its land fall and the early warning was very helpful for preparation to face the situation. However the devastation was very severe for the region, as these regions have never witnessed such severe cyclone in the past 50 years, as per the community's version. The public as well as the administration have realised that the cyclone 'Thane' could had further severe impact, however as there was no storm surge, due to winds the impact was comparatively less, along the coast. Similar cyclone with more wind speed occurred in Orissa Coast in 1999 during the super cyclone, which had devastated the state's economy, bringing the state to a halt. The community can be taught to be better prepared through awareness, training and community involvement in planning for such disasters. The volunteers can be mobilised in these areas, especially the youngsters, so that their energy is utilised in a positive way for the benefit of the community and the nation. Further the volunteers will be able to manage the disaster in a better way as they are located in the place of its occurrence and can utilise all the resources as they will be familiar with the area and start the operation immediately without waiting for administration and others, so that the golden hours are utilised in a fruitful way.

Lessions Learnt:

By three methods we may learn wisdom: first, by reflection, which is the noblest; second, by imitation, which is the easiest; and third, by experience, which is the bitterest." Confucius The year 2011 witnessed a number of major as well minor disasters, which were reported and many of them would have passed by unreported. On account of natural disasters, the loss of life was not much but in case of human made disasters, it was quite high. The fact however does not undermine the importance of mitigating the effects of both, natural as well as human made disasters. We have already discussed in the first chapter about how disasters result in loss of precious lives, damage to infrastructure and livelihood and carves a dent to the emotional well being of the affected community. It will be too huge a price to pay at the national level, at the community level and even at the individual level, if we do not learn from the past disasters and prevent the future hazards from becoming disasters. We need to incorporate the lessons learnt from the past disasters in our present to break the vicious cycle of hazards turning into disasters. The floods in Odisha highlighted the acute need for initiation of plan for permanent flood control or long term measures to tackle the flood and reduce its impact in the State. It calls for community participation so that the community is trained to cope, manage and spring back to normalcy in the minimum

time which also improves every year learning from their own experience, assisted by Government machinery. Another issue which needs to be looked into is that the livelihood of marginal farmers or the poor generally depends on the livestock he/she owns and ultimately the health and well being of the livestock. This is truer when the farmer is faced with challenges of coping with disaster and trying to regain normal life. The livestock helps in regaining the normal life and livelihood, atleast by partly supporting the livelihood of the affected community. So it becomes imperativeto cater to the livestock, in addition to care of human life and their settlement. This is possible by learning from Rajasthan, the way they manage the cattle population during drought, by way of "Ghosala" etc. so that there is some arrangement at each village as per convenience of the local population. The Government of Odisha might have realized that recurrent floods in these flood prone areas will have less impact, if livestock serve as part of their livelihood if they are also taken care of. This step will enhance the resilience of the farmers, after any disaster.

The recent figure of Planning Commission (Economic Times, March 20, 2012) shows that the population below poverty level in Odisha is 37.0% in 2009-10 as compared to 57.2 % in 2004-05 shows a good improvement. The situation can further improve if the recurrent disasters are efficiently managed and coping mechanism developed. Participation of local community in relief, rehabilitation and reconstruction work in the form of a core-team with Government officials along with other national and international stake holders is essential for success of propermanagement of the disasters. This will bring in the belongingness of the work being carried out and can lead to success, as the involvement of local community will ensure that it is as per the need of locality with all scientific input, as was seen in Gujarat Earth quake rehabilitation project of 2001.

The Sikkim earthquake highlighted the vulnerability of the state, and the region as a whole, to earthquake and a dire need for strict compliance with building bye-laws. The death of 16 people in the earthquake in hydroelectric power project shows that all developmental works, including power generation projects should incorporate disaster mitigation in their plans. We need to prepare not only for primary disasters but also resulting secondary disasters. As a result of the earthquake, a number of landslides were triggered. Hence, vulnerability assessment of the roads is extremely important. The roads were damaged not only due to earthquake but also because of resultant landslides and hence reaching the affected area was a tough task and took a lot of time. Precious lives were lost due to the delay caused in reaching the affected areas by the search and rescue teams.

Therefore, the need of the hour is to frame strategies to construct and maintain major hospitals, school buildings and public amenity building for storage of essential life saving

materials, to use as community halls, to store equipment and machinery for removal of damaged material, using disaster resistant technology of a higher order, so that these buildings not only serve as good examples of disaster resistant technology, but also could be utilized as relief shelters providing necessary support facilities. Despite the available knowledge base, the communities in high seismic regions such as Sikkim and neighbouring states are not adequately prepared, due to lack of implementation of earthquake-resistant building technology. However, with adherence to seismic codes and recommended construction practices, it is possible to mitigate such largescale disasters. The Karnataka drought drew attention to the fact that it was high time to think about the mainstreaming the drought risk management (DRM), especially in the areas which are prone to drought. The process can start with policy mechanism involving the stake holders, knowing their views how to go about it. The process will involve, defining a drought risk profile of various areas in the state, followed by identification of disaster risk management (DRM) options, defining the mainstreaming entry points, and finally internalizing DRM into the development framework. These steps can be followed by measuring the impacts of DRM mainstreaming, to assess the situation and carry out the needful modification or corrective measures so that the policy can be framed for mainstreaming. All these steps are vital and would be successful if the stake holders are included in every step starting from planning to implementation.

The process of drought risk management can also include the policy decisions in the field of water and land resources, to manage the fresh water, excess of which results in flood and scarcity in drought. It should be a holistic approach of integrated water and land management, which is key to the drought proofing, so that the agriculture and allied activities, the main livelihood of almost two thirds population of the country sustains even in the absence of a normal monsoon.

The important issue highlighted by Sabarimala stampede is the need to streamline the pilgrimage in a systematic way step by step. The entry and exit routes for pilgrims should have been segregated to decongest, as the arrival of large number of pilgrims was known beforehand, to enable safe passage of pilgrims and also of the response teams. Vehicular parking should have been near the base camp, where all the vehicles could be parked in such a manner to make way for a safe way out. Their movement should have been streamlined and restricted keeping the capacity of the parking lot. The movement of the pilgrims should have been structured in a long zig-zag path leading to the temple and monitored constantly. For all this, the pilgrims should be registered as is being done in Sri Mata Vaishno Devi Temple and Thirumala Devasthanam in Andhra Pradesh. If possible, pilgrims, who have to perform a particular pooja, may be routed through different path and

must have separate area for offering pooja or may be allowed at a different time. An integrated security plan, involving officials of temple administration, security staff and local police may be chalked out well in advance to have clear cut roles and responsibilities. Hospitals may be kept in ready condition to cater to any large influx of survivors from any such future incidents. Moreover, health administration within the temple administration must have liaison with both Government and private hospitals. For this an inventory of all the hospitals around the area may be done for future use. History of such incidents and the way in which these were dealt may be properly documented and displayed at different places for easy access to responders.

The AMRI hospital fire showed the possible violation of fire safety norms in this hospital, which took ninety one lives, needs a serious thinking regarding hospital fire safety in India or elsewhere in the world. Vital lessons need to be learnt by everyone who are connected with medical profession and governance at large. A no objection certificate has to be obtained from the Fire and Emergency Services before occupying/making use of a commercial building. The officials from the department need to conduct a spot inspection and suggest safety measures considering the purpose for which the building is used, its dimensions, the staff strength, the nearest approach road and its width, etc. A total adherence to these suggestions could minimise, if not, avoid fire accidents. However, many choose to bypass this crucialLprocedure before occupying buildings. The reason is not far to seek. The implementation of safety measures recommended by the department is always ignored due to investment of considerable money and the process is conveniently given a go by. The fire breakout incidents point out at the need for new hospitals to be safeguarded by risk- sensitive siting, design and building in compliance with building codes. We need to develop and implement national policies and programmes to make health facilities safe not only in emergencies but also in peace times.

The key issue in case Cyclone 'Thane' was that not many in both Cuddalore and Puducherry areas in spite of such accurate warning did not evacuate to safe shelters before the weather conditions deteriorated. This approach of 'wait and see' might have become very costly, had there been greater storm surge than what was observed during Thane. While poor maintenance of cyclone shelter remains one of the issues for people not moving easily to such shelters, a long absence of any severe cyclone affecting these areas has also been widely cited to be the reason for not believing that the cyclone's impact can be so damaging. The other issue which was noticed was the lack of crop insurance in place in many areas. The areas where cashew nut tree plantation (Panrutty Thaluk) was heavily damaged, though this area was not very near to the coast, there is a realization among

farmers that that they should have gone for crop insurance, as these crops take 6-7 years for full growth after cashew plantation. These farmers would have to wait for seven years to come to normalcy as their livelihood depends on these plantations. The Government can plan for some subsidy to promote insurance policies in such cases so that the financial burden is shared and the farmers have a responsibility and need not wait for the relief from the Government sector all the time, after such disasters.

The disaster history of 2011 has set the tone for accentuating that investments are made in disaster risk reduction in the reconstruction of housing, infrastructure, and other community assets. We need to frame strategies to construct and maintain major hospitals, school buildings and public amenity building using disaster resistant technology of a higher order, as pointed out above. Moreover, techno legal and techno financing regime should be brought in to ensure that all public funded housing and buildings and construction, be it for health, education, industry, community amenities, etc. be built only with disaster resistant construction features. Further, public financing institutions for housing and infrastructure development should be advised to extend financial assistance to projects from States only when disaster resistant construction features are introduced in the proposed housing and building construction programmes.

Disaster risk Assessment:

Risk assessment measures aim at ascertaining disaster risk in a certain region or sector of the population. Taking the equation for risk provided in earlier Chapter, the specific hazards and vulnerabilities of a society or group are assessed To make a realistic assessment of the hazard it is important to determine the probability and the possible intensity of the expected natural event. In the vulnerability analysis the different political-institutional, economic and sociocultural factors must be taken into account and a vulnerability profile drawn up accordingly. Risk assessment is the outcome of the investigation of the cause-effect matrix between hazards and vulnerabilities.

The main tools in risk assessment are:

- Records of past disasters and major natural phenomena. persons/households, condition of buildings, production activities, vehicles, animals, special abilities and needs in the case of an emergency).
- As precise as possible studies on the specific geological, climatic and other hazards in the national and/or regional context.
- Drafting and updating hazard maps and vulnerability profiles with a maximum level of participation.

- ❖ Surveys of the endangered population by gender and vulnerability (especially thorough analysis of these factors using the available tools enables us to identify specific disaster risk management measures for the endangered population.

Risk assessment / analysis

A process to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability / capacity that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

The process of conducting a risk assessment is based on a review of both technical features of hazards such as their location, intensity and probability, and also the analysis of the physical, social and economic dimensions of vulnerability, while taking particular account of the coping capabilities pertinent to the risk scenarios.

Risk Assessment is understood as " methodology to determine the nature and extent of risk by analysing the potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend." " The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of the vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios…."(I.S.D.R.)

Risk evaluation entails assessment of proposed risk reduction measures from the point of view of cost efficiency. Efficiency is examined by means of cost-benefit comparisons, which imply assessing benefits procured or expected to be procured from a measure against costs likely to be incurred. Assessment has significant administrative implications in that precise understanding of the underlying process of a hazard enables formulation of targeted risk reduction policies. Precise quantification of risk is often difficult in the absence of adequate data and proper analysis techniques. Moreover, certain areas are multi-hazard prone, which poses challenge for risk assessment. Risk reduction policy for such areas require risk assessments regarding each type of hazard to arrive at an estimation of losses involved. Besides, risks are not amenable to simple quantification in that intangible factors are involved that cannot be easily indentified and quantified.

Disaster risk is seen as a function of the hazard, exposure and vulnerability. To reduce disaster risk, it is important to bring down the level of vulnerability and to contain 'exposure' by relocating populations and property away from the hazardous zones.