UNIT 8 DISASTER MITIGATION

Structure

8.0 LEARNING OUTCOME

After studying this Unit, you should be able to:

- Outline the major considerations in Disaster Mitigation;
- Understand the concept of Disaster Mitigation, its relation with Preparedness and the need for systematic planning in this regard; and
- Get an overview of mitigation activities and problems faced while implementing mitigation projects.

8.1 INTRODUCTION

Disaster mitigation is defined as *"*Measures aimed at reducing the impact of natural or man-made disasters in a nation or community*"(Carter, 1991).*

The United Nations declared the decade of the 1990s as the International Decade for Natural Disaster Reduction. The aim behind such a move was to mobilise concerted efforts on the part of the international community with active participation from the UNDP and the UNDRO towards substantial reduction in disaster-related losses round the World. These agencies will encourage and assist national governments and non-governmental agencies to tackle disaster related issues, "through projects focused directly on reducing the impacts of hazards and through incorporation of risk awareness as part of the normal operation of development projects"(Sharma, 1998).

Disaster mitigation is an *evolving/ developing science.* Its rudimentary development could be traced back to the mid 19th century when governments undertook to eradicate the threat of epidemics like tuberculosis, typhoid, cholera, dysentery, small pox and other deadly diseases that were claiming lives in an endemic manner around the world. The subsequent campaigns of governments against diseases followed realisation of the fact that diseases were controllable and preventable, and 'sanitation' was a significant activity therein, in that it was crucial in controlling the spread of any disease or preventing its onslaught. What followed could be termed as a "sanitary revolution" in that considerable budgetary allocations were committed to specific activities, like cleaning, disposal of waste, public facilities etc., besides impetus to R&D in treatment and vaccination against these 'hazards.' It demanded considerable administrative reform along with resource commitment on the part of governments towards public health measures, in that governance thereafter had to proceed with a fresh perspective, *vis a vis* diseases and craft adequate policy responses to tackle the threats involved. Evidently, there has been considerable success achieved in that endeavour in that many dreaded diseases like plague, small pox, etc., have been eradicated; though countries still have to carry on with sustained efforts to achieve the same level of success with other diseases.

Notably, the change in approach was brought about by a *demystification* of diseases following *understanding* of the phenomena underlying epidemics. Similarly, natural hazards have hitherto been treated with a fatalistic approach. Currently, there is a revision of attitude/approach, as the 'mystery' of natural hazards is being increasingly unraveled through exploratory research. Accordingly, governments are increasingly investing in disaster mitigation, preparedness and prevention since there is growing belief that tangible gains can/will result from such investment. Scientific community as also social scientists are engaged in understanding hazards from both technocratic and social perspectives, which imparts a holistic understanding to the phenomena of disasters; hence the development of capability to tackle them through adequate policy responses (Sharma, 1998).

In India, distinct shift in policy responses towards mitigation and prevention is now evident. As per Dhar (2002), earlier the approach was geared towards crisis management. The famine codes, scarcity relief manuals and calamity action plans, wherever these existed, enabled administration to fight emergencies and provide relief, post occurrence of a disaster event. Policy shift towards pre-disaster preparedness planning began in the late seventies, and gradually thereafter, deliberate attempts on the part of the government towards an integrated approach towards disaster management has been discernible. It began with drought proofing wherein considerable success was achieved. The Central Water Commission evolved a model bill for flood plain zoning, though success in this regard was limited. The main reason was that State governments were lackadaisical or constrained in enacting the bill and complying with the requirements. Now with added emphasis, post-Yokohama, and regrettable experiences with disasters like the Bhuj Earthquake and Orissa Cyclone, renewed impetus has been provided to mitigation planning. The process is expected to proceed further along desirable lines in the future, which augurs well for disaster preparedness in particular and administrative reform/ improvement in general which is imperative for disaster management. For instance, granting more say to specialists has been a much discussed reform issue over the years. Disaster management as also rural and urban development demand specialist competence, for which, organisational hierarchy would need to be reconsidered/reviewed.

8.2 CONCEPTS OF DISASTER MITIGATION AND PREPAREDNESS

Disaster mitigation embraces actions taken in advance of a disaster to reduce its effects on a community. When used in this sense, mitigation includes those actions, which are often categorised as being preparedness measures, which means, preparedness is a part of mitigation. However, a distinction is often made between mitigation and preparedness whereby:

Mitigation refers to long-term risk reduction measures, which are intended to minimise the effects of a hazard; for example, dam construction is considered an activity that mitigates the effects of droughts. Hence, "Mitigation involves not only saving lives and injury and reducing property losses, but also reducing the adverse consequences of natural hazards to economic activities and social institutions."

Preparedness is concerned with measures taken immediately before and after a hazard event, for example, relating to evacuation plans, health and safety, search and rescue etc. Hence the crucial issue would be *logistics* for which advanced preparations are necessary. *Preparedness* assumes that certain groups of people or property will remain vulnerable and that preparedness would be necessary to address the consequences of a hazardous event's occurrence.

This distinction between the two terms provides a useful division of actions because it helps to highlight mitigation as a *long-term process,* aimed at addressing the explanatory factors, which convert hazards to disasters. In comparison, preparedness does not aim to correct the causes of vulnerability, which place communities at risk in the first place, rather to tackle them through speedy and effective response; hence the emphasis on readiness in this regard.

According to Coburn Sspence, Pomonis (1994 in the DMTP, UNDP), however, not much should be read into the distinction. Mitigation is defined as "a collective term used to encompass all activities undertaken in anticipation of the occurrence of a potentially disastrous event, including *long term preparedness and risk reduction measures*.... It has occasionally been defined to include post-disaster response, which makes it equivalent to disaster management."

Significance of Mitigation

Effective measures for mitigation involve understanding of hazards and the likely damages in the event of a disaster. For example, in earthquakes most fatalities (almost 75 per cent) are caused due to building collapses, hence prevention would demand earthquake proofing of structures and retrofitting (engineering modifications) of existing ones. In floods, most deaths reportedly occur due to drowning in turbulent currents; hence, prevention strategy would require keeping people out of the track of potential water flows or by preventing the flows from occurring. Mitigation saves the economy from losses. Industry and agriculture suffer heavily from earthquakes (damaged infrastructure) and droughts, respectively. Besides, these are interdependent sectors, which means agro-based industries suffer if agricultural produce goes down and industries in general, if communications, power, labour supply *et al* get affected (Sharma, 1998).

Mitigation is usually not given the same level of priority as preparedness or recovery. This is because there is a tendency on the part of both economists and politicians to view

disasters and development in terms of "trade-offs," with needed resources being diverted from development towards disaster mitigation. The attitude can be expressed as, "we are too concerned with day to day activities to worry about disaster problems that may not occur during our lifetime." This is reinforced when the problems with mitigation elements are examined; when will the disaster occur? Do we know where it will be? What percentage of resources shall we spend? Therefore mitigation of disasters is often not perceived as important to the public or individual domain as other issues such as economic development, social advancement, health care systems, etc., are.

Yet, disasters undermine development efforts and waste resources, which have been allocated to different sectors. They interrupt ongoing programmes and divert resources from their intended use and beneficiaries. Hence, "*When disaster-proneness is well known, failure to factor it into planning represents a serious mismanagement of resources" (Alceira Kremer, Managing Natural Disasters and the Environment, World Bank, 1991).* Hence dovetailing of disaster mitigation into development planning saves adhoc *measures*, which only results in less gain and much waste. Not only can mitigation protect these other important sectors, but also, if correctly carried out, can often be justified as being cost-effective in protecting other development gains.

Mitigation is therefore, a process justified and necessary for the protection it offers to a society's development as a result of avoidance of damage and losses. It requires systematic and logical planning processes to ensure that resources allocated adequately reduce risk, and protect development. To do so, an understanding has to be reached with regard to what the effects of a disaster are likely to be and what level of protection is required. From an economic standpoint it appears logical that the amount of mitigation, which is warranted, is *that amount that can be bought for less than the expected costs of the losses.*

However, it is important to note that acceptance of this principle depends on properly identifying all the costs, *direct* (death, injuries, capital stock and inventories), *indirect* (lost income, employment and services from lost production) and *secondary* (decreases in economic growth, balance of trade deficits, etc.) and those associated with preparedness and emergency relief. Equally important but harder to assess are the immeasurable costs associated with the political, social and psychological effects of traumatic events and their conversion into real losses.

Although the initiation of mitigation should be before a disaster occurs, the major opportunity to develop and implement mitigation measures occurs as the "window of opportunity" after a major disaster has taken place as politicians and public officials, in light of public displeasure and the exigency of the situation are ready to allocate resources for the task. This is usually a short-lived period before interest and attention lessen. Therefore the opportunity should be rapidly taken up and optimised. For that, dovetailing of disaster planning with mainstream development planning is imperative.

The Need for Systematic Planning

This establishes the significance of disaster planning. (It has been briefly referred to in Unit 5). Disaster Planning, in the words of T.N. Dhar (2002), " is an important area of disaster management that involves technical social, financial, organisational and administrative arrangements that need to be made in order to be well prepared for disasters…It involves timely execution of mitigation and prevention (as far as possible) measures. To an extent, mitigation can be achieved through measures like soil and water conservation, water

storages, protection structures, land use planning and regulation, introduction of building codes, hazard zoning, risk analysis, advance zoning and relief preparation, creation of public awareness and enlisting the participation of people. For social preparedness, there is need for training and motivation and mobilisation of NGOs, Voluntary Organisations and peoples' own institutions and sensitising the media…"

Planning for mitigation involves identifying the 'elements' at risk, or the physical infrastructure and people likely to suffer harm in the event of a disaster. If there were no habitations or buildings, an earthquake would be a harmless event. Hence, coincidence/simultaneity of a hazard in situations of vulnerability, physical and/or socio economic, result in disasters. Identification of vulnerable elements is a research exercise, which is undertaken as part of vulnerability analysis and risk assessment, wherein specialists from both physical and social sciences are involved, which can be vividly, depicted on/through a map. (Identification of elements at risk along with recommended mitigation measures has been attempted subsequently in table 1).

Under the initiative of the Ministry of Urban Development, a Vulnerability Atlas of India has been prepared for the period 1994-1997, in which earthquake, cyclone and flood hazard maps for every State and Union Territory (25 states and 7 Union territories) have been prepared on a scale of 1:2.5 million. In these maps the boundaries of the districts are clearly shown so that the areas of the districts prone to the various intensities of the hazards are clearly visible. Also, the vulnerability of the buildings, as per the census of housing 1991, had been brought out in a tabular form on separate sheets for each district. This information clearly highlights the risk to the buildings of various types in every district when subjected to different intensities of the three hazards, particularly. On a larger scale, state wise vulnerability atlases have also been prepared including an action plan that the state may adopt for achieving disaster reduction. State-of-the art technologies, such as Remote Sensing, Geographical Information System (GIS), Global Positioning System (GPS), Computer Modeling and Expert Systems, and Electronic Information Management Systems (collection, storage, retrieval and dissemination of information) are being emphasised. Efforts are on consistently to modernise disaster management control rooms in states. Database is also being prepared to keep track of past events for retrospective preparedness analysis, specific areas for mitigation planning, and estimation of the probability of future occurrence/repeat events (Sinha, 2002).

A High Powered Committee was set up in August 1999 by the Government of India to prepare a disaster management plan for the country comprising national, state and district level plans. It deliberated on thirty odd types of disasters including water and climate related disasters; geologically related disasters, chemical, industrial and nuclear related disasters, accident related disasters and biologically related disasters. Significantly, the distinction between natural and man-made disasters was academic, hence not in fact pertinent. It submitted its report in 2001. Some of the important recommendations for disaster mitigation, as per the committee, are as follows:

- Promoting and encouraging R&D through creating a network of national laboratories that can provide support for early diagnosis of infections during/following disasters and harness the expertise available. Networking of laboratories within the country, with other countries on bilateral basis was recommended.
- Upgrading of skills of professionals by providing state-of-the-art training and establishing a public health laboratory training programme.

- Dissemination of information to the general public and professionals was deemed necessary and desirable.
- Availability of safe drinking water was especially emphasised to control the situation in the aftermath of a disaster. Enforcement of preventive measures to ensure unadulterated and hygienic food was stressed. Establishment of a Control Room in National Institute of Communicable Diseases for information collation in related aspects was stressed.
- For effective surveillance and rapid response activities, establishment of a national high-level inter-sectoral committee, quick response medical teams, efficient functioning of surveillance machinery, developing more effective international surveillance networks were stressed.

8.3 MITIGATION MEASURES

Once decisions have been made concerning priorities the resources to be allocated to mitigation measures to protect vulnerable populations and infrastructure can be identified. Depending on their purpose mitigation measures can be categorised as being either "structural" or "non-structural" in nature.

Non-Structural Mitigation

Non-structural mitigation measures relate to those activities and decision-making systems, which provide the context within which disaster management and planning operates and is organised. They include measures such as:

- Training and education
- Public education
- Evacuation planning
- Institution building
- Warning systems

Structural Mitigation

However, efficient non-structural mitigation measures may be, they need to be complemented by structural measures for risk reduction to both engineered and non-engineered structures. These include, constructing or retrofitting buildings and infrastructure to suitable safety levels, using suitable materials and the incorporation of proper workmanship under correct supervision. Non-engineered structures are those built by their owners or by builders lacking formal training.

A typical structural measure is an earthquake resistant building whilst a typical non-structural element is a seismic building code, training and education, building safety codes, physical measures, land use planning, public awareness programmes, etc.

Both structural and non-structural mitigation measures may be termed either "Passive" or "Active". "Active" measures are those, which rely on providing incentives for disaster reduction. They are often more effective than "Passive" measures based in restrictive laws and controls. For example, while codes and land use planning may provide a legal context for mitigation these tend to be ineffective unless rigorously enforced. Instead, measures which provide incentives such as government grants or subsidies, a lessening of insurance

premiums for safer construction, provision of technical advice provides a framework for more sustainable mitigation.

Examples of Mitigation Measures

Mitigation involves implementing long-term risk reduction measures. Measures range from large-scale flood protection measures (for example, Bangladesh, China) to income generation programmes, diversifying livelihoods, grain stores, etc., to tackle socio-economic vulnerabilities. For the purpose of illustration, some simple examples of mitigation measures are as follows:

- Strengthening buildings to render them more resistant against cyclones, floods or earthquakes.
- The incorporation of hazard resistance in structures or procedures to be followed in new development projects.
- Planning certain kinds or varieties of crops that are less affected by specific kinds of disasters.
- Changing crop cycles so that crops mature and are harvested before the onset of the flood or cyclone season.
- The adoption of land-use planning and controls to restrict activities in high-risk areas.
- Economic diversification to allow losses in one sector to be offset by increased output in other sectors.

These approaches can be categorised as development projects, but can serve more than one developmental aim if planned accordingly. Other intervention areas, which address disaster mitigation include:

- Policy concerning land regulation, low income housing schemes, environmental regulations, national food/grain security policies, etc.
- Training involving policy makers, NGO staff, etc.
- Identification of vulnerable groups.
- Public awareness amongst community members, civic groups retailers, etc.
- Information systems for monitoring, documentation, dissemination *et al.*
- Education in disciplines in construction, architecture, urban planning, agriculture, etc.
- Integrate local disaster management plan with technical and planning principles.

Modifying or removing the causes of the threat or reducing the effects of the threat, should it occur, can achieve mitigation measures for disaster reduction. The most effective mitigation measures address not only the nature of hazards but also the vulnerabilities.

The options available for mitigation include, the type of hazard faced, the perception of the scale of the risk as well as other factors. However, because of the difficulties in reducing the actual hazard threat itself, most mitigation measures are aimed at reducing the vulnerability of communities to hazard. It is hard to stop a volcano but it is easier not to build a house at the foot of one!

Elements at risk in case of each natural hazard and requirements in mitigation with regard to each are represented below in a tabular form, as per Prof. Sharma (1998) in the *Training Workshop and Vulnerability Preparedness Management Development Programme)*

Table - 1

Natural Hazards	Elements at Risk	Mitigation Strategies
Flood and Water Hazards	Anything sited in flood plains, Earth Buildings or Masonry with water soluble Mortar. Buildings with shallow foundations or weak resistance to lateral loads or impact. Basements or underground buildings. Utilities: sewerage, power, water supply. Machinery and electronics including industry and communications equipment. Food stocks. Cultural artifacts. Confined/penned livestock and agriculture. Fishing boats and other maritime industries.	**Main Mitigation Strategies** woul control and locations planning to flood plain being the site of vulne Engineering of structures in flood pl flood forces and design for elevat Seepage resistant infrastructure.
Earthquakes	Dense groups of weak buildings with high occupancy. Non-engineered buildings constructed by the householder: earth, rubble stone and reinforced masonry buildings with heavy roofs. Older structures with little lateral strength, poor quality buildings or buildings with construction defects. Tall buildings from distant earthquakes and buildings built on loose soils.	Engineering structures to withstand Seismic building codes. Enforcemen with building code requirements and of higher standards of constr Construction of important undertakings to high standards design. Strengthening of impo buildings known to be vulner planning to reduce urban densities areas known to amplify grou Insurance. Seismic zonation a regulations.

Volcanic Eruptions	Anything close to the volcano. Combustible roofs of buildings. Water supplies vulnerable to dust fall out. Weak buildings may collapse, under ash loads. Crops and livestock are at risk.	Location planning to avoid areas c slopes being used for impor Avoidance of likely lava- flow chan of fire resistant structures. Engineeri to withstand additional weight of ash
Land Instabilities	Settlements built on steep slopes and softer soils or along cliff tops. Settlements built at the base of steep slopes, on alluvial outwash fans or at the mouth of streams emerging from mountain valleys. Roads and other communication lines through mountain areas. Roads and other communication lines through mountain areas. Masonry buildings. Buildings with weak foundations. Large structures without monolithic foundations. Buried utilities, brittle pipes.	Location planning to avoid hazard used for settlements or as sites structures. Relocation may be cons hazards where possible. Engineering withstand or accommodate po movement. Pile foundations to liquefaction. Monolithic foundati differential settlements, Flexible Relocation of existing settlements may be considered.
Strong Winds	Light- weight structures and timber housing. Informal housing sectors and shanty settlements. Roofs and cladding. Loose or poorly attached building elements, sheets and boards. Trees, fences, signs etc. Telegraph poles and high-level cables. Fishing boats or other maritime industries.	Engineering of structures to withsta Wind load requirements in buildir safety requirements for non- struc Good construction practices. Micro· of key facilities; for example, tow hills. Planting of windbreaks, plan areas upwind towns. Provision buildings (for example. strong vil community shelter in vulnerable sett

Technological Hazards	Industrial plant or vehicle and its employees or crew; passengers or residents of nearby settlements; adjacent buildings; livestock/crops in the vicinity of the plant) up-to hundreds of kilometers in the case of large-scale release of airborne pollutants and radioactive materials); regional water supply and hydrology; fauna and flora.	Use of fire resistant materials, buildi smoke extraction; improving detecto systems; preparedness planning fighting and pollution dispersal c emergency relief and evacuation pla employees and nearby settlemen passengers in the case of vehicles) and off site safety plans and co conjunction with local fire departi capabilities of civil defense a authorities. Limit or reduce stora dangerous or flammable chemicals.
Drought and Desertification	Crops and Forests; human and animal health, all economic activities dependent on continuous water supply; entire human settlements if drought is prolonged.	Water rationing; conserving or re water supply by water shed manage harvesting, construction of dams aqueducts; conserving soil and erosion rates by check dams, levelin management; reducing firewooc improved fuel stoves, introducti farming and cropping patterns; pop education and training programmes.

8.4 PROBLEM AREAS IN MITIGATION

From a practical disaster management viewpoint, certain problem areas affect mitigation adversely:

- There may be long-standing acceptance of hazards by governments and communities, who may feel that traditional measures (taken over many years) are sufficient. Also, for instance, a nation may have lived for centuries with a recurring major flood problem.
- Some mitigation measures can be costly; for example, enforcement of building codes is likely to increase the cost of buildings. Building dams is costly and takes time.
- In addition, there are other national priorities, which are given more attention. Thus measures of disaster mitigation may not receive importance in national planning. Problems like political issues and no public opinion for taking preventive measures add to the lack of initiative at the national level. There could be less interest articulation in this regard resulting from low level of risk perception among common people, particularly social action groups and public policy makers.
- Lack of technical expertise for applying mitigation measures such as retrofitting may be lacking.
- Resources could be scarce, which would result in inadequate attention given to disaster mitigation concerns.
- International cooperation, especially among regional groups regarding common vulnerabilities to hazards is necessary. The same could be impeded due to political tensions between neighbouring countries.
- Fatalistic perception of disasters precludes consideration of mitigation issues in development planning. Unless it is believed that disasters could be tackled effectively through public policy, not much effort is likely in this regard on the part of governments and communities.
- There could be organisational hurdles like lack of R&D in mitigation activities, or lack of proper placing of specialists in organisational hierarchy.

In view of resource constraints, certain questions need to be answered in appraising disaster mitigation options. These questions, as per Coburn, Spence and Pomonis in DMTP 1994, are:

- What is the appropriate level of hazard for which disaster mitigation measures should be designed?
- Which facilities should be strengthened and to what level?
- Should certain type of building development be prohibited in certain areas?
- How much should be invested in disaster mitigation or emergency planning measures?

No decision process model can be applied with regard to choices between aforesaid concerns, though addressing the questions would serve to assess the choices available and help arrive at a choice. However, it is realised that in the overall, disaster mitigation is a cost effective alternative. For example, while making a cutting road, steeper angle would be the cheaper option, but the road will give way easily during heavy rainfall or strong ground tremor. Cost cutting at the construction stage would ultimately prove costly.

Limitations of Cost- Benefit Analysis (CBA)

Cost- benefit analysis (CBA) is the most widely used method in computing losses and

gains from a proposed project. The important factor in these calculations is that present losses are borne if future gains are proposed from mitigation measures. Therefore, in computation of gains and losses *a social discount rate* is introduced which gives the society's preference for present benefits over future benefits. It is a standard rate applied uniformly in all project assessments. The alternative which scores better with regard to trade-offs between costs and benefits is preferred over others. However, there are serious limitations to using CBA. *Firstly,* there are very large uncertainties about the probable levels of future losses; *Secondly*, gainers and losers from such decisions are often not the same people, hence levying just taxes to arrange for costs is difficult. Thirdly, intangible costs or benefits are not quantifiable. The very idea of costing saved/saving human lives may appear to be unacceptable (DMTP, 1994).

Alternate approach is 'Goal- oriented Risk Reduction.' As per the level of acceptable risk, explained in Section 6.6 of Unit 6, the society decides how much resources are to be spent on disaster mitigation in each particular case/activity. Seismic codes adopted in California, as per the level of acceptable risk state explicitly that buildings designed according to the codes should:

- Resist minor earthquakes without damage,
- Resist moderate earthquakes without significant structural damage, but with some non- structural damage, and
- Resist major or severe earthquakes without major failure of the structural framework of the building or its equipment, and maintain life safety.

The crucial factor is how to determine acceptable level of risk. In this context, the concept of 'balanced risk criterion' and ' cost-effectiveness criterion are discussed. In the former, risks are equalized in different activities, that is, accepting some basic minimum level of risk in all activities pursued in society. Another approach is balancing trade-offs between dangers and benefits, such as fertile soil in flood prone and near volcanic zones, or capital costs and (versus*)* saved lives.

The cost- effectiveness criterion attempts to evaluate the unit cost of saved lives in different protection mechanisms available and then taking the decision. Other attributes are computing benefits of saved lives separately, in total financial costs and benefits. Different considerations are weighed separately to make proper choices.

8.5 GUIDING PRINCIPLES OF MITIGATION

The following principles are widely recognised as providing a valuable guide to Disaster Mitigation:

- **Initiation**

1) Disasters offer unique opportunities to introduce mitigation measures.
2) Mitigation can be introduced within the three diverse contexts of reconstruction, new investment and the existing environment. Each presents different opportunities to introduce safety measures.

- **Management**

3) Mitigation measures are complex and interdependent, and they involve widespread responsibility. Therefore, effective leadership and coordination are essential to provide a focal point.
4) Mitigation will be most effective if safety measures are spread through a wide diversity of integrated activities.

5) 'Active' mitigation measures that rely on incentives are more effective than 'Passive' measures based on restrictive laws and controls.

6) Mitigation must not be isolated from related elements of disaster planning such as preparedness, relief and reconstruction.

- **Prioritisation**

7) Where resources are limited, priority should be given to the protection of key special groups, critical services and vital economic structures.

- **Monitoring and Evaluation**

8) Mitigation measures need to be continuously monitored and evaluated so as to respond to changing patterns of hazards, vulnerability and resources

- **Institutionalisation**

9) Mitigation measures should be sustainable so as to resist public apathy during the long periods between major disasters.

10) Political commitment is vital to the initiation and maintenance of mitigation.

8.6 TOWARDS MITIGATION

Effective mitigation requires a participatory approach, which involves senior levels of government and private sector as well as at the local levels of government and community based organisations. Such an approach facilitates identification of needs, the establishment of practical solutions and a combined sense of responsibility in programme implementation. Local communities also play a significant role in effective disaster mitigation through meaningful participation in planning and execution of schemes for the purpose.

Some of the actions/steps desirable towards mitigation are:

- A clear and comprehensive National Disaster Management Policy that addresses all aspects of disaster management and ensures that mitigation is given proper consideration and priority.
- Adequate assessment and monitoring of disaster hazards and vulnerabilities, in order that the need for mitigation measures is accurately identified and defined. Indeed, effective vulnerability analysis is a primary requisite for mitigation programmes.
- Adequate and accurate analysis of all reasonable mitigation projects. In this regard, it is especially important to achieve sensible gain/loss comparisons; for instance, whether by instituting mitigation measures programs, the nation and community are going to gain more (bearing in mind the cost and restrictions involved), as against the losses which might arise if nothing is done.
- A permanent Disaster Management Centre or Agency should be created. The existence of such a centre is vital for coordination and collation of activities and information respectively in overall disaster management activities.
- Insistence by the disaster management centre or agency that a post-disaster review is undertaken after each major disaster event. The review must include advice to the government on whether, as a result of a particular disaster, mitigation measures are adequate or additional mitigation measures are needed.
- Recognition that mitigation measures can originate from all levels of government, not only from national level. Since the local levels would be the first responders to any disaster, therefore mitigation measures are essential and more obvious at this level.
- Specialist programmes may assist large-scale mitigation measures, for example,

agricultural programmes to assist farmers.

- Adequate public awareness and educational prpgrammes, in order assist communities in playing their appropriate part in mitigation measures.
- Regular monitoring and evaluation: Levels of vulnerability to hazards are constantly changing, as are the resources available to meet the threats. In some cases, the probability of hazard occurrence also varies depending on changes in the environment they occur. To remain effective mitigation actions have to be monitored, evaluated and if necessary improved against these changes in the risk to populations and societies

8.7 RESOURCES RELEVANT TO MITIGATION

The main resources, which are most relevant to mitigation measures and programmes, are given below:

Activity	**Resources**
Identification and Analysis of Disaster Risk, Hazards, Vulnerabilities and similar Aspects	• Academic and Research Institutions • Technical Authorities • Departments and Agencies concerned with hazards (for example. meteorological, seismological, hydrological) • Government and private agencies having public responsibility (dealing with land, sea and transport systems) • Private sector authorities dealing with projects or production which may generate potential threat (chemical factories etc.) • International Agencies
Need and possibilities for implementation	• Government Organisations • National Planning Authorities • Disaster Management Authorities • Specialised Agencies
Implementation	• Government Organisations • Non Government Organisations • Military Forces • International Disaster Assisting Agencies • Disaster Management Authorities
Sustainability of the programme	• Non Government Organisations • General Public • Educational & Training Authorities • Media

Special Considerations

Above discussed steps, resources and circumstances for formulating and implementing mitigation programmes are likely to differ in various countries. Therefore, in addition to the above, the following considerations are likely to have some general application:

- If possible, a simple broad strategy should be devised to cover foreseeable mitigation requirements. This strategy should contain component programs, with desirable priorities.
- The strategy should be interlocked, as far as possible, with national development planning, environmental considerations and other disaster management activities.
- A system for monitoring and reviewing the strategy should be introduced and applied.
- Responsibilities for overseeing and coordinating the mitigation activities should be clearly defined.
- There should be a requirement of an annual progress report covering mitigation activities; this should normally be embodied in an annual disaster management report.
- Mitigation programmes should not be regarded as, or be allowed to become a separate activity. They should be a part of an integrated national programme.

Sustainability

Mitigation measures should be sustainable so as to resist apathy during the often-long periods between major disasters. To affect this there needs to be strong level of political commitment. Measures taken also have to be explained to the public and standards set for planning etc. need to reflect the reality of normal public behaviour, perception and prioritisation. Mitigation and its associated costs will only be supported and incurred if the purpose is understood and it is a reasonable response to the scale of the threat posed. Should a gap exist between the actual risk faced and a society's perception of it, awareness generation based on the reality of the situation will be required. Ways to maintain mitigation include:

- An active public awareness programme
- Well documented success stories of risks that were reduced in a past disaster
- Institutionalising mitigation into normal government practice
- Updating of risk assessment and cost benefit analysis
- Maintaining commitment

Sustained commitment on the part of governments would result in a new culture in disaster management standing firmly, in the words of Anil Sinha (2002) on the four pillars of:

- Culture of Preparedness
- Culture of Quick Response
- Culture of Strategic Thinking; and
- Culture of Prevention

8.8 CONTRIBUTION OF UNITED NATIONS AGENCIES IN DISASTER MITIGATION

The significance of international cooperation in disaster mitigation could not be understated. Disasters know no national boundaries and cannot be pre-warned on most occasions. Concerted efforts alone could save the devastation wrought by the fury of natural disasters. International cooperation is needed in technical dissemination regarding hazard control technology, sharing of warning information, common craft of strategies, telling what works and what doesn't, which helps other countries facing similar subsequent events. For example, flood preparedness in Bangladesh would benefit a far off land like Brazil, solely through information sharing. The United Nations coordinates efforts in this regard. It has organised United Nations Disaster Management Teams (UN-DMT), in each country to act as support systems to national governments during times of crises. UN assistance extends from post disaster rehabilitation and relief to disaster preparedness and mitigation planning that is, involving all activities in the Disaster Management Cycle. Nature of contribution is advising governments, mobilising technical and material resources as per mandate and cooperate with UN Resident Representative or any other coordination mechanism in place. The following UN agencies are involved in the following ways:

United Nations Disaster Relief Organisation (UNDRO) promotes study of Risks and their reduction as well as information dissemination to promote disaster management and planning. It is entitled to utilise up to 50,000 $, following request of assistance from the government and approval of the same by the UNDRO coordinator.

United Nations Development Programme (UNDP) promotes incorporation of disaster mitigation in development planning and funds technical assistance for all aspects of development planning. $50,000 per occurrence is sanctioned for immediate relief and up to $1.1 million for long- term rehabilitation and reconstruction programmes.

FAO (Food and Agriculture Organisation) focuses on agriculture, livestock, fisheries, and local food production. It monitors availability and possible shortages in the future. It is authorised to utilise up to $20,000 for a project.

World Food Programme (WFP) provides targeted food aid for humanitarian relief and supports rehabilitation, reconstruction, and risk reduction development programmes. Fund allocations are to the tune of $45 million per annum and allocations are made from the International Emergency Food Reserve and WFP general resources.

World Health Organisation (WHO) provides assistance and advice in all aspects of preventive and curative health care including the preparedness of health services for rapid disaster response.

United Nations High Commissioner for Refugees (UNHCR) seeks durable solutions for problem of refugees and seeks to assist them in the country of asylum.

United Nations Educational, Scientific and Cultural Organisation (UNESCO) contribute to the duty of geological and hydro-meteorological agencies in particular besides assessing and mitigating risks from natural hazards in general.

United Nations Center for Human Habitation (UNHCS) promotes incorporation of natural disaster mitigation concepts in urban planning and management. It attempts to develop innovative methodologies for hazard and vulnerability analysis.

United Nations International Children's Emergency Fund (UNICEF) assists in child health and nutrition especially in disaster prone areas.

Other UN agencies, specifically engaged in /for South East Asia are:

The Asian Disaster Reduction Center (ADRC), established in Kobe, Japan, collates information regarding disasters from different countries within the region and carries out research and dissemination work.

Asian Disaster Preparedness Center (ADPC) in Bangkok is a focal point in Asia and Pacific for promoting disaster awareness and developing local capabilities. It is a regional resource center for promoting best practices in disaster management. It is the regional focal point for the United Nations International Decade for Natural Disaster Reduction (UN-IDNDR) UN-ISDR for Asia and the Pacific.

Asia-Pacific Disaster Management Center, Manila, Philippines is a non- governmental agency actively involved in disaster management plans in India.

8.9 CONCLUSION

A successful strategy for risk reduction will eventually incorporate mitigation into development planning and hence, everyday practice. This also happens in other walks of life, for example, the requirement of road testing of vehicles to stay on the road, or the adherence to building codes for safe building in new (formal) construction. A further example is the way with which preventative medicine has now been accepted as a normal process of public health care. Pre-requisites to enable this are:

- The commitment to mitigation of key actors including communities, government, its agencies and NGOs.
- The integration of mitigation to all stages of the disaster cycle, including in particular the stages of disaster, relief, rehabilitation.
- After risk assessment has taken place there is a need to prioritise mitigation actions towards protecting key elements within a society. Measures taken will be either structural or non structural in nature.
- Active mitigation measures which promote rather than enforce risk reduction are more successful - those at risk need therefore to understand why mitigation is necessary, a process which can be achieved in part through training.
- Mitigation planning needs regular review and evaluation to meet the threats posed by ever changing hazard characteristics and vulnerability.
- The normalisation of mitigation within a society is the hallmark of strides towards effective risk reduction.

8.10 KEY CONCEPTS

Assessment : Assessments are relevant to both pre and post-disaster situations. Post-disaster, it involves estimation of direct and indirect losses, short-term and long-term and how they could be curbed in future events. In the pre-disaster phase, it involves vulnerability analysis to different hazards. It is an inter-disciplinary exercise requiring involvement of experts from various fields, both science and social sciences, collation of knowledge

under a single umbrella organisations (preferably) and its communication to relevant decision centers.

Geographical Information System : Analysis that combine relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programmes for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced. This definition is attributed to the Asian Disaster Reduction Center.

Global Positioning System : It is a worldwide radio navigation system that was developed by the U.S. Department of Defense. It uses satellite signals to track the location or position of vehicles or vessels on earth. In addition to military purposes it is widely used in marine, terrestrial navigation and location based services. India is using GPS extensively for surveying, precision agriculture and environment monitoring.

Mitigation : Mitigation is the aim of all disaster reduction efforts. It refers to long-term measures taken towards reducing the impact of inevitable disasters, considering the hazard proneness and frequency of past events. Examples of mitigation measures include, flood plain zoning to avoid habitation in hazard prone zones, building codes to ensure hazard resistant structures.

Remote Sensing : Remote sensing is the science of deriving information about the earth's land and water areas from images acquired at a distance. It usually relies upon measurement of electromagnetic energy reflected or emitted from the features of interest. This understanding is attributed to Campbell (1987).

Retrofitting : Retrofitting refers to engineering modifications to make existing structures disaster proof. Retrofitting techniques include flood proofing, elevation, construction of small levees, and other modifications made to an existing building or its yard to protect it from flood damage. Access more information on retrofitting at www.msdlouky.org/programs/crssite/fpglossary.html.

8.11 REFERENCES AND FURTHER READING

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8.12 ACTIVITIES

1) Study and organise a group discussion on the case study given below. Note down all the comments and suggestions that come from the participants. Finally compile the recommendations that from the view of the students could have helped to implement the program more effectively.

Case Study

The experience of Tarun Bharat Sangh (TBS) in the past twenty years in Alwar region has been that the solution to the severe water crisis is in mobilisation of rural communities to use their rich tradition of water conservation by constructing water-harvesting structures and managing their natural resources. This region was going through an ecological breakdown with depletion of resources, forest and wildlife. However, during the last 18 years, TBS has put in concerted and free spirited efforts in mobilising the people of the villages to be flag bearers of their surrounding environment. The traditional water structures are a prime example of the ingenuity of inexpensive simple traditional technology that is quite remarkable in terms of recharging ground water of the entire region; Tarun Bharat Sangh has successfully accomplished this in Alwar with mobilization of the villagers, regenerating 6500 sq. km of land.

Amongst the various issues, the one aspect of this region that has a bearing on everything else is the water resource or the lack thereof. Taking this as their driving force, TBS has been responsible for mobilizing villages of Alwar district to build 4,500 johads, anicuts, check dams or water harvesting structures to collect rainwater in 1050 villages regenerating 6500 sq. km of land. The environment, which was deteriorating due to intensive and improper use of resources and mining activity, was revived. As farming activity resumed in hundreds of drought prone villages and self disciplinary codes were set by the villagers with regards various aspects like cutting trees and poaching, the revival of the traditional water harvesting structures revived five rivers Ruparel, Aravari, Sarsa, Bhagani and Jhajwali flowing again after remaining dry for decades. Nembi and the Sariska region, which were declared "dark zones", have been converted into "white zones" thus rejuvenating the environment of the entire region.

2) Considering the disaster, which your area/village is prone to, try and prepare a disaster mitigation strategy/plan considering the resources and restraints. Assign roles to members of the community. Also, include the traditional mitigation measures from the elderly people in the community.