UNIT 14   STRATEGIES FOR SURVIVAL

Structure

14.0   LEARNING OUTCOME

After reading this Unit, you should be able to:

- Discuss strategies for Disaster Prevention and Control;

- Understand the role of the administrative agencies involved in Disaster Management; and

- Understand the application of Information Technology in Disaster Management and the Role of the Armed Forces in Disaster Response.

14.1   INTRODUCTION

Hazards have increased in number as the civilization has progressed. There are now newer kinds of threats apart from the ever-present natural hazards, which also have got more intractable as man's intervention with natural processes has increased. Hence, the price of civilization has been 'uncertainties' and unexpected catastrophes, both natural and man made or both, which require to be addressed if years of gains have to be protected and built upon. It is now conclusively settled that development has increased the risk of disasters and also created newer kinds of vulnerabilities. More people are dying due to transport accidents than today than was the case a few decades back (World Disasters Report, 2004). International conflicts have added to disaster risks. Post September 11, the threat of terrorism has made the concept of disaster more inclusive and disaster management a more multi dimensional function in that, deaths due to heat strokes, severe cold or transport are now a part of disaster concept and hence more urgent problems. These problems had not been treated as disasters up till now, but global warming has created these new hazards, which require serious attention on the part of nations and the international community.

Tackling disaster events and preparing for the same requires both broad- based and generic policy (at the macro level), and more specific strategies (at micro levels) that tackle region specific hazards and specific vulnerabilities of communities within the broad framework of and indications made in the policy statement. For example, control of industrial hazards requires legislation and safety regulations, which are stringent enough to trap detractors. This would be part of the wider strategy of pollution control, which in turn forms part of the wider objective of controlling global warming and climate change. Pollution control would require laws and strict enforcement of such laws by concerned agencies. This would require imparting requisite authority and responsibility to agencies responsible for implementation of such laws and regulations and flexibility of administrative processes to facilitate intervention at appropriate stages to prevent a hazard turning to disaster (drought to famine); or minimising its impact and limiting its scale, when incident. Corruption would need to be checked through stricter vigilance over implementation processes. Both the hazards referred above, would require activism on the part of the media to create awareness among people to 'voice' their genuine concerns and press for policy in this regard.

Personnel Strategies

Earthquake and flood hazards require structural mitigation measures like earthquake and flood proofing of buildings, land use regulations etc. incorporating traditional building knowledge with modern engineering knowledge and engaging peoples' participation in mitigation, preparedness and response as explained in previous Units. Government initiative in this regard would imply strategies aimed at human resource development, manpower planning, training and development to build expertise in civil engineering and related arenas and administrative reforms with a view to making governance corruption free, flexible and empowered with requisite authority to intervene at appropriate stages and ensuring peoples' participation. For disaster response, strategies are required for mobilisation of efforts at various levels, local, regional, state and national/international, depending on the scale and reach of the disaster; whether, localised or nation wide and so on. Effective synergy has to be established between government and civil society and the private sector. There is considerable stress on *empowerment* of communities in the new paradigm of public administration and also disaster management, post Yokohama, to promote self help on their part through training and awareness generation, especially among vulnerable communities. To that end, strategies to build social capital through catalytic state intervention are important.

Coordination Strategies

Strategies for coordination between state, civil society and private sector are critical for the success of any policy, more so, disaster management. Each have their defined roles in that NGOs mobilise communities, world on an international scale and provide expertise in many matters, the private sector creates jobs and income and the state establishes conducive the political and legal environment for such effort. A general tendency, particularly among NGOs has been evidenced of distrust in the state. They have to get in a closer mode of interaction with the state (Palakudiyil and Todd, 2003). Strategies to encourage research and development in disaster phenomenon in particular regions are also being taken up.

Coping Strategies

Indigenous coping strategies are also important. When people are aware of the probability

of hazard occurrence, they develop their own coping/ safety mechanisms. Such coping strategies, which one may call survival strategies, work on the assumption that an event will follow a familiar pattern, and past experience could be successfully drawn upon to meet present/future threats. Most disasters have such precedents; however, some hazards, which lie dormant for long periods, cannot be treated on the basis of memory, as data gets destroyed because of improper storage or other technical difficulties or is simply not available. Then, there are also unprecedented hazards, like the AIDS pandemic, which are completely intractable. Such hazards have to be 'controlled' because their cure has still not been found. Containment of AIDS requires national and international effort based on specific strategy, applied innovatively as per need articulation through survey based researches from time to time, which bring to light aspects of the disease like the mode of spreading; for instance; which has been found to be different in different nations, and other related issues. The fallacy of humanitarian assistance, specifically food aid to tackle AIDS pandemic in Sub Saharan Africa has been exposed. Food aid worth $600 million (2002-03) could not avert the tragedy of 3 million dying last year, 2.2-2.4 million of which were in Sub Saharan Africa. A "multi-dimensional response is needed, which incorporates support for local economies and livelihoods, agricultural irrigation and production, urban food security, education, clean water and sanitation-as well as prevention of the disease and care for those who succumb to it (World Disasters Report, 2004).

Reform Strategies

Existing policies and laws may need to be modified in accordance with such special requirements, for which, in built flexibility in policy making and implementation processes as well as in the formal procedure, administrative hierarchy implying 'unity of command' (one superior) and span of control (number of subordinates under supervision) if the requirement arises.

The above account gives a broad categorisation of strategies. In the above context, it would now be in order to discuss specific kinds of strategies to tackle different disaster related problems.

14.2   KINDS OF STRATEGIES

I)   **Preventive Strategies:** Preventive strategies are attempts to avoid the disaster altogether or reduce its scale considerably to the extent possible. This technique of survival strategy requires successful political mobilisation at all the levels i.e. both at National and Local levels. In the words of Kofi Annan, " More effective prevention strategies would save not only millions of dollars, but save thousands of lives. Funds currently spent on intervention and relief could be devoted to enhancing equitable and sustainable development instead, which would further reduce the risk of war and disaster. Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; they are the disaster that did not happen" (Annual Report on the work of the United Nations, 1999). The enforcement and implementation of such a strategy is often easier in the immediate aftermath of a disaster, when public awareness is high and the political pay off of government action, significant. In case of low risk perception, investing in preventive options may be considered a wasteful expenditure. In the third world risk perception of disasters is low and there are not enough resources to   allocate to disaster management. The result has been repeated

losses in the same geographical regions and communities because of lack of preparedness on the part of administration. Orissa, for example did not have a disaster management plan when the super cyclone struck in 1999. Clearly the lessons had not been learnt from previous experiences. Andhra Pradesh on the contrary, arranged for disaster management through state and community preparedness through synergic partnership between state and community based organisations and generation of awareness among people living near the coastline. Cyclone shelters and warning systems had been arranged before the cyclone struck. The death toll of 1977 cyclone exceeded 10,000. It was only 960 in 1990, when the cyclone struck again (Todd and Palakudiyil, 2003).

Preventive strategy should be fundamental in that it should attack the root cause of the problem, at the level at which it originates, which could be micro, local, levels or intermediate regional, or macro national/international levels. In practical terms it would imply keeping off dangerous times and spaces, such as offshore fishing in small open craft during the storm season, evading seasonal and/ or altitudinal concentration of disease vectors (malaria mosquito) and choosing locations for housing that are less exposed to wind, flood or mass movement of earth. Thus, preventive strategy is the best survival strategy that requires awareness on the part of the local people and good amount of investment on the part of the government. A community-based approach is a must for a successful preventive strategy, which tackles fundamental / core vulnerabilities at the local level and provides for protection through self-help. People are passive beneficiaries in a government-based approach, "indifferent if not completely distrustful of government". Government mobilisation is also slow since the formal process has to be observed. By contrast a community based approach focuses on strengthening of Panchayati Raj institutions, empowering the communities through fostering a self help culture, and, making up for the shortcomings of government service delivery which is often shows signs of "criticised for ill coordinated relief and duplication" among agencies involved in similar work. When power and responsibility are transferred to the people instead, feeling of self-reliance in place of dependency is inculcated, communities are energized and begin to realise that with organizations and training, they have the resources to withstand even severe disasters (Palakudiyil and Todd, 2003). Gram Vikas a rural development organisation has been working in Orissa since 1979. Their chief work has been the Rural Health and Environment Programme (RHEP) which is a development initiative involving people closely through membership in the two bodies: the Village General Body, and the Village Executive Committee. The former comprises all adult male/female members of the village; the latter, of four men/women nominated by the General Assembly. These organisations take care of both the physical (disaster proofing of buildings) and social infrastructure (building social capital through meetings and assemblies) in the village. Collective assets are maintained (grain stocks) for use in contingencies. The village of Tamanna in Orissa where Gram Vikas's RHEP progamme has been in operation for years reported no loss of life and bounced back to normal within 7 days. The village of Garedipancham in Orissa, apart from sustaining itself could help neighbouring villages recover from the devastation. Panchayat Raj institutions are crucial for community level disaster preparedness. It forms a pivot around which all work of community based organisations, international, non -government organisations and local volunteers is organised. However it has to be protected from vested/nefarious interests (oligarchs who successfully circumvent the electoral process and arrogate power unto themselves). As pertinently put, " as vehicles of disaster preparedness,

the PRIs, if reformed, are unsurpassed" (Palakudiyil and Todd, 2003) and also as institutions of self-governance. Successful results in disaster response and preparedness have come from wherever PRIs have operated free of corruption. After the Gujarat Earthquake it was the local panchayat that absorbed the first shock; organised relief and rescue operations; set up community kitchens; involved all non- government, government and external agencies in immediate relief. They were subsequently sidelined by parallel agencies set up by the government, handling different programmes under different organisations and the potential was never fully realised. The cohesiveness of effort was lost and often repeated woes of lack of coordination *et. al.* hampering organisations' functioning. The message is loud and clear; enable local, institutions with proper devolution of power, and transfer of responsibility. Funds should be earmarked for use in emergencies and PRI members should be trained in handling modern communication equipment.

II) **Impact Minimising Strategies:** When such type of strategies for survival are formalised and made part of the objectives of government policy, are known as 'mitigation' strategies. For example, these strategies seek to minimise losses due to disasters and facilitate speedy recovery in its aftermath. Administrative preparedness, enactment of enabling legislation, promulgation of acts to vest authorities with requisite legal power and legitimate administrative authority are important components of impact minimizing strategy. Two generalisations could be made regarding such strategies. *First,* the objective of such strategies is to secure basic needs, to restore/ resume normal life as soon as possible. Such strategies are also in tune with and contribute to the wider developmental objective of reducing poverty and encouraging growth. This further bridges the gap and distinction between poverty and vulnerability. *Second,* sustenance of improved conditions of living has to be ensured over time in a socially and/or environmentally risky environment. This usually implies diversification of access to resources. Setting up non-agricultural income sources and strengthening or multiplying social support networks can attempt this in agricultural, pastoral and livestock productions. Alternate livelihood opportunities should be opened and certain backward classes granted upward social mobility through enhanced economic provision. This makes the social profile more horizontally broad based rather than vertically differentiated. Economic power through better 'choice' between livelihood options lessens somewhat the rigors of social hierarchy.

III) **Strategies to Create and Maintain Labour Power:** Strength of labour power in an economy is determined by economic imperatives. In poor third world countries, children are considered assets since they add to the net income of the household. Nature of production is labour intensive since industrial processes are not at an advanced stage of technical sophistry. Labour intensive techniques are also economically more viable for the industry since labour is surplus and cheap which keeps the overall cost of production low. This reinforces the incentive to have more children. This explains partly, the reasons for lack of success of population control measures. Hence having more children is a survival strategy followed by poor families. Having a large number of children is also thought to improve security by increasing the possible future incomes to which the family would have access. The motive is also part cultural, in that religion prohibits adoption of birth control in certain communities or simply a matter of tradition in some others. The issue also has a psychological dimension too in that children are considered to be a less risky investment than land and also that a reduction in the perceived risk of severe and acute deprivation brings

about a change in the desired number of children (Cain, 1978). Cain compared two communities in Bangladesh and in nearby East India. Greater desire for children was seen in Bangladesh. The inference was that higher level of risk of disaster in Bangladesh seemed to create a greater desire for children and more actual births. By comparison, in the Indian village, the level of mortality, social security and health provisions were superior, hence no marked urgency to have more children was evident. Thus, by creating and maintaining more labour power, one can easily handle and mitigate the after effects of a disaster. The matter of concern, however, is that leaving matters of population purely to tradition or religion might lead to another disaster, that of population explosion. Hence government intervention no matter how studied or cautious would be necessary to control the rate of population growth.

IV) **Strategies for Building up Stores of Food and Saleable Assets:** Vulnerable communities cope with hazards by making provision during good 'seasons' for lean 'periods.' Reserves of food stock and other essential commodities are built up during normal times, or comparatively more prosperous times, to sustain life during periods of deprivation, especially due to periodic disasters. For example, India is subject to periodic cyclones, floods and droughts. For those rural masses who have access to land, storage of grain and other staple food is the most important buffer against expected seasonal shortages, as well as prolonged periods of hardship. Accumulation of small stock and chickens is another shield (Watts, 1983). Pastoralists are seen following a strategy of increasing herd size in years with high mortality. The Deccan Development Society is a local NGO, which has been working among rural communities in Andhra Pradesh for the past 20 years. It is active now in 65 villages and focuses on food security of the local farming families and building up their livelihood bases. The government public distribution system (PDS) provides five key staples (wheat, rise, cooking oil, kerosene and sugar) to the poor at subsidized rates. Though success of PDS in reducing poverty is undeniable, some of the shortcomings noticed have brought to light the critical significance of peoples' participation in governance. By building the PDS on rice and wheat, which is primarily grown in irrigated fields, other food grains on which families in arid and semi arid regions used to subsist got discouraged. Hence, DDS has identified two key areas of activity: cultivating idle land, and reintroducing customary farming practices. A grain fund is maintained out of loan repayments in kind by landowners, which is used for food provision at highly subsidized prices for poor households. The money goes into a village bank account. Traditional seed varieties, which had almost been lost, are being rediscovered and stored at a seed bank. (World Disasters Report, 2004)

V) **Strategies for Diversification of Production:** Farming people and farm workers are often regarded as 'risk averse' (in the sense of avoiding chances in cultivation that may bring higher rewards but with greater exposure to dangers). Less educated/ aware farmers in developing countries fall prey to natural hazards, particularly droughts, because they remain ignorant of modern risk mitigation measures which farmers in developed countries widely apply. Farmers in hazard prone areas are encouraged to adopt mixed cropping, inter cropping, cultivation of non-staple root crops and use of kitchen gardens. This strategy often results in a 'normal surplus' in good years since it is planned for a sustainable supply in contingency situations. Planting a greater variety of crops provides the best chance of an optimum yield under all conditions of weather, plant diseases, and pest attack. It is also one of the most assured precautionary strategies for coping with food shortage. Diversification

strategies often make use of environmental variations, including farming and different activities, soils or diverse ecosystems on the slopes of mountain systems. It is not only agricultural production that needs to be brought under this strategy for diversification of production, but agro-based industries and also forest-based industries should be covered under this net. These strategies can prove to be good survival strategies in times of distress. In this context it would be pertinent to discuss strategies to tackle climate change. As per IPCC, 2001, in the 21st century, Asian countries would need to produce more food and other agricultural commodities under conditions of diminishing per capita arable land and irrigation water resources and expanding biotic stresses, including climatic constraints. The dual demands for food and ecological security would have to be based on the appropriate use of biotechnology, information technology, and eco-technology. Practical achievements in bringing about the desired paradigm shift in sustainable agriculture will depend on public policy support and political action. Critical areas for intervention would be:

- Improving the availability of seed/planting material of high-yielding varieties

- Developing and promoting the use of hybrids, especially for rain fed agro-ecosystems

- Expanding areas under different crops and commodities, through diversification of agriculture

- Improving the productivity of crops, existing plantations, and livestock

- Developing infrastructure for post-harvest management, marketing, and agribusiness

- Small farm mechanisms

Transfer of technological inputs through assessments and refinements at regular time intervals in consonance with our understanding of climate variability and climate change" (Inter Governmental Panel on Climate Change, 2001).

VI) **Diversification Strategy for Income Sources:** The entirely self-provisioning rural household is an ideal type, which is very rare in the world today. Even the most isolated people in the Amazon rainforest, the Andes, Northern Quebec (Canada) or the Himalayas engage in production or sale. In addition, the remittance of income from wage earners who have moved to distance cities, mining sites, or plantations is very important to rural livelihoods in many parts of the world. This is sometimes graphically represented by the economic disruption and hardship caused when crises erupt in such systems as with the hundreds of thousands of migrant workers from Egypt, Bangladesh and the Philippines who left Iraq in 1991 as a result of the conflict. Non-farm income becomes even more important following disasters that temporarily disrupt farm and livestock production, handicrafts, handlooms, extractive enterprises such as charcoal, honey and gum collection have often been noted in strategies for survival in different parts of the world. A series of 'sideline' occupations, sometimes illegal or quasi- legal is a main stay of 'normal' life for urban dwellers and even more important as a fall back if employment is interrupted by an earthquake, flood or landslide.

VII) **Development of Social Support Networks:** These include a wide variety of rights and obligations between members of the same household, within the extended family and the other wider groups with a shared identity, such as a clan, tribe and caste.

Within the household and family, "successfully securing resources in potentially disastrous times depends upon the implicit bargaining strength of its members, and of their 'fall back' position" (Agarwal, 1990), or "break-down" position, as Sen terms it, in case "co-operation in this bargaining process should fail" (Sen, 1980, 1990). Women tend to lose in such conflicts for scarce resources and are affected adversely in matters like who eats first, the share of available food, and lack of access to cash earned by other family members. The range of resources controlled by women, and employment opportunities open to them, tend to be more limited. The disintegration of the family and abandonment of women, children and old people expresses the breakdown of such obligations. Development of social support system also includes some governmental initiatives like providing social security, employment schemes for women as target group beneficiaries. During times of droughts or even floods, governments provide gratuitous relief to persons who have been severely affected. This is also a part of the development of social support systems.

VIII) **Post Event Survival and Coping Strategies:** Once the hazard, which had been foreseen, understood and prepared for, actually befalls a population, the preparedness measures are implemented. They are retrospectively assessed and future preparedness incorporates improvements, which are considered necessary. Hence behaviour of relief agents at the times of disaster is 'studied' behaviour, which is based on plans prepared in advance. When there is potential food shortage or possible famine, the period during which stress develops can be long, allowing for a succession of strategies. Such pattern or sequence has been discerned in a number of case studies. This endorses the need for flexibility of administrative processes and requisite powers on the part of local agencies and district administration to intervene early to prevent large-scale disaster. Here the significance of common property resources for allowing access to food is important. The next step involves calling on resources from others, which usually involves reciprocal social interactions and avoiding usurious rates of interest and therefore preserves the longer-term access position of the individual or the household. At the same stage, secondary sources of household income other than the dominant one may be tapped, such as wage-labour, petty commodity production, or artisan work. Sale of important assets such as oxen for ploughing, agricultural implements and livestock to maintain minimum food levels, migration of the whole household to roadsides, towns, and possible sources of food often ensues.

IX) **Early Warning Systems Strategies:** One of the tools that have been developed since the Indian Famine Code and particularly since the famines in the '*Sahel'* in the 1970's have been famine early warning systems. It can be defined as 'instruments for measuring variations in the factors that determine a population group', food situations, vegetation cover, estimating preferably in quantitative terms, the consequences of these variations and finding specific solutions, which prevent a famine from occurring'. There is the FAO's Global Information and Early Warning System developed in the 1970's, which predicted crop yields by estimating biomass from satellite imagery. Such technical sophistry however is not much useful because it is not user friendly or explanatory enough and the information does not generally percolate down to the lowest level, that is, the vulnerable communities. An example of a successful community based early warning comes from the Coyolate river basin in Guatemala, which was inundated by yearly floods. The National Emergency Council with the help of the Swedish International Development Agency (SIDA) began a project in 1997 to establish a community based warning system and undertake other risk management

measures. Local people were trained in handling a simple communication set to monitor rainfall and river levels, their cooperation elicited in developing hazard maps, and other disaster response activities. The experiment has been successful in preventing losses due to disasters.

X) **Strengthening Livelihood Systems:** Moving to less direct measures for preventing famine, the strengthening of rural livelihoods is the most obvious policy requirement in improving disaster resilience of communities. Of course, these measures can have larger development objectives other than famine prevention. In India, the government has attempted land-tenure reforms, improved agricultural production technology (including irrigation), encouraged better processing and storage, operates a fairly effective public distribution system of food grains and has a well tried decentralised emergency response mechanism. These have meant that a reasonably effective famine prevention strategy has emerged. However, this list of achievements apparently has not led to the abatement of widespread malnutrition in India. Nonetheless, it becomes difficult to demonstrate the level of impact of different rural development policies in famine prevention, except in general terms. This is because the causes of famine are essentially conjectural and always involve more immediate and local factors.

14.3 SURVIVING DISASTERS

Disaster preparation must include lessons from the past, especially if there are some data that can help identify the main vulnerabilities and priority areas, as different countries face different types of natural disasters.

14.3.1 Socio-Economic Aspects of Survival

All manners of economic and social issues receive inadequate attention in the debates on "environment and development" and "managing the global commons". Family life, community, stratification and individual dignity and fulfillment all suffer from varying degrees of neglect, while international security, nature/society relations, economic alternatives, and processes of social change are really in need of new strategies to mitigate the impacts of these neglects resulting in extreme events.

Vulnerability can be interpreted as loss of effective power in the creation of one's own future; one is made part of a collective future or some entity's future. Risk matters are inescapably about different futures. Will, with these changes in risk come increasing contentiousness and uncertainty?

With scientific and technical advancements, newer risks are being generated. High level of uncertainty will accompany many of the newer risks- genetic engineering, cybernetic hazards, and global change. Such uncertainties, and the growing need for anticipation and forecasting of risk, have lent 'voice' to the demand for precautionary policy. The question remains, which field/agency is relied on to make precautionary policy? This would call for greater applications of science and formal analysis at time when society, in its democratic impulses, appears more suspicious and skeptical of both. The current debate over the precautionary principle, which has gained prominence in the 1990s, suggests what is likely to be a continuing source of tension. The prime questions are, whether science and expertise will carry forward our course to new futures or whether moral principles and the desire to limit the influence of expertise will gain ascendancy. Hence

risk assessment has to answer moral concerns as much as physical. The contradiction may not be easy to resolve.

In addition, this grappling with risk futures will become more explicitly international and global in scope. In a world in which regions and places are more tightly integrated in a global economy and social communication system, risk would have international ramifications. Some of these risks will be those associated with systematic global environmental change; others will reflect the growing reach of technologies, information systems and global economy. Thus, notions of "our common future" are not just wishful rhetoric.

There is risk inherent in changing orientations to economic growth, technological innovations in some ways. At the close of the twentieth century, a single economic system, that is, capitalism, has embarked on a new period of global spread. Capitalism is enjoying a new heyday while risk aversion is growing. This aversion is expressed in demands for 'good governance', transparency and accountability of government and policies that are responsive to the interests of the people, or public interest.

14.3.2 Strategies for Survival through Risk Assessment

Risk assessment deals with a contentious subject, that is, how a society balances potential dangers posed by environmental contaminants (some with potential to cause cancer, birth defects, neurological damage, or species extinction) with benefits and how much it is willing to sacrifice, in the sense of inconvenience for success of environment protection measures. They may have to keep up, with a possible ban on plastic bags, certain animal based products like fur coats, cooperate with alternative forms of waste disposal etc. in that unpopular policies may be 'politically inexpedient'. Risk assessment reports play a central role in the risk management decisions, for example, whether to clear and give a go- ahead to a proposed project and institute risk reduction activities to reduce human or ecological risks or to restrict the project itself. Risk assessment helps indicate problem areas, pollution in this case, which aids decisions on project siting, land use planning etc. The constraints in risk assessment exercise is that it occurs within a highly political framework. If political considerations outweigh economic or environmental, potential for harm to human health and environmental quality, is not curbed. There could be difficult decisions such as imposing penalties, legal liability or regulatory enforcement on big business.

Many people expect that the results of a risk assessment would provide a true estimate of risk, which may not be true. Risk assessment can provide only an estimate of risks within the framework and limitations set by the data available, expertise to analyses the data, and broad decisions of the government. Besides, risk assessment may not be as objective as is expected. Risk assessment cannot be used to predict exact risks. It cannot say that who will or will not be the person that has their health affected by a chemical, process, activity or site. It can give risk estimates with associated limitations and uncertainties.

The processes of 'exposure' and 'effect' are analysed and modeled in a risk assessment. Uncertainty can enter risk assessment through both *exposure* and *effect centered analyses*. In an exposure process, subjects are exposed to the possibility of damage. The *effect process* is the harm that is inflicted. For example, children are exposed to lead through ingestion (paint chips, dirt, dust and contaminated food and water), inhalation (dust particles) and dermal contacts. Possible effects of lead poisoning in children include decreased intelligence, impaired neurobehavioral development, decreased stature and, in

severe cases, death. Since the sources of the harmful agent have been identified, mitigation policy can accordingly be crafted, provided political or commercial considerations do not outweigh environmental/ecological.

14.3.3   Recovery and Survival

Recovery is the process by which communities and   nations return to the pre- disaster mode of functioning. Three main categories of activity are normally regarded as coming within the recovery segment. These are:

1)   Restoration;

2)   Rehabilitation; and

3)   Reconstruction.

Rehabilitation and reconstruction comprise most of the disaster recovery phase. This period following the emergency phase focuses on activities that enable victims to resume normal, lives and viable means of livelihood. It also includes the restoration of infrastructure, services and the economy, in a manner, appropriate to long-term needs and defined development objectives, rehabilitation of affected populations so as not to induce newer vulnerabilities or affect the ecosystem adversely (relocated in ecologically fragile environment) by ill thought out rehabilitation policy. After some disasters, there also may be a need for continuing humanitarian assistance for selected vulnerable groups. Disaster response is the sum total of actions taken by the people and institutions in the face/aftermath of a disaster. It commences with the warning of an oncoming threatening event or with the event itself if it occurs without warning. Disaster response includes the implementation of a disaster preparedness plans and procedures. The culmination of disaster response comes with the completion of disaster reconstruction, rehabilitation and restoration programmes. Over the last decades, the costs of emergency responses, disaster recovery and rehabilitation have shown an alarmingly increasing trend.

14.3.3.1 Concerns in Recovery and Survival

Women children, backward sections and disabled form the most vulnerable sections of society. Their vulnerability is exacerbated during disasters. Their rehabilitation is a matter of special concern in response efforts. Unresponsiveness to such concerns has resulted in ineffective relief operations that get off target, which is expressed as, and show unmet objectives in balance sheets. Women's' skill as householders make them good 'technicians' and 'managers'. Their potential could be harnessed in disaster recovery operations, especially in tending to the old and infirm and working for community kitchens. Understanding gender relations is important also for strategic reasons in that long-term social relationships among women are affected by insensitive emergency interventions (Ariyabandu, 1999). Children form the other special target group. Many children are orphaned or rendered homeless which exposes them to pimps and child traffickers. There have been reports of children bought and sold during disasters for menial and jobs of a hazardous nature. Many others fall prey to hunger, diseases, mal nutrition and epidemics. Many newborn babies die for want of care and nutrition. Many children homes are also destroyed. Reports of corruption in orphanages has forced change of government stance in that children should be kept in transit homes (temporary shelters) till they are rehabilitated; given over to relatives or adopted by willing couples as a last resort. Palakudiyil and Todd (2003) give an account of initiatives taken in the aftermath of the Orissa Cyclone. In December 1999, post Orissa Cyclone, 'Mumta Gruhas' were set up as temporary

shelters to house children affected. With the initiative of a German NGO, SOS and cooperation of the Department of Women and Child Development, 'Children Villages' were set up which was a scheme of putting children under a 'house mother' to give them a family atmosphere. They were subsequently handed over to their relatives. Efforts were made by the government to revive 'Anganwadis' and set up crèches; reconstruct schools, provide informal education to children till school reopened, and above all, elicit childrens' participation in restorative activities like cleaning, and disposing of waste. With the assistance of UNICEF, Child Labour Prevention Centers were set up to stop trafficking of children. There have been reports of buying and selling of children for sex trade and beggary from earthquake hit Muzaffarbad in Pakistan (2005). The guise used is often 'adoption'. This has brought to the fore the critical importance of maintenance of law and order, hence police services in the aftermath if a disaster.

14.4   MITIGATION OF NATURAL HAZARDS

While the cause of the event (either an earthquake or a cyclone or a flood) may vary, the effects and mitigation needs among the individual natural hazards are not much different. Observations of past natural disaster events reveal the following common hard facts:

a)   Variance in performances is expected between newer and older construction, with the latter usually being inferior to the former;

b)   Performance of the built environment is affected not only by design requirements, but also by the quality of construction (method of construction, quality of materials and workmanship) for both the structural and non-structural components;

c)   There is a technical knowledge gap:

- Between performance of newer and older construction; hence there is a need of studying the performance of older buildings in relation to the new ones;

- In developing codes for new construction and establishing guidelines for development of existing construction, for which more research and development is needed;

- Between scientific research and practical needs, there is a need of better reciprocal input between theory (research) and practice;

- There is lack of regulations (legal and retroactive requirements) and institutionalised cooperation between government and other stakeholders.

Some of the areas where improvement is urgently needed are:

- Integration of relevant Armed Forces formations into disaster management planning at all levels from District to State and Central Governments.

- Setting up a modern, permanent national command centre or operations room, with communications and data links to all the State capitals. The national command centre or operations room needs to be manned on a 24-hour basis by professionals to cater for instant integrated response. There needs to be a properly equipped operations room at the State level as well.

- Establishment of a National Stand by, Quick Reaction Teams comprising experienced professionals, both military and civilian, drawn from Central and State Government staff to respond immediately by flying in a matter of hours an experienced response team to the locations when a disaster strikes. This team can be organised and run professionally on the same lines as the United Nations Disaster Assessment and Coordination (UNDAC) teams.

- Creation of urban search and rescue capacity at all levels, by establishing a fully equipped Search and Rescue unit, as part of the fire service in all the State capitals, with trained staff and modern equipment. This is of immediate relevance since a major weakness exposed in the Gujarat earthquake was a lack of specialized urban search and rescue capability in India.

- Media policy geared to handling the growing phenomenon of real time television reporting, which generates enormous political pressures on a government to respond rapidly and efficiently. This needs attention since the effect is going to increase, not decrease in future.

- Closer interface with and better understanding of the international system for disaster response, and putting in place, systems for dealing with international assistance once it comes in e.g., customs, immigration, foreign policy implications etc. A greater appreciation is needed for the speed and automation of modern international response to a natural disaster. Closer interaction is required between the Ministry of External Affairs and the relevant inter-national agencies concerned with disaster response.

- Standard procedures for dealing with domestic humanitarian and relief assistance from non-government sources. Procedures and systems need to be set out to avoid confusion and ensure best utilization of the assistance being offered, just as in the case of systems for international assistance.

- There is need for a modern unified legislation for disaster management. In view of the current division of responsibilities between the State and Central Government into state, central and concurrent lists, there is a need to create a body of legislation dealing with response to natural disasters and other emergencies, clearly delineating responsibilities and powers of each entity and specifying what powers or actions would need to be triggered on declaration of a disaster by the Government of India or a State Government. This legislation should also incorporate the current legislation dealing with chemical emergencies that has been created by the Ministry of Environment so that all emergencies are dealt with one law. The legislation should include clear definitions of what constitutes a disaster at a national level.

14.5 EMERGENCIES AND POST-DISASTER ASSISTANCE

The overall aims of emergency and post-disaster assistance are:

- To ensure the survival of the maximum possible number of victims, keeping them in the best possible health in the circumstances;

- To re-establish self-sufficiency and essential services, as quickly as possible for all population groups, with special attention to those whose needs are maximum, the most vulnerable and underprivileged;

- To repair or replace damaged infrastructure and regenerate viable economic activities. To do this, in a manner, that contributes to long-term development goals and reduces vulnerability to any future recurrence of potentially damaging hazards.

- In situations of civil or international conflicts, the aim is to protect and assist the civilian population, in close collaboration with the International Committee of Red Cross (ICRC) and in compliance with International Conventions. In case involving population displacements (due to any type of disasters), the aim is to find durable solutions as quickly as possible, while ensuring protection and assistance as necessary in the mean time. There are important differences, however, between sudden and slow onset disasters. Differences also emerge when comparing the specific geographical situation and the disaster's socio/political context. The following are typical activities for survival:

Warning: Warning refers to arrangements to rapidly disseminate information concerning imminent disaster threat to government officials, institutions and the population at large in the areas at immediate risks.

Evacuation/ Migration: Evacuation involves the relocation of a population from zones at risk of an imminent disaster to a safer location. For evacuation to work there must be a timely and accurate warning system, clear identification of escape routes, an established policy that requires everyone to evacuate when an order is given, and a public education programme to make the community aware of the plan. The movement of people from the zone where they are at risk to a safer site is not in fact, evacuation but crisis- induced migration.

Search and Rescue: Search and rescue, often known by the acronym SAR, is the process of identifying the location of disaster victims that may be trapped or isolated and bringing them to safety and medical attention.

Post-Disaster Assessment: The primary objective of assessment is to provide a clear, concise picture of the post-disaster situation, identify relief needs and develop strategies for recovery. The post-disaster assessment must distinguish between pre-disaster chronic conditions, which are worsened in critical times, and post disaster trauma among victims.

Ready resources are the key factor in post disaster assistance. As a long term measure, Primary Health Care centers should be reformed and readied for emergency situations.

Emergency Relief: Emergency relief is the provision on a humanitarian basis of material aid and emergency medical care necessary to save and preserve human lives. It also enables families to meet their basic needs for medical and health care, shelter, clothing, water, and food. Government has to tackle the problem of too much relief too soon, from indigenous and international donors, probability of theft and other forms of criminality, black market in relief items etc. Inventory management should be a crucial component of disaster preparedness. The delivery of emergency relief will require logistical facilities and capacity of well-organised supply service is crucial for handling the procurement or receipt, storage, and dispatch of relief supplies for distribution to disaster victims.

Communication and Information Management: All the above activities are dependent on communication. There are two aspects to communications in disasters. One is the technical aspect, or the equipment that is essential for information flow, such as radios, telephones and their supporting systems of repeaters, satellites and transmission lines. The other is information management, content and protocol of knowledge communication,

which communicates what information to whom, what priority is to be given to it, and how it is to be disseminated and interpreted. Coordination of effort is dependent on communication.

Survivor Response and Coping: In the rush to plan and execute a relief operation it is easy to overlook the real needs and resources of the survivors. The assessment must take into account existing social coping mechanisms that might even obviate the need to bring in outside assistance. On the other hand, the ambit if social service may be widened as special needs of the vulnerable sections; the sick and the homeless etc. would have to be handled.

Security: Security is always a priority issue after a sudden onset of natural disaster(s). There are incidents of looting which have to be immediately controlled. Communal feelings are also incited during periods of such stress, which turn to serious law and order problems if not controlled immediately.

Emergency Operations Management: None of the above activities can be implemented without some degree of emergency operations management. Policies and procedures for management requirements need to be established well in advance of the disaster. The chief actor in emergency operation and management are the army and the police and para-military organisations. The concept of incident command is pertinent here. It was started in America after a series of wild fires in California in 1970s. Incident command is based on integration of efforts in the field between all organisations, a 'modular organisation', which expands, and contracts as newer agencies join it; agency autonomy, modern operations as per modern management principles like management by objectives (MBO), end orientation; discovering new sources of resource, joint planning, resource management, timely intelligence and thoroughly planned operations (Irwin, 2002).

Rehabilitation and Reconstruction: Rehabilitation and reconstruction complete the disaster response activities. The disaster occurred because the society was vulnerable to the impact of the hazard concerned. Rehabilitation and reconstruction must therefore not be seen as a process of simply restoring what existed previously. Assistance to rehabilitation and reconstruction must therefore be planned on the basis of a thorough assessment and appraisal of the technical and social issues involved. While the planning of such assistance cannot be unduly rushed it must be accomplished as expeditiously as possible. There are two reasons for this:

A)   Certain rehabilitation and reconstruction measures if organised rapidly enough, can shorten the period for which emergency relief assistance is needed and eliminate the need to invest resources in temporary measures.

B)   The window of opportunity may be short for the risk reduction measures in reconstruction (of housing for instance) or new development initiatives (especially social aspects). The majority of people affected are the poor. For the poor, disasters represent lost of property, jobs, and economic opportunity. In real terms, that can mean enormous total economic setback. Therefore, reconstruction assistance should be designed to:

- Relieve economic constraints and reduce the cost of reconstruction
- Reject capital into the community
- Create employment opportunities
- Support and strengthen existing economic enterprises

Timely and imaginative planning is therefore required to dovetail rehabilitation and reconstruction with short-term "relief" measures, and to make the most effective use of external financial resources, materials, and technical assistance in achieving development gains while satisfying humanitarian needs.

14.6 APPLICATION OF INFORMATION TECHNOLOGY IN DISASTER MANAGEMENT

Information technology is being used for practically all applications discussed above. It specific uses in the highlighted areas can be discussed separately. Information and communication Revolution is set to play a major role in not only disaster response but also preparedness and mitigation activities by creating awareness of the same among government officials and common people in general and helping strategise effectively for disaster response and developmental planning in general. It is possible to map disaster prone areas today. The problem with traditional manual maps is that they are tedious and time consuming to prepare, difficult to update and inconvenient to maintain. Therefore, nowadays remote sensing is emerging as a popular means of map preparation, and Geographical Information Systems (GIS) can be used for storage, analysis and retrieval. Under remote sensing techniques, maps can be prepared using satellite data or aerial photographs, and are then digitized and stored on computers using GIS software. Once this is done, they can be retrieved and viewed on the computer any time. They can easily be enlarged or reduced, and even printed (Vinod K. Sharma at http://www.GISdevelopment.net). Sharma examines the application of satellite communications in hazard mitigation, response and preparedness.

 Mapping can be done regarding road and rail links, urban and rural pockets, socio economic profiling, e.g. scheduled castes and scheduled tribes in a region, pockets of intense poverty, degree of vulnerability as per different indices, total resultant vulnerability, categorization on a vulnerability index etc. These maps can be superimposed on each other depending on the context within which specific information is required. This can serve as an important policy tool as techniques get more sophisticated and speedy and effective policy formation as well as implementation is required. Specific IT tools are discussed below (Arora, 2003):

Remote Sensing

Remote sensing (RS) is the science of extracting information about the earth's surface from "images acquired at a distance". It differs from aerial photography which deals with only the visible spectrum while RS covers the infrared and microwave regions also. Data from satellites is downloaded in digital form at Earth receiving stations, where they are converted into photographic form. Objectives are differentiated on the basis of differing brightness or colour. Data image processing is a highly technical process involving large-scale anslysis of data received from image sensors.

The Geographic Information System (GIS)

Disaster management is a multi disciplinary function involving information from various sources. Data obtained from remote sensing has to be studied in conjunction with data from ancillary sources like socio economic data, topography, soil type etc. that is analysed to deduce relevant information. The global positioning system (GPS) has increased the scope of GIS. The GPS is a satellite based radio-navigation system that provides real

time data to GIS. For example in earthquakes studies, the GPS may be used to measure the deformations caused by an earthquake. This information along with seismological and other data may be analysed in GIS to locate the source of an earthquake.

14.5.1 Application of IT tools

Drought

Satellite data may be used to target potential ground water sites for taking up well-digging programmes. Satellite data provides valuable tools for evaluating areas subject to desertification. Film transparencies, photographs and digital data can be used for the purpose of locating, assessing and monitoring deterioration of natural conditions in a given area. Vegetation cover can also be monitored to notice signs of an impending drought.

Earthquake

GIS and Remote Sensing can be used for preparing seismic hazards maps in order to assess the exact nature of risks in specific locations and facilitate targeted structural mitigation measures for these areas. The epicentral maps are used for preparing seismic hazard maps. Seismic zoning map is in the code for designing earthquake resistant structures. Apart from earthquake data, geological factors, structural design, soil data etc., are used for preparing the building codes. More sophisticated information regarding other important factors like gravity, magnetic, geodetic, electrical data are necessary. These data are then used to prepare micro-zonation maps, which are used for urban and rural planning (*ibid*).

Floods

Satellite data can be effectively used for mapping and monitoring flood inundated areas, for flood damage assessment, flood hazard zoning and post-flood survey of rivers configuration and protection works. River configurations are studied post flood, to assess the status of embankments and spurs, which offer natural protection against floods. Corrective action might be needed if any damage is detected.

Landslides

 Landslide zonation maps provide information about an area's susceptibility to landslides, area likely to be affected in case of a landslide, rate of slope mass movement etc. These maps are useful for government, private business and non-government agencies for various purposes. These maps are used for development plans, town planning, master plans for cities, construction of highways etc., land use planning in the sense of avoiding high risk zones and decision making during disaster response.

Volcanic Eruptions and Forest Fires

There are two active volcanoes in India; Narcondum and Barren Islands, located in Bay of Bengal about 130 km North-East of Port Blair. The Barren Island Volcano erupted after 200 years of lying dormant in March-November, 1991. Vent temperature, lava flows and extent of damage to forests was done applying satellite imagery. Similarly, damage due to forest fires and regeneration of these areas is being closely studied with the help of remote sensing. This answers important research purposes and helps early warning and evacuation.

Search and Rescue

GIS can be used in carrying out search and rescue operations in a more effective manner by identifying areas that are disasters prone and zoning them as per the intensity of the impact, estimating people and infrastructure at risk, computer simulation of likely damage in the area, etc. Most significant is the role of the locals in the area who are in the best position to guide the response effort. Pointing out missing members, searching in the rubble, etc., is facilitated by their participation. Real time disaster management through satellite is currently being development. When ready, it would ensure speedy operation of disaster response activities.

Internet

Disaster mitigation communication has been greatly facilitated by the internet. Launching of a well-defined web site is a very cost-effective means of intra-national and international linkage. It provides a new and potentially revolutionary option for the rapid, automatic, and global dissemination of disaster information. A number of individuals and groups, including several national meteorological services, are experimenting with the Internet for real-time dissemination of weather observation, forecasts, satellite and other data. In the most critical phase of natural disasters electronic communication have provided the most effective and in some instances perhaps the only means of communication with the outside world.

Warning and Forecasting System

An advance system of forecasting, monitoring and issuing early warnings plays the most significant role in determining whether a natural hazard will assume disastrous proportions or not. The countries have the following forecasting systems:

Indian Meteorological Department (IMD)

IMD provides cyclone warnings from the Area Cyclone Warning Centers (ACWCs). It has developed the necessary infrastructure to originate and disseminate the cyclone warnings at appropriate levels. It has made operational a satellite based communication system called Cyclone Warning Dissemination System for direct dissemination of cyclone warnings to the cyclone prone coastal areas. IMD runs operationally a Limited-area Analysis and Forecast System (LAFS), based on an Optimal Interpretation (OI) analysis and a limited area Primitive Equation (PE) model, to provide numerical guidance.

National Remote Sensing Agency (NRSA)

Long-term drought proofing programmes on the natural resources of the district have been greatly helped by the use of satellite data obtained by NRSA. Satellite data can be used very effectively for mapping and monitoring the flood-inundated areas, flood damage assessment, flood hazard zoning and past flood survey of river configuration and protection works.

Seismological Observations

Seismological observations in the country are made through national network of 36 seismic stations operated by the IMD, which is the nodal agency. These stations have collected data over long periods of time.

Warning System for Drought

The National Agricultural Drought Assessment and Management System (NADAMS) has been developed by the Department of Space for the Department of Agriculture and Cooperation and is primarily based on monitoring of vegetation status through National Oceanic and Atmospheric Administration's (NOAA) Advanced Very High Resolution (AVHR) data. The drought assessment is based on a comparative evaluation of satellite observed green vegetation cover (both area and greenness) of a district in any specific time period, with that of any similar period in previous years.

Flood Forecasting

The Central Water Commission (CWC), Ministry of Water Resources, issues Flood forecasts and warnings. These are used for alerting the public and for taking appropriate measures by concerned administrative and state engineering agencies in the flood hazard mitigation. Information is gathered from the CWC's vast network of Forecasting Stations on various rivers in the country.

Cyclone Tracking

In view of the enormous disaster potential of cyclones, the need for study and analysis of the phenomenon has been recognised by the scientific community. The result of this information has been collection of historical data on cyclones, which has enabled systematic study of the phenomenon from the point of view of risk analysis as per the needs of different societies. Cyclone warning is an important short-term measure though it needs to be complemented with long-term mitigation strategies involving measures such as preparing and educating the community is not in any way undermined. Information on cyclone warnings is furnished on a real-time basis to the control room set up in the Ministry of Agriculture, Government of India. High-power Cyclone Detection Radars (CDRs) that are installed along the coastal belt of India have proved to be a very useful tool to the cyclone warning work. These radars can locate and track approaching Tropical Cyclones within a range of 400 km. Satellite imagery received from weather satellite is extensively used in detecting the development and movement of Tropical Cyclones over oceanic regions, particularly when they are beyond the range of the coastal radars. The existing mode of dissemination of cyclone warnings to various government officials is through high priority telegrams, telephones, telex and fax. (Gupta, 2005) According to Todd and Palakudiyil, (2003), early warning should be more than a technological instrument to detect, monitor and inform. It should communicate the warning in a way that is intelligible to non-technical people and the lay public. Many people in Orissa did not heed warnings issued by the Indian Meteorological department about the impending cyclone in 1999, simply because they could not follow them. Hence a warning system should be user friendly in that warning agency should not employ too much scientific jargon or technical sophistry in its communications to the lay public. More direct communication is recommended that gives information that is more relevant to the vulnerable communities, like the extent of a tidal wave for fishermen in coastal areas.

14.7   ROLE OF THE ARMED FORCES

Disaster management being a multi-disciplinary subject involves interaction between several agencies, departments and non-governmental organisations. In this context, the Armed Forces have been at the fore front in assisting state governments during such disasters. The army provides invaluable infrastructural assistance, which is helpful in rescue and relief

operations. Because of their extensive mapping of geographical terrains and deep studies and war time preparedness disaster response is effective and quick. According to a U.S Government study on disaster response in India, the organisational strength of the armed forces, their high sense of discipline, the enormous manpower at their disposal and their excellent human resource management makes them an extremely useful tool in providing disaster relief. In particular, the Army's expertise lies in 'advocacy planning' in disaster preparedness specifically. Advocacy planning acts as catalytic agent for:

a) Analysis of options for local self-government, NGOs and other community based organisations.

b) Seeking a cost effective approach to bring maximum benefits to a wide range of beneficiaries at an affordable cost.

c) Clear allocation of responsibilities to various agencies and coordination.

d) Understanding in social psychology, particularly human behaviour and response of communities and various institutions.

e) Generating community participation, public awareness and management of information.

f) Relief measures and managing assessment techniques.

g) Community health and casualty management

h) Post disaster rehabilitation and reconstruction, including its social and economic aspects.

j) Monitoring methodologies.

Apart from its role in advocacy planning, the armed forces are often called out to assist civil authorities in dealing with natural calamities like cyclones, earthquakes, floods and man-made disasters such as air and rail accidents. Their expertise ranges from humanitarian aid, food supply, medical assistance, evacuation of casualties and emergency relief, to providing assistance to local government in bringing early normalcy. These operations are commonplace in peacekeeping. (Ray, 1999) The Charter of Duties for armed forces in the country is: -

Primary Role: The primary role of the armed forces is to preserve the national interests by safeguarding the territorial integrity of the nation against external threat, as well as the nation's strategic interests in the region.

Secondary Role: The secondary role of the armed forces is to assist the civil administration in handling internal threats, maintenance of essential services as also to assist the national and state governments during natural and other calamities.

The Indian Armed Forces are supposed to be called upon to intervene and take on specific tasks only when the situation is beyond the capability of the civil administration. In practice, the Armed forces are the core of the government's response capacity and tend to be the first responders of the government of India in a major disaster. Due to their ability to organise action in adverse ground circumstances, speed of operational response and the resources and capabilities at their disposal, the armed forces have historically played a major role in emergency support functions such as communications, search and rescue operations, health and medical facilities, transportation, power, food and civil supplies, public works and engineering, especially in the immediate aftermath of

disaster. Disaster management plans should incorporate the role expected of them so that the procedure for deploying them is smooth and quick.

The armed forces have made laudable contributions in the following areas of disaster response in the last decade. (Kushwaha, 2002)

Search and Rescue: The armed forces' capability, particularly for search and rescue is indispensable in the event of disasters in remote areas.

Communications: The army has state-of-the-art communication network which can be utilized in case of breakdown of the civil communication network. This was unequivocally proved during the Orissa super cyclone of 1999 and the Gujarat Earthquake of January 2001 when the army's INMARSAT phones were the only means of communication between Delhi and the state capital for the initial 72 hours.

Debris Clearance: The Earth moving equipment of the army is invaluable for such tasks as demonstrated in the Latur and Gujarat Earthquakes.

Casualty Evacuation and Medical Aid: The army's fleet of ambulances and helicopters including those of the air force are vital for timely evacuation of casualties. The Army has a vast capacity for establishing field hospitals for treatment of the victims. During the Orissa super cyclones, the Army moved its field hospitals from Mathura and Chandigarh for treating the victims.

Roads and Bridges: The Army engineers have a vast array of road construction of bridging equipment from as far as Calcutta to bridge the National Highway, which had been breached stranding thousands of trucks for days.

Transportation of Food and Essential Supplies: The Army as well as the air force plays a vital role in this area during any disaster situation especially during earthquakes and floods/cyclones.

14.8   CONCLUSION

Coping and survival strategies are often complex and involve a sequence of activities involving obtaining and managing resources in times of adversity, particularly disaster. They grow out of the recognition of the risk of an event and adjustments in the established patterns of response. People seek not just survival but also the maintenance of other vital requirements of civilized life, such as respect, dignity and the maintenance of family, household and community cohesion. These survival strategies have long lasting impact on social relations involving caste and class hierarchies that come under pressure due to changing economic relations (as per resource even liability) New social capital may be built up as many strategies have been internalised as a way of life, which have dismantled the old social order and supplanted the new. Therefore disasters do not just change the physical ecology of a region. They reconstruct social relations as well; in other words, have a 'social engineering' impact.

14.9   KEY CONCEPTS

Bargaining Process   :   Amartya Sen employs the economic analogy to describe the power equations in social relations, which make   certain   segments   of   the   population   more

vulnerable than the others on the basis of factors, like gender, class, etc. Women lack the bargaining process v*is a vis* men and are therefore at a disadvantage in disaster resilience response and coping capacity because of less 'entitlements' or 'means' for a better life and 'capability deprivation' due to unequal access to education and food as compared with their male counterparts.

Pandemic : The term pandemic is used to denote an epidemic that spreads to other countries and becomes an international humanitarian crisis. The word epidemic is used to describe a disease that is limited to the national scale.

Strategy : Strategy is a well thought out course of action. It can be referred to as a plan of action towards attainment of desired end. Distinguished from plan, strategy is more specific and targeted while the latter is a more broad based, comprising different strategies, therefore a more inclusive concept.

14.10   REFERENCES AND FURTHER READING

Agarwal, Bina, 1998, "The Gender and Environment Debate," Keil, Roger Bell, V.J David, Penz Peter and Leesa Fawcett (Eds.), *Political Ecology: Global and Local*, Routledge, New York.

Aggarwal, P.K. and S.K. Sinha, 1993, "Effect of Probable Increase in Carbon dioxide and Temperature on Productivity of Wheat in India", *Journal of Agricultural Meteorology,* 48(5), 811-814.

Arora, K. Manoj, 2003, "Role of Remote Sensing in Disaster Risk Reduction " Pardeep Sahni, Madhavi Malagoda Ariybandu, (Eds*), Disaster Risk Reduction in South Asia*, Princeton-Hall of India, New Delhi.

Ariyabandu, Malagoda, Madhavi, 1999, *Defeating Disasters: Ideas for Action,* A Duryog Nivaran Publications, Sri Lanka.

Cain, M, 1978, "The Household Lifecycle and Economic Mobility in Bangladesh", Center for Policy Studies Working Paper, *Population Council*, NewYork.

Climate Change 2001: Working Group II: "Impacts, Adaptation and Vulnerability", Inter Governmental Panel on Climate Change at, http://www. grida.no/climate ipcc_tar/index

Gupta, Alok, 2005, "Information Technology and Natural Disaster Management in India' online at http://www.GISdevlopment.net

Irwin, L. Robert, 2002, "The Incident Command System (ICS)", Paper Presented in the Training Programme on Disaster Management, Lucknow University, India.

Kushwaha, M, 2002, "Role of the Armed Forces" Paper Presented in the Training Programme on Disaster Management in India, Department of Public Administration, Lucknow University, India.

Palakudiyil Tom and Mark Todd, 2003, "Facing up to the Storm: How Local Communities can cope with the Disaster: Lessons from Orissa and Gujarat", Christian Aid, PO Box 100, United Kingdom

Ray Arun, 1999, Discussion Core Group, at the VSM International Seminar organised in New Delhi, March 17 -19.

Sharma Vinod K, "Use of GIS Related Technologies for Managing Disasters in India: An Overview," at, http://www.GISdevlopment.net

Sen, Amartya, 1990, *Development as Freedom*, Oxford University Press, London.

Watts, 1983, "On the Poverty of Theory: Natural Hazards Research in Context," Hewitt K. (Ed), *Interpretations of Calamity*.

World Disasters Report, 2004, International Red Cross and Red Crescent Societies.

14.11   ACTIVITIES

1)   Write short notes on:

   a)   Preventive Strategies

   b)   Impact minimising strategies

   c)   Socio-economic measures to tackle vulnerabilities

2)   Discuss strategies to tackle climate change. Talk to experts in the area and write an essay in about 500 words on ways to control climate change.