
UNIT 17 STRATEGIC DEVELOPMENTS FOR VULNERABILITY REDUCTION

Structure

- 17.0 Learning Outcome
- 17.1 Introduction
- 17.2 Population Growth and Vulnerability
- 17.3 Infrastructure for Vulnerability Reduction
- 17.4 Interactive Areas in Policy-making
- 17.5 Hazard Resistant Designs and Construction
- 17.6 System Management
- 17.7 Strategic Planning for Vulnerability Reduction
- 17.8 Social Infrastructure for Vulnerability Reduction
- 17.9 Experimenting with Technology
- 17.10 Vision for the Future
- 17.11 Conclusion
- 17.12 Key Concepts
- 17.13 References and Further Reading
- 17.14 Activities

17.0 LEARNING OUTCOME

After reading this Unit, you should be able to:

- Understand causative factors of Vulnerability;
- Analyse various ameliorative strategies; and
- Look at the vision for the future with appropriate issues involved and recommendations of strategies.

17.1 INTRODUCTION

Vulnerability is a measure of exposure to critical stress or hazard combined with the restricted capacity to cope. Vulnerability is a function of *powerlessness*; it is created as people face phenomena beyond their control and, at times, comprehension. Vulnerability can arise out of power equations owing to which the exposed are deliberately kept ignorant of their danger or their positioning vis a vis dangers. Many risks are the result of people being misinformed for a variety of political or commercial reasons. Access to food, in contrast to its production, is the most important explanatory variable in food security and the resilience of populations. Amartya Sen (1981) has developed this into a theory of “*entitlements*”. He argues that entitlements are rights, which individuals can

access and most famines are caused by political actions that determine such entitlements. Thus, he explains how all the major famines of the past century, such as the Bengal famine beginning in 1943 and the famine in China in 1958-60 were results of lack of access to food, not absolute scarcity. Drawing upon these insights, the underlying connection between vulnerability of societies and poverty in relation to the paucity/access to resources in the context of population pressure in a poor developing/underdeveloped society is explained. By this approach, it is social groups and individuals that are vulnerable to changes in their socio-economic and environmental circumstances and thus need to adapt to such changes through self-help measures like occupation diversification or migration through catalytic state action/assistance. An alternative geographical perspective hypothesises that regions and areas can be defined as vulnerable or critical based on the environmental and socio-economic pressures incident (Jeanne Kasperson, et.al., 1995). The argument is, that identifying *criticality* brings about opportunities to overcome adversity or stress through the focused application of technology and new institutional devices. The onset of criticality is a manifestation of ill-adapted institutional arrangements, acting without precautions or consideration for the vulnerable.

17.2 POPULATION GROWTH AND VULNERABILITY

The demographic factor is important in many biophysical assessments of vulnerability, for examining the capacity of the physical environment to support populations. One example of this approach is a study by the Food and Agriculture Organisation of the United Nations on the food production potential and population-carrying capacity of lands in the developing world (FAO, 1984; Higgins, et al., 1983). This study on the basis of climate and soil constraints estimates the agricultural production potential of lands that determines the calories available for consumption to people and the cost at which they are available. This process identifies certain regions and countries as ‘critical zones’ in which the current demand for food already exceeds the agricultural production potential that is, the carrying capacity. The number of critical zones in the FAO study increased dramatically when population growth was included in the estimates of carrying capacity, for the year 2000. The analytical framework of understanding vulnerability is biophysical determination of vulnerability to food shortage (Hekstra and Liverman, 1986).

Today we find ourselves in a demographically divided world where national projections of population growth vary widely from that any other time in history. In most European countries and Japan, population has stabilised or is declining; but in others, such as Ethiopia, Pakistan, and Saudi Arabia, population is projected to double or even triple before stabilising.

Many countries that have experienced rapid population growth for several decades are showing signs of “demographic fatigue”. Governments are struggling with stresses and strains of providing education and employment requirements for a growing number of people and managing environmental degradation that comes with uncontrolled population growth. Without a concerted effort by national governments and the international community to attend to sociological changes such as weakening social and filial ties, and developmental factors like land scarcity and water shortage could become unmanageable, which could lead to political instability, economic decline, rising death rates and increase in vulnerability; heightening future disasters’ potential.

The world is already facing the consequences of past neglect of the population issue. Two regions, where death rates are already rising or show signs of rise are Sub-Saharan Africa

and the Indian Subcontinent, which together contain 1.9 billion people, which forms nearly one third of humanity. Without clearly defined government strategies in countries with rapid population growth with active assistance from the international community, one third of humanity may fall into a “demographic black hole” (Brown, 2001).

Increasing population pressure is outweighing provision of national and social security services like hospitals, educational institutions etc. If birth rates do not come down soon, these natural systems and social services might deteriorate to the point where death rates rise exponentially.

During 1987, the world population passed the 5 billion mark, yet only ninety years ago, it was under 2 billion. Although the predictions of very rapid population growth forecast in the 1970s by the club of Rome have not materialised (because of a slowing growth in China and most industrialised countries), further rapid growth is regarded by demographers as possible or even inevitable.

It is difficult to object to the idea that population growth is a significant global pressure contributing to increasing vulnerabilities. However, the exact cause and effect relation between population growth and vulnerability in the context of disaster management remains unspecified. Some of the implications of population expansion relative to disaster risks can be more easily related to different age groups, but specific determination of vulnerability in the context of demographic profile has yet not been attempted. One would not deny that rising population is a component of increased vulnerability. But “demographic processes themselves are largely a reflection of people’s individual responses to the opportunities and uncertainties presented to them by broader economic processes,” in that, neglect of the elderly and children might be a fallout of vulnerability or disasters.

Certain co-relations however are obvious. Population growth has led to increasing access of marginal/depleted land for habitation and agricultural/commercial purposes. Such activity in coastal areas has disturbed the ecology of these fragile systems and exposed people and facilities to hazards, particularly, flood and cyclones. This is particularly true of low-lying islands that emerge as a result of silt deposition in the river estuaries of delta regions. This poses serious risks to the occupants from both cyclones and riverine flooding and makes them seriously vulnerable.

Reducing disaster vulnerability and slowing global population growth are related in that for vulnerability reduction, population growth rate has to be controlled.

Vulnerability to disasters will be tied up with increased resource access and empowerment, but they should also incorporate the means to secure livelihoods that do not require large families in consonance with sociological dynamics. Disaster management and development share a mean end-mean relationship in that one is the means of to the other and so on.

17.2.1 Demographic Profile and Vulnerability

The first and foremost concern is of the increasing proportion of young people in the world. Already in many developing countries, as much as fifty percent of the total population is under fifteen years of age. By the end of the century, it is projected that, the population under thirty years will increase by five hundred million (500 million) constituting sixty percent (60%) of the world’s population. Although a high proportion of these children and teenagers engage in productive economic activity, it will be increasingly difficult to cater to their basic needs, since a relatively small percentage of the adult population has to bear the responsibility for feeding, clothing, housing and educating them.

It is highly possible that this highly vulnerable segment of society could be neglected. Many may have no option other than becoming 'street children', forced to fend for themselves in hostile urban environments. Street children may be more vulnerable to certain diseases like cholera because of the unsanitary conditions under which they live. If driven by poverty into the sale of sexual services, they are much more vulnerable to the risk of HIV infection.

As per the World Disasters Report, 2004, in Southern Africa, distress due to HIV AIDS has increased because of abuse and isolation by families. Increasing social capital through intervention of outside agencies is being looked upon as a disaster management/ mitigation measure. UN organisations are expected to work towards increasing social interface among communities and strengthening filial ties through promoting of dialogue to arrest/ reverse negative sociological changes.

Implications of this changing age profile need to be understood in the context of disaster management and incorporated in disaster awareness programmes. The critical importance of making all school buildings resistant to hazards has to be recognised. With necessary political will, mobilisation of predominantly young communities to protect their settlements against disaster risk would be fruitful in developing organisational capacity of the youth. This implies the development of training, leadership and suitable institutions for the task. Also, specific risk reduction policies would need to focus on the protection of the elderly, who have so far received minimal attention.

Europe's population is ageing. According to the UN's Population Division (UNFPA), by 2050, there will be 2.4 older persons per child, and more than one in three people will be aged 60 years or over in the region. UNFPA points out that fastest growing segment of the global population in 200 was aged 80 or over. This has increased peoples' vulnerability to heat waves. Heat waves are causing loss of many lives in France, and cold waves in the U.K. This is because of the social structure, which isolates the elderly. In third world countries, heat and cold waves target the poor and the homeless (World Disasters Report). Some steps like converting school into shelter houses in extreme conditions has been attempted, more concrete policies are needed.

If the quality of population is good, developmental process can be regulated properly. Health and age are important determinants of vulnerability as brought out in various case studies. Pankhurst (1984) lists the elderly, the disabled, pregnant women and mothers, the chronically ill and children as particularly vulnerable groups in refugee camps. Their groups have particular nutritional needs or disadvantages in that they are more sensitive to food shortages, climate extremes and other physical stresses that may accompany global change. They are also not able to move easily from risk or disaster struck zones.

17.3 INFRASTRUCTURE FOR VULNERABILITY REDUCTION

The global patterns of famine and hunger reflect the pervasive effects of human vulnerability. In 1990, an estimated 477 million people lived in countries where local crop production and import capacity failed to meet their usual levels of consumption and 828 million people suffered chronic under nutrition in 1994-96, up from 822 million in 1990-92. In addition more than 100 million children are estimated to have below normal growth. The recent increase in the number of hungry people in the world is directly connected with vulnerability due to the lack of progress in reducing world poverty and the growing gap

in income distribution in many parts of the world. In the 1985-95 decade, countries with 50 percent or more of their population undernourished all had stagnant or worsening per capita income. Similarly, where more than 30 percent of the people were chronically hungry, income growth had stagnated or declined.

Vulnerability problems are also apparent in the growing global scarcity of high quality water resources. The global water situation reveals a growing inequality and potential for social conflict. Over a billion people lack access to safe, clean potable water, 1.7 billion lack appropriate sanitation facilities, some waterborne diseases are still rising or are widely prevalent, groundwater overdraft are rising and irrigation development remains highly unequal.

Global urbanisation is likely to be a major force in determining vulnerability patterns. By 2005, more than 50 percent of the world's population will reside in urban areas, and, over the next 20 years, over 90 percent of the urban growth will occur in cities in the developing countries. Food insecurity will increasingly be an urban problem worldwide, adding to the complex of problems that rapid urbanisation will involve. Most number of deaths from heat waves has been reported from urban slums around Paris and industrial areas around New Jersey in America (World Disasters Report, 2004).

With respect to rural areas, in respect of climate change and world food security, the IPCC (1996) assessment of agriculture security in the face of climate change reached a number of important conclusions. Global agriculture production appears to be sustainable in the face of climate change, although the situation of countries in the low latitudes with low income is worrisome. Many of the countries in sub-Saharan Africa dependent on isolated farming system and with low income are likely to be the most vulnerable to climate change. Other vulnerable regions worldwide are south of South-East Asia, where dependence on the food production sector is high, and, a group of Pacific Island nations and increased tropical storms pose substantial threats. Of the physical infrastructures, a society or a group may have resources sufficient to carry on through several years, but lack of development of physical infrastructure on a sustained basis, and prolonged stress may reduce those economic reserves and significantly increase vulnerability.

Following groups may be identified as vulnerable to global change due to lack of physical infrastructural facilities:

- a) Rural smallholder agriculturists, with limited land and labour, who are resource poor, and especially exposed if they are farming in marginal lands;
- b) Pastoralists, often sensitive to drought and pests, and subject to dramatic collapse if entitlements fail in a political context of marginality;
- c) Wage laborers, dependent on exchange entitlements with little or no direct agricultural production and who may be sensitive to market and political failures;
- d) Urban poor, who often form a more visible vulnerable group with some power and access to the political economy;
- e) Refugees, often nearly destitute, who remain dependent on the political economy for their subsistence; and
- f) Destitute groups, who are no longer capable of productive activity are unlikely to re-enter their former occupations and are dependent on food aid from a variety of sources;

There are some physical infrastructural changes, which may be viewed as dimensions of vulnerability.

- a) Reduction in the availability or value of the resources necessary to satisfy human needs, desires and aspirations;
- b) Reduction in the capacity of the human subsystem to make adequate use of the resources available;
- c) Reduction in the autonomy to use resources and to make decisions;
- d) Reduction in the capacity to respond to internal and external changes; and
- e) Reduction in the capacity to future improvement or maintenance.

17.4 INTERACTIVE AREAS IN POLICY-MAKING

For vulnerability reduction, developmental planning has to be done in a strategic way. There should be proper land-use planning and regulations for sustainable development of an area to minimise vulnerability. Preventing or modifying hazard potential can significantly reduce the risk involved. Land-use planning and management in hazard prone areas such as in case of floods and earthquakes can do this. Rapid urbanisation has led to higher concentration of people living in hazardous areas and consequently to higher losses when disasters occur. As urbanisation is proceeding, declining standard of facilities like drainage and sewer is making large cities increasingly vulnerable to flooding.

Long-term disaster reduction efforts should, therefore, aim at promoting appropriate land-use in the disaster prone areas by ensuring land suitability with agricultural development strategies. High investment industries and installations, as well as critical facilities like hospitals and government offices etc. should not be located in areas that are susceptible to disaster impact.

Fire and Industrial Accidents can be reduced if land-use planning ensures location of hazardous and fire prone industries away from residential areas. Licensing authorities of industries should consider sustainable development issues.

Proper, long-term land use planning, by incorporating all geological data available would identify and locate hazard free areas for industrial and urban development, which would be the most effective way of dealing with disasters. Large concentrations of people living in hazardous zones, not capable or willing to be moved to safer areas, should be provided the best help possible. Authorities in charge of disaster management should, therefore, have at their disposal, reliable estimates of the type, severity and location of the damage likely to occur. Damage to property can be limited, if, for example, building codes are enforced.

Introduction of legal enforcement of property insurance against damages inflicted by disaster events may be considered as one of the most efficient ways to ensure that building codes are based on actual geological parameters. Regulations have a potentially greater impact on loss reduction than any other single management tool that has been widely used. Infrastructure development that conforms to regulations is less prone to damage. Regulation is largely a local government responsibility. Effective enforcement often requires more trained personnel and financial resources than many governments can provide. Regulations cannot provide full protection when they have a limited impact on

existing buildings and infrastructure prone to hazards. The minimum regulations vary depending upon the risk studies and mapping that have been done in the community.

17.5 HAZARD RESISTANT DESIGNS AND CONSTRUCTION

In urban areas, safe construction is the most important issue. Safe construction begins by choosing a safe site. A lot of protection can be gained by careful location. For some hazards, like flood or land instability, site selection is the most important protection measure. For other hazards, like earthquakes and cyclones, site selection is less critical than engineering or how well it is built, though location can still be important in determining how strongly the hazard is experienced and the potential for follow-up on hazards causing damage.

The degree of 'choice' that people have in siting structures is highly variable in that some may have little or no choice, and others may have a large area from which to choose a site. The hazard considerations of a site are outlined so that their hazard potential is known. Site selection can be considered on a number of scales such as the community scale, where perhaps there is a building improvement programme, relocating a community within a geographical area, and at individual scale, when choosing a site for a building within a locality.

In locating a new town, village or housing estate, the hazard aspect is only one of the factors that are taken into account to ensure a successful settlement. It should, therefore be considered at an early stage of site selection. The penalties of site selection on ground with possible hazard problems should be balanced against the advantages of location. When a large site is needed, it is possible that some areas within the land chosen will be safer than others. Therefore, sensitivity to the use of land within the settlement will be important.

Perspective and knowledge of disaster management among engineers, architects and technical personnel is essential. Training of craftsmen and property developers in disaster resistant construction techniques and practices is also significant to secure disaster proof settlements that are in keeping with norms prescribed in rules and regulations.

Many of the public buildings are also vulnerable to damage from disasters. They should be a priority consideration in mitigation plans. As part of mitigation strategy, both structural and material standards have to be complied with to ensure that these structures and installations are sufficiently protected from disaster impact of differing magnitudes. Apart from adopting the building codes, conceptual design should into account, factors such as the location of the building, zoning and building code requirements, functional relations between sections, geometry, shape or composition of the building, structural system, impact of disaster on occupants, types of beneficiaries or users, and nature of occupancy by beneficiaries and users, that is, residential or non-residential to estimate economic losses or possible loss of life.

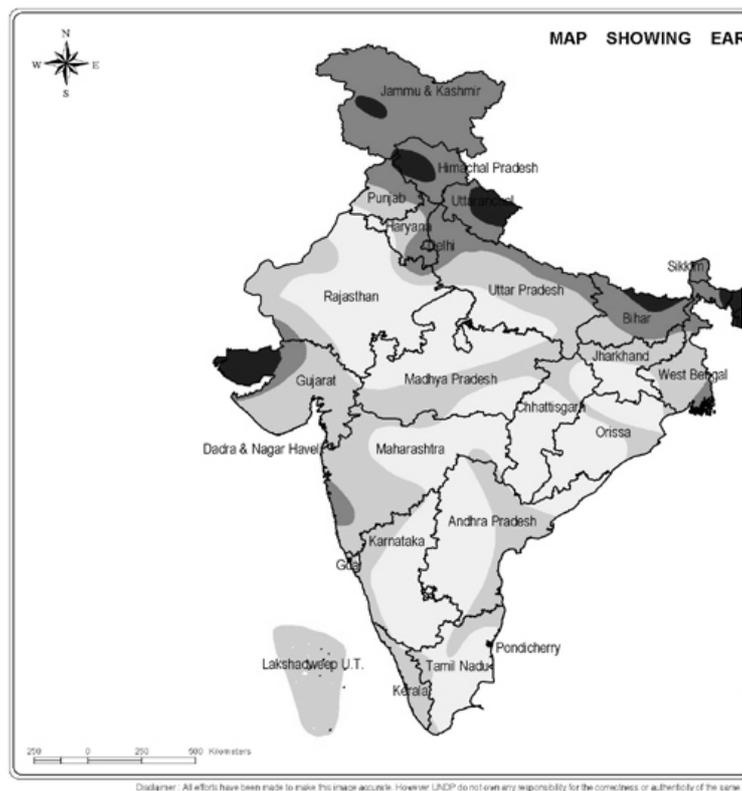
There is need for manpower planning for making provision of adequate number of earthquake 'engineers' in the country. The negative fall out of 'unplanned' growth of infrastructure in the context of disaster management has been lack of preparedness in terms of expertise and sufficient manpower for earthquake disaster mitigation. Despite the seriousness of the problem and the long existence of the profession, a vibrant "earthquake

industry” has not yet emerged whereby earthquake-related services and products can be made conveniently available within the country on a commercial basis. India is at the threshold of a major boom in the construction activity. In the next 25 years, major construction opportunities in the world are projected to arise in India and China. This provides a tremendous opportunity for growth in the earthquake engineering industry (Murthy, Rai, Sinha and Jain, 1999).

Despite India being in seismically active zones, no initiative seem to have been taken in said area up till now, however the requirement has been recognised and steps are being taken to develop manpower capability and availability in the area. Different aspects of the profession include, teaching, research development and publication of Indian seismic codes for earthquake resistant construction, installation and operation of strong motion instruments and seismological observatory, and successful design and construction of many civil engineering projects of national importance in high seismic areas. These activities have involved only a very small group of persons and/or organisations. Professional interaction across these groups and across allied interest groups/organisations has not grown. The main impediments to the growth of earthquake engineering industry have been, lack of adequate highly trained manpower, lack of necessary facilities for dissemination of knowledge and inadequate legal framework. Furthermore, there is a prevailing attitude that earthquake engineering can be confined to a few experts who can be called upon to address earthquake related problems and issues. The building byelaws and development control rules in India do not have any structural requirements, and therefore seismic requirements also do not find a place in specification of requirements. Moreover, seismic specifications cannot be left to the discretion of the owner, who is often not conversant with these requirements. It is heartening to note that the proposed development control rules for the hill districts of West Bengal have explicit provisions for seismic requirements. The example needs to be emulated in other seismically vulnerable regions of the country. The severe shortage of earthquake engineering professionals in certain specialisations such as engineering seismology and geo-technical earthquake engineering can be overcome through suitable government intervention by facilitating opportunities for training of working professionals in an appropriate international environment.

The Himalayan region of India has experienced large earthquakes at frequent intervals; in fact, this region has seen some of the largest earthquakes ever recorded in the world. The recent earthquakes in the peninsular and southern India have also shown that damaging earthquakes can occur in most parts of the country. This has thrown new challenges and unique opportunities for the earthquake engineering community. The extent of damage that is possible in the absence of such an approach can be gauged from the following map (UNDP, 2005) shows the earthquake zones in India.

(P.T.O)



As can be seen in the map, entire North- East, parts of Gujarat, Uttaranchal, Jammu and Kashmir and Himachal Pradesh fall in high-risk zones. Academic studies on a sustained basis would be required to address the problem on a long term basis, apart from region specific strategies integrated with wider state level and national socio economic planning. Due to demographic pressure, greater number of people is forced to reside in areas such as, unstable slopes, coastal flood planes and recent landfills that have higher seismic risk. Moreover, due to poverty and lack of serious consideration of the risk among policy planners, large-scale use of inappropriate construction technologies is taking place. This, together with high population growth and rapid urbanisation has led to increased threat of seismic risk. Cities most at risk are major commercial centers like Patna, Dehradun, etc., which require concerted action on the part of administrative authorities. Unattended disaster risk in these cities could spell economic ruin for the country, not to speak of the damage possible to human life. According to K. R. Datye (2005), alternative energy sources and structural engineering using traditional bamboo –wood composites and innovative joining techniques can give a major fillip to rural infrastructure development in India.

17.6 SYSTEM MANAGEMENT

Poverty, use of resources, and the distribution of wealth and income within a population are institutionally determined. It is formal political institutions that devise and implement the legal enforcement of property rights, for example, and all economic structures can be conceptualised as dependent on the institutional structure. Analysis of political economy is, therefore, an essential component of any assessment and thus formulating strategies for the reduction of vulnerability has to take the political economy approach (through state initiative). Assessment of vulnerability, then, must rely on the examination of the structures of institutions and of constraints on their evolution and on the constraints they exert on individuals. The cultural context and the social differentiation of entitlements are not

constrained in our analysis to those institutions of the state but extend more widely to include both formal political structures and the more diffuse 'rules of the game' and social and cultural norms.

How vulnerable people are, depends on their age, gender and health status and how society treats its members or different groups. Vulnerability also depends upon the quality and citing of buildings and land uses; public and social infrastructures and services; and ways of life and political authority. These are critical features of the exposure, safety and resilience of people in the face of dangers. A major concern in the modern and modernising world is how social change and patterns of development can affect vulnerability more or less drastically.

Vulnerability, some of the basic forms in which it arises are:

- i) Exposure to dangerous agents and environments;
- ii) Weaknesses as predisposition of persons, buildings, communities or activities to greater harm;
- iii) Lack of protection against dangerous agents and for weaker persons and sections of the society and items;
- iv) Disadvantageous position in terms of lack of the resources and attribute to affect risks or respond to danger;
- v) Lack of resilience reflected in limited or no capability to avoid, with stand or offset and recover from disaster; and
- vi) Powerlessness, that is, inability to influence safety conditions or to acquire means of protection and relief.

Irrigation reservoirs may buffer agriculture and related sectors against moderate precipitation deficit but may actually increase the catastrophic potential of major droughts in areas outside its coverage. There is considerable debate about the role that improved seeds and fertilizers may play in reducing the vulnerability of producer countries to climatic variability and other changes. It is argued that traditional varieties of pulses and oil seeds etc. have been lost because of excessive emphasis on wheat in the Green Revolution; others believe that the Green Revolution has reduced ecological and social vulnerability to environmental change. It is undeniable however that even though we talk about privatisation, there is no real investment in agriculture, especially in these rain-fed areas that are outside the much hyped, "Green Revolution" areas.

Indigenous agricultural technologies and low input or sustainable agriculture are seen by scholars such as Wilken (1987) as appropriate buffers against global change, reducing biophysical vulnerability through soil and moisture conservation practices, and economic dependency on purchased inputs. Dependence on certain types of energy (for example, imported oil) can create vulnerability in periods of economic and political instability. According to Datye (2005), the target should be five tons of coal-equivalent energy supply per family per year. "We currently make available only 0.5-1 ton. However, there is capacity to provide this level of energy with 50% from solar and other 50% from materials such as bamboo, small timber chemical intermediates from plants (such as non-edible oils, phenols, starch, ethanol) etc."

Majority of the lands owned by the rural poor are categorised wastelands where yields are about 0.5 to 1 ton of grain per hectare. Forests and pastures have been highly degraded, and the topsoil has been eroded or deprived of nutrients. Usually one crop per year (with poor yield) is cultivated in these areas due to inadequate irrigation facilities. On the whole, the present natural resource endowment in this region appears quite bleak.

System management can be improved by setting up service enterprises for energy generation and distribution. A joint sector leasing and financing company with participation of the state, renewable energy development agencies, private enterprises, professionals, user groups and cooperatives of artisans is considered an attractive prospect. This will help to separate ownership and service functions. A two-pronged strategy is recommended where basic services are provided at affordable prices by availing of existing generation of distribution facilities and concession for development of renewable energy sources.

It is argued that changes are needed in land and water use and allocation policy. A biomass strategy must be implemented to raise the biomass production by use of funds currently available for wasteland development with a condition to create and sustain biomass pools. Entitlement of the bio-mass to the poor from the local and regional bio-mass pools would make it possible to recover the cost of energy services in the form of bio-mass.

Migration and population movement are important aspects of social stability and in many circumstances, contribute to livelihood security and resilience at the household level through remittances, as these provide opportunities for diversification and reduction in resource dependency.

Following steps may be taken to reduce social vulnerability:

- a) Poverty reduction clearly must be a priority, though that alone may not be sufficient to ensure the wider access to resources necessary to reduce vulnerability;
- b) Risk spreading through income diversification can be promoted in a number of ways and again will assist the poorest members of the community;
- c) The loss of common property resource management rights represents serious erosion of the ability to resist stress and, where it cannot be avoided, compensatory measures should be implemented; and
- d) The reduced efficiency or loss of forms of collective action or investment affects the community as a whole and this process warrants careful monitoring with efforts to promote the development of other, perhaps traditional forms of community security.

17.7 STRATEGIC PLANNING FOR VULNERABILITY REDUCTION

Organised emergency measures and humanitarian assistance in disasters are major approaches in reducing vulnerability. These can reduce damage and speed up recovery. Less often considered but perhaps more effective is how societies can improve public safety in a broader sense through general material uplift, social security measures, and broad legislation to protect people's rights. Also setting up of social infrastructure would be an appropriate approach towards reducing vulnerability.

To return to the role of planning in the context of ecological and economical reconciliation and reduction of vulnerability, although there is an argument that responsible public policy must try to manage key environmental dimensions, planning alone is not enough. Furthermore, it cannot be done in a social vacuum; neither rational environmental policy, nor planned economic growth necessarily guarantees fundamental human rights such as livelihood security, freedom, dignity, or opportunity; nor do they enhance human welfare, particularly for marginal or exploited groups. Securing such values must be a principal motive behind whatever planning does occur and therefore cannot be the prerogative of current planners. The full plurality and diversity of values that exist in society must be mobilised to inform and guide policymaking.

Development of social support infrastructure includes a wide variety of rights and obligations between members of the same household (for example, Wives and husbands, children and parents), with the extended family and other wider groups with a shared identity such as clan, tribe and caste. Within the household and the family, successfully securing resources in potentially disastrous or fallback position or breakdown position is facilitated because of sound social infrastructure. Women tend to lose these conflicts for scarce resources and are affected by 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 tends to be more limited. The disintegration of the family and abandonment of women, children and old people is the support as well based mainly on non-economic relations. These offer a minimum subsistence and a margin of security and constitute a subsistence ethic based on the norm of reciprocity. Planning in agriculture, health, education, agriculture and industry is important for building long term resilience.

17.8 SOCIAL INFRASTRUCTURE FOR VULNERABILITY REDUCTION

Following may be the social infrastructures to reduce the vulnerability of a particular society:

- a) View of society and social goals
- b) Agent of change
- c) Population
- d) Equity
- e) Relative rights and responsibilities of individuals and society
- f) Political organisations and authority
- g) Institutions
- h) Awareness and education programmes
- i) Primary health centers and hospitals
- j) Maternity relief system
- k) Lifestyle
- l) Security of livelihood

The central insight brought by social scientists to the study of vulnerability is that the state of vulnerability is social differentiated. Vulnerability to environmental change is not the

same for different populations living under different environmental conditions or are differently 'socially positioned'. Moreover vulnerabilities build up over time; therefore 'affirmative action' by the state in support of minority groups is essential to reduce vulnerability in the long run.

Social vulnerability is a negative state endured by groups or individuals. In the broadest sense, vulnerability occurs because livelihoods and social systems are exposed to stress and are unable to cope with it effectively. Vulnerability is a chronic and pervasive state arising due to underlying economic and social situation, not only in terms of lack of income and resources but also with respect to a range of factors determined by government policies, societal trends and so on. Vulnerability to food insecurity can be defined in terms of:

- a) Exposure to stress and crises;
- b) Capacity to cope with stress; and
- c) Severe consequences of stress and the related risk of slow recovery.

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' portion or 'break downs' position, as Sen terms it, and referred earlier in the Unit, if co-operation in this bargaining process should fail. Women tend to lose their conflicts for secure resources and are affected by who eats first, the share of available food and lack of access to cash earned by other family members (for example, cash from casual male labour). The range of resources controlled by women and employment opportunities open to them tends to be more limited. The disintegration of the family and abandonment of women, children and old people is the expression of the breakdown of such obligations.

Cardona and Sarmiento (1990) have examined the issue of the vulnerability of communities to disasters with a specific focus on their health status. They suggest considering the following ten variables: -

- a) Age structure
- b) Health structure – morbidity
- c) Health structure – mortality
- d) Family income
- e) Illiteracy rate
- f) Level of schooling
- g) Location of the workplace
- h) Spatial distribution of the population
- i) Urban population density
- j) Rural population density

Most neo-Marxists consider class to be the overriding category, which differentiates social vulnerability. The appropriate divisions (proletariat, bourgeoisie etc) have been discussed many times and occasionally identified with differences in -

- a) Income in which wealth can be used to purchase land, food or other resources to buffer an individual against environmental change.

- b) Gender, according to Schroeder (1998) and Ali (1984), is an important indicator of vulnerability to drought. Women, because of lower incomes and lack of rights to land and other resources are frequently more affected than men by drought and natural disaster. Darkelman and Davidson (1989) also describe how changes in water soils and forest resources are likely to affect women more than men in the third world because women often have traditional responsibilities for fuel and water collection and for farming.
- c) Race and ethnicity can be important factors in determining vulnerability to global change. Researchers associated with cultural survival have shown many times how the loss of land, power and other rights by indigenous groups in regions such as Brazil, Central America, Australia and United States has increased their vulnerability to deforestation and other environmental changes.

17.8.1 Importance of Education Sector

Educational institutions potentially have three areas where they can make a contribution related to disaster reduction.

- a) *Knowledge generation:* Many educational institutions have conducted research in traditional sciences and social sciences, which have formed the basis for public policy and business ventures.
- b) *Technical advice:* Different types of agencies access academic expertise on a wide range of disaster issues, spanning from earthquake prediction technology to socio-economic/political analyses of vulnerabilities. Their opinions are empirical and fact based and are therefore sought and respected by institutions and the society at large.
- c) *Knowledge transfer:* (education and training): Course work in disaster related subjects shape the careers and minds of professional decision makers in a wide range of fields, from biology, engineering and medicine to economic, public administration and politics. In India, Indira Gandhi National Open University, Roorkee University, Anna University, Jamia Millia Islamia and the National Institute for Disaster Management are some prominent institutes currently offering courses related to disaster management.

17.8.2 The Role of Non-Government Organisations

Emerging trends in managing natural disaster have highlighted the role of Non-Governmental Organisations (NGOs) as one of the most efficient communication links between the disaster management agencies and the affected communities. Many different types of NGOs are already working at advocacy as well as grass root levels. In typical disaster situations, they have shown potential to help in preparedness, relief and rescue, rehabilitation and reconstruction and also in monitoring and feedback.

The role of NGOs is a potential key element in disaster management. The NGOs operating at grass roots level can provide a suitable alternative to monopoly government service provision as they have an edge over governmental involvement in certain matters. This is chiefly because, the NGOs sectors, have strong linkages with the community base and can exhibit great flexibility in procedural matters vis-à-vis the government.

Based on the identified types of NGOs and their capabilities organised actions of NGOs can be very useful in following activities in different stages of disaster management.

| Stage | Activity |
|-----------------|---|
| Pre-disaster | Awareness and information campaign Training of local volunteers Advocacy and planning |
| During Disaster | Immediate rescue and first aid, supply water, medicines and other immediate materials Ensuring sanitation and hygiene Damage assessment |
| Post-disaster | Technical and materials aid in reconstruction Assistance in seeking financial aid |

In the recent past, the NGO sector has played a major role in strengthening the community to face the disasters. The trend is based on a long-term experience of the need of maximum self-reliance at the lowest level. Synergetic partnership between the government and the NGO sector is recommended for better disaster management, particularly response, and also policy inputs for long term disaster mitigation.

- Service oriented NGOs provide assistance in areas of health, planning, education etc.
- Charity oriented organisations aid in humanitarian disaster response activities such as distribution of relief supplies which supplements government effort and probably send aid before the government machinery swings into action.
- Empowerment oriented organisations give voice to peoples' concerns hence articulate real issues at the grass roots level.
- Participation oriented organisations articulate and implement community based projects
- Certain NGOs operate at local levels others at State, National and International Levels. They also perform vital monitoring and evaluation functions in relation to government programmes (IGNOU, 2003).

17.8.3 The Role of Community

It has been revealed that the community as an institution in itself is emerging as the most powerful force in the entire process of disaster management. In the event of actual disasters, the community mobilises skills and efforts in response and mitigation activities. Communities have also shown awareness regarding response and mitigation strategies both in terms of engineering and social networking for mutual help. Awareness and training of the community is particularly useful in hazard prone areas.

It is quite heartening to note the laudable effort made in certain areas where communities have formed their own organisations, which take right initiatives in such situations. One such community-based organisation is the village task force formed in villages of Andhra Pradesh by the Church Auxiliary for Social Action (CASA). The village task force has been trained in emergency evacuation and relief within the village. The people elect it themselves and during disasters it serves as the modal body at village level, which has to mobilise resources for the community and disseminates necessary information passed on by outside agencies.

While the community as an effective institution is yet to take shape in this country mainly

due to low literacy levels and widespread poverty, and lack of programmes to generate awareness among people regarding disaster risks, considerable effort is being made to further and strengthen community based organised at grassroots levels.

Information Dissemination

For the two aforesaid to be effective, information dissemination would be crucial. Human Resource Development (HRD) would be important for the country if future manpower policies were to be effective. In the usual mitigation programmes, the most cost-effective methods are public awareness education drivers. This is because they target the population and share with them the responsibility for preparedness. Such campaigns are also cheap and immediately effective.

In some cases, it is crucial to approach this method innovatively. In some areas, information becomes difficult to disseminate. In this case, different media and formats should be tested and the most effective used. If we are to make an effective education system, we should first consider a proper programme. There are several approaches towards disaster awareness education programmes, but the ideal programme would be to start by resolving the following: -

Kinds of information the public needs: -

The information to be communicated to the public can be classified into various categories, such as basic or general information, information on government assistance programme; or it can be classified based on the target audience, for example, basic information for middle school children and so on.

a) The target audience: -

In developing the education programme it should be noted to be able to impart information, materials developed should be focused on creating a lasting impression on the particular audience. Usually the best place to start disaster awareness education is in schools. School education does not simply mean education for children. In some societies with a high proportion of adult illiteracy, children in school may in fact be the only effective means of communicating more complex concepts to adults.

b) The information format: -

The format for communicating information to the public can vary. Some possible options are: -

- Printed materials as in books, posters, or pamphlets
- Audio-Visual such as films, radio or television features
- Multi-media as in computer games or computer based education entertainment programmes.

c) The Information medium: -

The following are examples of channels that can be used to communicate information:

- Print (telephone directories, newspapers and magazines)
- Broadcast media (Cinema, radio and television)

- Community and other groups (gathering or meeting of various kinds, church or mission and others)

Hazards, vulnerability risks and disasters in general are dynamic phenomena. Disaster awareness is also very dynamic as people focus their attention just after a major disaster but tend to lose interest as time progress. For this reason, information imparted by programmes should also be checked and updated periodically to determine whether it is intended sense

17.8.4 Training of Staff

The Disaster Management Action Plan extends to influence the present institutional assignments to the capacity of each of the components, within the institutional assignments. This is proposed to be done through capacity building of the linked departments on the one hand, and providing an organisational structure such as Emergency Operation Centre (EOC), on the other hand, at the local government level and at the district level. The efficiency of such an exercise will largely depend on the type of preparedness measures, coupled with the necessary training inputs undertaken. One of the most critical components of the mitigation strategy is the training to be imparted to the officials and staff of the various departments involved at the state and the district level. Village volunteer groups are the first responders when a disaster strikes. Their training is also being considered as a necessary input in disaster mitigation strategy.

17.8.5 Population Control

There is an explosion in world population. The time period for an addition of a billion to the population of the world is alarmingly shrinking. It is estimated that by 2025, there will be about eight billion people in the world. A large part of this increase is expected to be in developing regions, and concentrated in urban areas.

The population size of India is increasing at a high exponential rate of 2.0 to 1.9 percent per annum. A second urban India has been added in a period of just two decades. These trends put immense development pressures on those lands that were till now left unoccupied due to being in high risk zones. Economic pressures drive the surging populace to establish themselves on such fragile and risky locations, thereby rendering them vulnerable to disasters. In order to reduce disasters, it is imperative to control population growth.

17.8.6 Emphasis on Research

With an increase in the perception towards spreading a culture of prevention in the disaster management scenarios, considerable emphasis is now being placed on research and development activities, in addition to capacity building of all personnel concerned with disaster management. In India, a number of research institutions are conducting active research in the field of disaster management. Valuable inputs in technical, social, economic as well as management areas of the field are being considered

Different ministries depending on the type and level of research are coordinating research activities. The universities play an important role too in this sector in that besides running programmes on disaster management, and also serve as think tanks for the government. Institutes spread geographically across the country have developed specialisation in terms of particular regions where most of their research is concentrated and also in terms of particular disasters. Notable universities are the University of Roorkee, the Indian Institute of Technology and the Anna University.

The Department of Science and Technology, Government of India, coordinated activities through a network of scientific institutes, for example, the Central Building Research Institute at Roorkee. The Ministry of Urban development carries out research through Building materials and Technology Promotion Council on subjects such as appropriate building materials for disaster-prone areas. These institutes besides providing technical assistance to implementing and engineering organisations also trains field level officers and other concerned role players.

The Ministry of Agriculture and Cooperation too has set up a National Center for Disaster Management at the Indian Institute of Public Administration to look after administrative training activities in the field of disaster management.

17.9 EXPERIMENTING WITH TECHNOLOGY

The ecological paradigm in public administration has been in consideration for sometime now. There have been divided opinions about appropriateness of technology transfer from the western world to third, for example, the agricultural production technology described as the 'Green Revolution'. Also in the field of disaster management, the applicability aspect of technologies has to be considered. For example, the Geographic Information System (GIS) and Remote Sensing systems causing millions of dollars worth of monitoring systems and expensive predictions systems. All this is practically useless until there is actually a method of applying these technologies at the local level. The problem is implementation. The challenge is to make warning systems more users friendly to disseminate information in easily intelligible way to local people. Roadblocks in implementation in most developmental schemes are many, ranging from economics, local or national politics, corruption and/or lack of leadership. In most developing countries, economics, corruption and politics play a very strong role.

In other words, there should be more effective use of technology so that new technologies can be transferred from the developed world will have a real impact on the safety of the people. With this background, we see that the important challenge, which would be faced by every developing country disaster manager at present, is how to make present mitigation programmes work effectively and efficiently.

17.10 VISION FOR THE FUTURE

Traditionally, disaster management consisted primarily of reactive mechanisms. However, the past few years witnessed a gradual shift towards a more proactive, mitigation-based approach, as it was being proved time and again that reactive mechanism yielded only temporary results, at a very high cost. In this context, an exploration of the concept of 'sustainable development' inevitably ensures the recent definitions of sustainable development encompass the three dimensions of economic efficiency, social equity and environmental protection, all three of which contribute to, and are affected by natural disasters.

On the other hand, disaster relief personnel have repeatedly been confronted with the same kinds of problems in a number of disaster situations. There is an increasing recognition of the fact that relief, rehabilitation and other disaster mitigation action should be coupled with interventions aimed at development as the wider objective. Only by overcoming poverty, developing infrastructure, inculcating awareness and spreading literacy can reduce vulnerability. In this respect, all development programmes that are committed to sustainability are relevant to disaster mitigation and prevention.

Disaster management is a multi-disciplinary arena of theory and practice, involving a wide range of agencies engaged in mitigation, prevention and preparedness involving evacuation search and rescue, relief, reconstruction and rehabilitation. It is also multi-sectored administration in that scientists, planners, volunteers and communities, all have important roles to play. These roles and activities span the pre-disaster, during and post-disaster phases. Since their activities are complementary as well as supplementary to each other's there is a critical need for co-ordination in their actions.

One of the many lessons learnt by victims, of various natural disasters, is that the aftermath of the disaster can be even worse than the disaster event itself. Thus, there is a need to acknowledge the necessity of preparedness towards disaster reduction. However, people are often surprised by the concept of reduction of disaster risk. It is often asked, whether a natural disaster, such as an earthquake or a cyclone, can be reduced or prevented?

Unfortunately, due to rapid population growth and development of human settlements in disaster-prone areas, more and more people and capital assets are becoming vulnerable to natural hazards. The number of disasters was three times higher worldwide in the past ten years than that in the 1960s. Economic losses were eight times higher, exceeding US\$ 60 billion a year. For the period 1994-2003, total damage in millions of US\$(2003 prices) works out to 691,426 millions of US\$ as reported in the World Disasters Report, 2004.

Disasters in the developed world (High human Development-HHD) led to more damages than disasters in low human development (LHD) countries, amounting to losses worth US\$ 318 million worth of damage per year, over 11 times higher than the US\$ 28 million recorded per disaster in LHD countries (World Disasters Report, 2004).

Natural occurrences such as floods, earthquakes, cyclones, etc simply cannot be stopped from taking place; they are a part of the environment we live in. What can be done, however, is to take preventive measures at various levels of society in order to make the impact of such natural hazards as harmless as possible for people and people's properties.

The impact of a natural hazard can be reduced; its worst effects can be prevented. Therefore, in order to reduce the vulnerability, various infrastructures, that is, demographic, social, physical, etc have to be utilised properly so that maximum benefit can be extracted from them and vulnerability can be minimised.

17.11 CONCLUSION

Mitigation refers to efforts for reducing the actual or probable effects of a disaster on people, structures, economic and social systems, and, the environment. Mitigation seeks to reduce risk, that is, vulnerability to damages or losses. Mitigation focuses on the hazard that causes the disaster and attempts to minimise the adverse impacts of the hazard on regions and communities.

The reason of focussing on mitigation disaster impacts include rising economic and social costs of disasters, existence of technical know-how to reduce disaster impacts and costs, and the fact that mitigation is an integral part of sustainable development.

Several basic principles, based on past experience, can guide mitigation efforts:

- Pre-disaster mitigation helps ensure faster recovery of a community from the economic and other impacts of disasters;
- Hazard reduction measures should take into account the various hazards faced by the community, including technological hazard;
- Potential mitigation measures should be evaluated for cost-benefit and should be consistent with the desires and priorities of the affected community, both those who will pay and those who will benefit;
- Mitigation measures should protect natural and cultural resources of the community; and
- An effective mitigation programme is based on partnerships involving the government, the private sector, and the community.

17.12 KEY CONCEPTS

Hazard Reduction Measures : These measures are specific institutional or technological steps undertaken by the government following a detailed feasibility report to reduce the hazard potential of project, for example a dam. The concept of sustainable development entails Environment Impact Assessment Reports as a necessary part of project appraisal, which is an example of a hazard mitigation measure.

Physical Infrastructure : Basic requirements, like shelter, food and communication specifically in the context of disaster management are required for protection from the vagaries of nature, and in the event of man made and technological hazards in the form of institutional support for effective coping and resilience. Livelihood support in political economy countries implies state assistance, particularly for the poor and the marginalised sections of society.

Potential Mitigation Measures : Potential mitigation measures refer to the possible measures that could be adopted by the state for disaster mitigation which need to be evaluated in terms of cost effectiveness of the option, the ability to pay of the community and distribution of such cost and the resultant benefit to society. In developing countries the choice with regard to potential mitigation options is rather limited mainly because of the affordability factor. Mitigation options also need to be evaluated in terms of *practicability* and *feasibility*.

Social Infrastructure : Network of community support understood as positive social capital aids disaster recovery. Such positive capital is both institutionalised in the form of social action groups and non-government

organisations and amorphous in the form of natural and informal ties of association. Such social support base is crucial for disaster recovery. Stratification of society along communal lines thwarts development of positive social capital.

17.13 REFERENCES AND FURTHER READING

Ali, Shaikh Maqsood, "Income and Employment Generation Programme for Self-Reliance of Landless and Poor Farmers in Bangladesh", Conference Paper 1992 at [./1975.htmView Bibliographic Record](#) Organization for Local Level Development: The Case of Bangladesh, Book Chapter, 1981, at, [./2727.htmView Bibliographic Record](#)

Brown, N, 2001, Fire and Emergency Services Authority, WA *Pers comms*.

Cardona, O.D., and J.P. Sarmiento, 1990, *Análisis de vulnerabilidad y evaluación del riesgo para la salud de una población expuesta a desastres*. Cruz Roja Colombiana.

Dankelman, I, J. Davidson, 1988, *Women and Environment in the Third World*, Earthscan, London.

Dankelman, I. And J. Davidson, 1989, *Women and Environment in the Third World: Alliance for the Future*, Earthscan, London.

Datye, K.R, "Sustainable Development in India: How and Why"? Talks and Discussion, Sunday, September 17, 4:00 PM, University of M.D.

"Development, Planning and Administration", 2003, Course material for Commonwealth Executive Masters in Public Administration, Commonwealth of Learning, Vancouver.

FAO, 1984, *Ethiopian Highlands Reclamation Study (EHRS)*, Final Report, Vols 1-2, Rome.

FAO & OAU, 1982, *Famine in Africa: Situation, Cause, Prevention, Control*. Food and Agriculture Organisation of the United Nations, Rome.

FAO, 1983, "Rome Declaration on Hunger", Report on the 1982 World Food Day Colloquium. Food and Agricultural Organisation of the United Nations, Rome.

Hekstra and Liverman, 1986, *Land Use and Cover Change (LUCC)*, Open Science Meeting Proceedings, read on line at <http://webserver.sc.ucl.ac.be/GEO/LUCC/pdf/proceedings.pdf>

Higgins, E.T. et al., 1983, "A Structural Analysis of the Self-schema Depression" read on line at <http://springerlink.com>

Jeanne, Kasperson, et.al. (Eds.), *Regions at Risk: Comparison of threatened Environments*, United Nations University Press, New York.

Murty, C.V.R., R. Sinha, and S.K. Jain, 1998, "A Report on the Workshop on Earthquake Resistant Construction in Civil Engineering Curriculum," Supplement to *ISET Newsletter*.

Murty, C.V.R, Durgesh C. Rai, Ravi Sinha, Sudhir K Jain, 1999, Special Report, *The Indian Concrete Journal*, Vol.73, No.8

Pankhurst, 1984, "Risk and Vulnerability in Ethiopia: Learning from the Past, Responding to the Present, Preparing for Future," read on line at http://nutrition.tufts.edu/pdf/research/famine/risk_ethiopia.pdf.

Pankhurst, 1986, "The Ethiopian Famine: Cultural Survivals Report", *Anthropology Today*, 2 No. 3

Schroeder, Larry, "Evolution of INPRES and Regional Development", Conference Paper, 1998, at [/2083.htmView Bibliographic Record](#)

Schroeder, Stephanie, 1998, "Alternative Dispute Resolution Resources", *Risk Management*, Vol. 45, New York.

Sen, Amartya, 1981, *Poverty and Famine, "An Essay on Entitlement and Deprivation*, Oxford University Press, Clarendon.

Wilken, G.C, 1982, "Agroclimatic Hazard Perception, Prediction and Risk Avoidance Strategies," Lesotho, *Working Paper no. 44*, Natural Hazards Research and Applications Information Centre, Boulder, Colorado.

Wilken, G, 1987, *Good Farmers: Traditional Agricultural Resource Management in Mexico and Central America*, University of California Press, Berkeley.

17.14 ACTIVITIES

- 1) Discuss recommended strategies for (1) urban and (2) rural renewal.
- 2) Discuss the role of community and Non-Government sector in disaster response and mitigation.
- 3) Discuss the chief considerations in planning for vulnerability reduction?