
UNIT 8 VULNERABILITY IDENTIFICATION

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8.0 LEARNING OUTCOME

After Reading this Unit, you should be able to:

- Acquire a brief overview of vulnerability factors;
- Understand Vulnerability Assessment; and
- Examine the phenomenon of Drought.

8.1 INTRODUCTION

The major role of social sciences in disaster research is that of identifying, quantifying, and analysing the impacts of natural disasters on populations and socio-economic systems of affected regions. Social sciences' researchers focus on the interaction in disaster situations between two systems: the socio- economic system and the physical environment system. Economic vulnerability measures the potential losses to economic assets and livelihoods. It involves evaluating the direct loss potential, the indirect loss potential and the secondary effects on other sectors. With the insight provided by economic vulnerability analysis, disasters can now be studied from an economic perspective. The estimation of potential losses can be carried out using various disaster scenarios based on mild, average or worst case assessments to allow the authorities to measure the economic magnitude of the problem.

In economic terms, hazards can cause the following impacts:

- Destruction of crops, buildings, dams, highways, ports, lands and forest;
- Loss of human, animal and plant lives;
- Imbalance in equilibrium of Nature and Earth; and
- Shattering communities' lifelines.

8.2 VULNERABILITY IDENTIFICATION

Vulnerability identification includes identification of the target groups and regions that are susceptible to health hazards and other environmental hazards concentration of settlements and a detailed description of different kinds of vulnerability that can be caused by hazardous conditions.

Thus, human sensitivity to environmental hazards represents a combination of:

- **Physical exposure:** Reflecting the range of natural and technological events and their statistical variability at a particular location.
- **Human vulnerability:** Reflecting the breadth of social and economic tolerance available at the same site.

It follows that the vulnerability may vary through time according to changes in either physical exposure and/or human vulnerability. Out of different kinds of vulnerability, 'hazard vulnerability' is the most common and widespread. Vulnerability causatives includes different social factors like gender, poverty, and literacy, political, economic, technological population change, migration, urbanisation, inequality, land pressure etc. Hazard vulnerability may be increased because of rising social expectations, particularly in the most developed countries. People have become much more mobile in recent years and expect to be transported around the world in minimum elapsed time, irrespective of adverse environmental conditions such as severe weather. Frequently, the drive for greater competition in commerce and industry has resulted in reduced margins and smaller operating margins. In turn, these apparent improvements allow less scope for an effective corporate response to environmental hazards.

8.2.1 Driving Forces of Vulnerability Identification

The root causes of vulnerability are a set of well-established, widespread processes within the society and the world economy, which create inequalities of different/various kinds. The important root causes that give rise to vulnerability involve economic, demographic, and political processes. Understanding vulnerability is important for formulating appropriate measures to combat and preempt it in order to prevent large-scale damages when disasters happen and also improve the coping capacity of people for better resilience in their wake. Disaster vulnerability is closely linked with the economic inequality in regions in Asia, Middle East, Africa and Chile. Globally, it has been estimated that some 20 per cent of the population control 80 per cent of the wealth. Such socio-economic national disparities continue to rise. For example, in Chile, the wealthiest 20 per cent of the population have expanded their control of national income from around 50 per cent to 60 per cent between 1978 and 1985. Over the same period, the income share of the poorest 40 per cent of the population has fallen from 15 per cent to 10 per cent (UNDP, 2005).

Rising vulnerability also afflicts developed regions. Infrastructural growth has led to a concomitant increase in the vulnerability of these regions. Infrastructural development has expanded into hazard prone areas because of paucity/increased demand of/for land and increasing industrialisation and urbanisation, which has increased the threat of man-made hazards such as toxic chemicals and nuclear power.

Vulnerability also spreads in that repercussions of environmental hazards are global. International trade is dependant on inputs from different countries. Where any one of these sources gets affected because of a natural disaster, other regions, dependent on industrial inputs such as agro-based industries in poor regions of the world are badly affected because of non/reduced availability of inputs. Consequently, major disasters, such

as droughts, not only disrupt local economies, but bring about shortages in neighbouring regions, creating floods of international refugees.

Poverty increases vulnerability to disasters and contributes to perpetuating the impoverished state in turn. In order that sustainable development is facilitated, it is imperative to eliminate this vicious cycle of poverty and vulnerability. Sustainable development, with emphasis on the long-term growth and inter-generational equity is geared towards this end. Compatibility between economic growth and 'other concerns' such as equity, sustainable livelihoods, employment, gender justice, protection of child rights and environmental protection etc. demands a method to produce growth that encompasses all important aspects pertaining to the quality of life, such as quality of air and water, protection of biodiversity, livelihoods, technological advancement and development in general/at large, tempered with human concern, human exposure to risk situations such as transport accidents, occupational hazards lifestyles, etc.

Such root causes are normally a function of the economic structure, legal definitions of rights, gender relations, and other elements stemming from the ideological order. The same, as identified from *various sources*, are represented in a tabular form as follows:

Table-1

Root Causes	Dynamic Pressures	Unsafe conditions produced by
<ul style="list-style-type: none"> - System promoting unequal asset holding prompts bias. - Private gain may promote - Wrong protection measures - Population growth puts people in path of floods - Migration/urbanisation often in areas prone to water logging - Debt crisis reduce real income of poor; makes social protection by govt. more difficult. - Environment degradation may increase flood risk (deforestation and soil erosion) 	<p>Class: Low income means poor self-protection; livelihood is in dangerous place; few assets so less able to recover.</p> <p><u>Gender:</u> Poorer nutrition means women may be more prone to disease.</p> <p><u>Ethnicity:</u> Lower income; deprived of assets; dangerous livelihoods; discrimination in access to social protection.</p> <p><u>State:</u> poor support for social protection; regional or urban bias leaves others less protected; inappropriate protection measures create risk for some.</p>	<p>Low Preparedness</p> <p>Poor self protection</p> <ul style="list-style-type: none"> ◆ House site low land ; lacking artificial mound ◆ House material easily eroded damaged (Collapse is cause injury) ◆ Land erodibility <p><u>Poor social protection</u></p> <ul style="list-style-type: none"> ◆ Inadequate warning ◆ Excluded from flood protection ◆ No insurance scheme ◆ No vaccination <p><u>Resilience</u></p> <ul style="list-style-type: none"> ◆ Unable to replace assets which might be lost ◆ Livelihood liable to disruption (wage work flood field) <p><u>Health</u></p> <ul style="list-style-type: none"> ◆ Poor existing health raises risk of infection ◆ Water logging

Vulnerability that arises from unsafe conditions intersects with a physical hazard (trigger event) to create a disaster, but is itself only explained by the analysis of the dynamic processes and root causes, which generate the unsafe conditions. 'Root causes' reflect the distribution of power in a society. It is particularly crucial to understand *differential vulnerability* based on gender. In general terms, economic and cultural systems are male dominated and allocate power and resources accordingly. With respect to flood hazards, this may mean that women, who in most 'normal' situations have to work harder in rural, agricultural and domestic activities, are likely to be more prone to post flood diseases, largely because of poor nutritional condition and physical susceptibility. Men and women's time and place patterns of daily and seasonal activities also differ, and this may produce inequalities in their physical exposure to flood hazards. To the extent that young children are more likely to be with women, relates children's vulnerability with women's. People, who are economically marginalised (such as urban squatters' inhabitanats) or who live in 'marginal' environments tend to be of less importance to those who hold economic and political power. This creates two sources of vulnerability for such groups. *Firstly*, their livelihoods and resources are less secure and rewarding. *Secondly*, these are slow priority in government interventions for hazard mitigation. Hence, insecurities have to factor prominently in hazard mitigation.

People's basic health and nutritional status relates to their ability to survive disruptions of livelihood. Chronically malnourished people have less active immune systems and suffer more from infections, common in disasters such as measles or dysentery. Chronically undernourished and diseased populations succumb sooner to disasters such as famine.

Rural-urban migration is another dynamic pressure, which arises in many parts of the third world in response to the economic vulnerability stemming from root causes. Examples include, people forced to live in dangerous locations, being unable to afford safe buildings, lacking effective protection by the state (for instance, in terms of effective building code), forced to engage in dangerous livelihoods options such as ocean fishing in small boats, or wildlife poaching with its health risks.

8.2.2 Indicators of Vulnerability

Hence, indicators of vulnerability include poverty, marginalisation and access to resources; resource dependency and diversity; inequality and marginalisation; and the appropriateness of institutional structures of enhancing resilience (see Table-2). It is helpful to split social vulnerability into two distinct aspects: *individual* and *collective* vulnerability. *Individual* vulnerability is determined by the access to resources and the diversity of income sources as well as by the social status of individuals or households within a community. The collective vulnerability of a social group is determined by institutional and markets structures, such as the prevalence of informal and formal social security and insurance and viable sources of income. Inequality and vulnerability linkages are associated with relationships between inequality and diversification of income sources and poverty. In other words, inequality affects vulnerability directly through constraining the options of households and individuals when faced with external shock and indirectly through its links to poverty and other factors.

The following table (Adger and Kelly, 1999) gives the characteristics of vulnerability and their management.

Table-2

Vulnerability indicator	Proxy for	Mechanisms of vulnerability
Poverty	Marginalisation	Narrowing of diversified and empowerment
Inequality	Degree of collective responsibilities, informal and formal insurance and underlying social welfare function	<u>Direct:</u> resources collective <u>Indirect:</u>] cause of e
Institutional adaptation	Architecture of entitlements determines exposure; institutions as conduct for collective perceptions of vulnerability; endogenous political institutions constrain or enable adaptation.	Responsiveness adaptability

8.2.3 Economic Vulnerability

Economic vulnerability differs from country to country. Diversified economies are less affected whereas single market economy countries are highly vulnerable. An estimated 3-10 million people died as a result of drought in India in 1764-70 and about 3.5 million near Madras in 1876-78 primarily because dependence on the primary sector, particularly, agriculture for livelihood source(s) is preponderant. Vulnerability has also increased with the growth of cities and as competition has grown for resources.

Damage impacts will probably be most acute in regions already under stress and therefore particularly vulnerable, for example, those exposed to the natural hazards of sea or river flooding and erosion, severe drought or those located in known storm zones. Hurricane Andrew in the United States offers a recent example of the devastation that can result from extreme weather events. That hurricane approximately made 2, 50,000 homeless, destroyed 85,000 homes and incurred costs around \$ 10 billion.

The direct links between inequality and vulnerability concern the concentration of resources in fewer hands, constraining coping strategies based on private resources for households faced with external stresses. The indirect link between inequality and vulnerability occurs because skewed accumulation is associated with increased levels of poverty and hence security. Inequality and vulnerability are inter-linked. Direct links between inequality and vulnerability are through differential access to resources and opportunities. Indirect linkages between inequality and vulnerability are through impacts of inequality on poverty.

Poverty, resources' use and 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 and all economic structures can be conceptualised as dependent on the institutional structure.

Commentators and policy makers debate whether risk controls should be 'rational' or 'social' in that while the former is based on cost-benefit analysis (fact based), the latter advocates negotiation between experts and lay persons to emphasise the right values involved (Baldwin, Hutter and Rothstien). A participatory process involving local community based organisations and a local self-governing institution is a must to gain understanding of real problems involved through consideration of different perceptions. The hard approach (engineering approach) has been replaced by the soft approach, which takes a primarily social science perspective to understanding vulnerabilities (Cannon, 2000).

8.3 VULNERABILITY ANALYSIS

Vulnerability analysis identifies the exposure to risk and the levels of coping ability. It also includes an understanding of the long-term factors affecting people's ability to respond to major political or physical events and their susceptibility to crisis as well as their requirements for survival or recovery from a crisis. People's underlying vulnerabilities intensify the severity of impact of disasters, impede response, and extend hardships for periods much beyond the crisis. Examples are, lack of resources for subsistence, such as land and debilitating/deepening poverty. Strengths and weaknesses vary according to gender, age, wealth, class, and cultural identity. Development projects and programmes can make people more vulnerable in the long-term by encouraging dependency, or strengthening some groups at the expense of others (for example, giving men more responsibility over resources traditionally managed by women). The vulnerability analysis deals with material and physical factors as well as social organisation and motivation that make people stronger or weaker during a crisis. While analysing vulnerabilities and needs, planners must:

- Anticipate the problems likely to arise and the socio-economic groups most likely to be affected;
- Avoid activities that make the problems worse;
- Be alert as to how conflict and aid can be used to further political strategies; and
- Be aware of the sources of support. A capacity-building approach for human security enables people to retain and build upon their existing capacities in addition to identifying and addressing the factors that affect their security. The structure of global environmental risk reflects human driving forces, patterns of environmental change, and fragility of ecosystems, the vulnerability of social groups, and the adverse effects on the surroundings.

The stages in the evolution of risk consequences are highly inter-active and inter-related. The magnitude of the impact will depend on the extent of the environmental change, decreased length of the growing season or number of hectares of the cultivable land inundated by the increased flooding or sea-level rise. Ongoing processes and the existing factors also contribute to the resilience or capacity of a group or a region to be harmed (that is, its vulnerability). Five broad categories of factors and processes are important in determining the vulnerability of affected populations. These are *ecosystem fragility*, *economic sensitivity*, and *social system sensitivity*, *individual decision-making* and *demographic characteristics*.

The nature of social and economic institutions is yet another factor that may contribute to vulnerability. The infrastructure of social institutions and resource management pervasively shapes the breadth and depth of response capability. Whether institutions are highly adaptive or prepared to respond only to a limited set of opportunities, the potential to benefit (or to avoid harm) rests largely with the ability to identify and react to the opportunities. Increasing the reliance on management systems to reduce the variability of an ecosystem may erode the overall resilience of the ecosystem and its associated social and economic systems (Holling, 1986). The ability of social institutions to provide warnings, diagnosis, insurance and planning support is a key element in shaping successful societal coping.

8.3.1 Assessment Methodology

The concept of vulnerability can be assessed at a variety of levels and from diverse perspectives. Assessing the vulnerability of communities to “natural” disasters requires a range of *information* about both natural and human contributing factors. For example, flood-hazard locations require *physical* information like climatic and hydrological factors as well as the spread, depth, speed-of-onset and duration of flooding. It also requires *human* information about people at risk, land and building elevations, the nature and intensity of land uses, and related socio-economic activities. *Inter-relating* these data sets indicates the extent of hazard and the damage potential and the social dislocation of disasters. Vulnerability will also be influenced by what people do to reduce the risks.

The closer the analysis gets to the fundamental causes rather than the symptomatic expressions of vulnerability, the more difficult and complex vulnerabilities get to unravel. However, the more fundamental the vulnerability addressed, the more hazard-resistant the vulnerable group is likely to become, as a result of mitigation policy. Each type of hazard puts a different set of ‘elements’ at risk. Most of disaster mitigation work is focused on reducing vulnerability and in order to do so, those engaged in development planning need an understanding and indication of which elements are most at risk from the principal hazards that have been identified. Vulnerability assessment of hazards usually takes place in the following two-stage sequence:

- 1) **Making an inventory of what is at risk:** Once the hazards in any location or area have been identified it is necessary to find out what may be affected by them. Thus, base line data is required regarding the following: (Seeds India)
 - population; age, gender, health
 - livelihoods; types, locations
 - local economies
 - agriculture and fisheries
 - buildings
 - infrastructure
 - cultural assets (i.e. libraries, museums, historic buildings etc.)
 - local institutions
- 2) **Assessing the vulnerability of elements at risk:** After an inventory has been prepared of the elements at risk, further examination has to be made regarding how

they are likely to be affected in order to make an estimation of the damages involved. It should be noted that whilst a quantification of the elements existing in any location is relatively straightforward, an assessment of how they are likely to be affected in a hazard event is harder to make. This is the job of technical specialists who have to be educated and trained to carry out the tasks. It is also important to note that it is often the case that the ‘intangible’ aspects of vulnerability will be as important as the quantifiable aspects in determining the extent of damage (s). These should include the evaluating of socio-economic vulnerability and individual or societal “coping mechanisms” as well as support systems which allow some people to cope with the impact of a hazard and recover from them comparatively faster.

As part of its Risk and Vulnerability Assessment Program, the Pacific Disaster Center (PDC) has developed and implemented a strategy to assess and reduce the impacts of natural hazards within the Asia Pacific region. For multi-hazard assessments at regional and national scales, a “Vulnerability-Exposure-Sensitivity-Resilience (VESR)” methodology is being used to assess the spatial variability of vulnerability to natural hazards, and to assess their impacts on populations and infrastructure.

Most recently, Vulnerability Sensitivity, Exposure (VESR) methodology has been applied to the Lower Mekong River Basin to assess vulnerability to flooding. In this particular case, these factors are included: The factors are discussed under:

E = Exposure to floods over time as a function of frequency and severity

P = Presence (and number) of people exposed to flooding

S = their Sensitivity, or susceptibility, to negative impacts of flooding as computed from measures of awareness, fragility, remoteness, and access to high ground

R = Resilience of subjects, or their ability to mitigate and rebound from effects of flood exposure, computed as a function of per capita GDP, food and water security, and governance measures. The following are the vulnerability indicators in this case.

Vulnerability Indicators are generally identified as Unemployment rate, Crime rate, Premature birth rate, School dropout rate, Average income, Recreation to population ratio, and Autos to population ratio.

Data Requirements

Data is required regarding employment, population from the census bureau, education, parks and recreation, health care, and economic data.

The VAM

The Vulnerability Analysis is a Community Profile reflecting social, economic, and Environmental indicators. The Vulnerability Analysis and Mapping (VAM) Unit is an internal structure within World Food Programme (WFP) that provides temporary and long-term technical assistance in food security analysis to decision-makers at WFP Headquarters in Rome and in WFP Regional and Country Offices. The VAM network is currently comprised of three full-time international staff members in Rome Headquarters, 12 international VAM Officers, and approximately 20 VAM National Officers and VAM Focal Points: This network currently provides food security analysis coverage for 36 countries.

8.4 VULNERABILITY IDENTIFICATION: DROUGHT EXPERIENCE

Despite a millennia-long struggle with drought, vulnerability remains and in some cases is even increasing. Basic problem is that the society is changing and is generating new and different risks. Other key factors are the variability of climate, poor memories and inadequate planning. Mitigation planning usually attempts to augment moisture supplies or reduce demand. Demands usually increase to match supplies, which is sustained in humid periods, can far exceed those available, when drought returns. If newly augmented supplies are allocated to new activities then the protective cushion, they would have provided, is lost and vulnerability is maintained or augmented. Non-integrated planning can create new vulnerabilities such as due to immigration, drainage of wetlands to meet increased demand, increased need for water because of urbanisation, industrialisation etc.

Droughts are more serious where demand is greater relative to supply or there is a marked variability in supply. Such conditions are common along the dry frontier of agriculture in semi-arid areas, e.g. the Sahel and parts of Australia and India. They have taken their greatest toll in densely populated lands that are highly dependent on agriculture. Fragile government's inadequate storage and transportation facility, very low technology (ability to plant and harvest at optimal times) amongst others, leave such countries extremely vulnerable to drought. Extreme droughts occur simultaneously with other problems, such as war, which create most havoc. The appalling consequences were quite evident in recent events in Sahel, Ethiopia, and the Sudan.

As population in these areas increases, lands that are at higher risk, must be put into cultivation, for the most reliable lands are already inhabited (Glantz et. al., 1984). Strong dependence on agriculture intensifies vulnerability for there is no viable alternative, given it should fail. If misused, it can increase the level of hazard by allowing demands for finite water resources to grow. A green revolution has not been manifested in Africa. Within developed countries, recent studies show a shift of vulnerability from the farmer to financial institutions and real estate. Most farmers can cope with commonly occurring dry periods. For example, Canadian cereal production is considered relatively secure against droughts of up to two-year duration. However, less buffered sectors such as livestock production farm implement manufacturing and recreation can be strongly affected. The land resource continues to be at risk. The desire for profit can increase the drought hazard diversification; risk spreading crop insurance, assistance and the exploitation of different technologies etc. The economic impact of drought can be great but being distributed across an otherwise robust economy, mitigates personal distress.

8.5 INTEGRATED APPROACH TO VULNERABILITY REDUCTION

The preferred disaster management system should integrate the following elements as per INDNR and ESCAP deliberations:

- the individual management measures
- the roles and responsibilities of all stakeholders
- the disaster management plan and the disaster emergency plan

- the resource management considerations and programmes
- where applicable, the concept of comprehensive land-use planning based on total watershed management principles.

An integrated approach is required to bring together these diverse issues, for the purpose of comprehensive strategy involving all stakeholders in charge of specific subject areas in disaster management. The extent to which the integrated approach can be achieved depends on a number of factors including the management of natural resources and the strength of existing legislation. The ultimate goals of integrated disaster management should be to limit the hazards and damages to *socially acceptable levels*, to promote environmental enhancement and to provide disaster warning, response, evacuation and recovery.

Hence there is need for:

- further mitigation of disaster damage to existing development
- controlling future growth of potential disaster losses.

8.6 CONCLUSION

The variety of efforts across disciplines to address vulnerability has generated a *pot-pourri* of terms, differing approaches and concepts. The related concepts of ‘resistance’ (the ability to absorb impact and maintain functioning), ‘resilience’ (the ability to maintain a system and to recover after impact), and ‘exposure’ (the presence of a threat to a group or region) provide some guidance on *exposure*, *capacity* and *potentiality*. These three dimensions account for most of the discussion included under the general rubric of vulnerability. High population densities, population growth rates and pressure on limited food, land and water resources can make regions very vulnerable to global change.

8.7 KEY CONCEPTS

- Drought** : Drought is caused by acute water crisis. Adverse conditions relating to water shortage precipitate a drought over time. Effective policy intervention can prevent the hazard from turning into a disaster. Possible measures including dams, irrigation facilities and water harvesting techniques aimed at preventing wastage of the precious natural resource.
- Vulnerability Analysis** : Vulnerability Analysis is the process of estimating the vulnerability to potential disaster hazards of specified elements at risk. Vulnerability analysis has both the engineering aspect and the socio- economic dimension. It is holistic analysis, which is a prelude to a comprehensive package of disaster preparedness.
- Vulnerability Assessment** : Vulnerability assessment is an inter-disciplinary process undertaken to unearth both short- term and long-term and, direct and indirect losses likely in case of a disaster. It involves detailed investigations including on the filed observations, surveys and statistical analyses, etc.

8.8 REFERENCES AND FURTHER READING

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8.9 ACTIVITIES

- 1) "Vulnerability is susceptibility to any kind of harm, whether physical, moral or spiritual, at the hands of an agent or agency." Discuss.
- 2) Highlight driving forces of vulnerability identification.
- 3) Mention various indicators of vulnerability.