UNIT 5  DISASTER PREPAREDNESS WITH RELEVANCE TO HOUSING, INFRASTRUCTURE AND LIVESTOCK

Structure
5.0  Learning Outcome
5.1  Introduction
5.2  Disaster Preparedness with Relevance to Housing and Infrastructure
5.3  Livestock Preparedness in Disasters
5.4  Conclusion
5.5  Key Concepts
5.6  References and Further Reading
5.7  Activities

5.0  LEARNING OUTCOME
After going through this Unit, you should be able to:
• Discuss the various dimensions of disaster preparedness with relevance to housing and infrastructure
• Highlight the effects of disaster on livestock; and
• Explain the preparedness measures pertaining to livestock management.

5.1  INTRODUCTION
Disasters, which are extreme events, cause destruction of human beings, livestock, property, infrastructure, and other resources. Preparedness measures need to be taken for the protection of housing, infrastructure and livestock. It is difficult to ascertain in precise terms the extent of death and destruction that can be avoided if precautionary measures are taken. But concrete measures many a times can mitigate the damaging effects of disasters. Hence adhering to structural specifications, building codes, and byelaws in housing and infrastructure can go a long way in reducing the intensity of disaster impact. Similarly, with regard to livestock on which there is excessive dependence in a country like India, there is need to pay attention to a certain level of preparedness. In this Unit, we shall focus on certain preparedness aspects with relevance to housing, infrastructure and livestock.

5.2  DISASTER PREPAREDNESS WITH RELEVANCE TO HOUSING AND INFRASTRUCTURE
In a disaster, buildings and other structures get destroyed and cause the maximum damage to human life and property. After every earthquake it has been pointed out time and again that loss of life and property could have been minimised if buildings had been designed
and constructed keeping in mind the potential disaster. Unlike cyclones and floods, earthquakes cannot be predicted. At best, there is information about broad geographical zones where earthquakes are likely to occur. Even this information has proved to be questionable with the Gujarat earthquake. In simple terms, the scale of any earthquake disaster depends upon the magnitude of the earthquake, the closeness of the settlements in question to the epicentre, density of habitation in the settlement and the degree of preparedness. Therefore, the potential disaster becomes greater, when larger and nearer the earthquake is to the settlement and also in situations of large population, increase in economic development and poor preparedness.

Let us now examine how an earthquake affects a building. An earthquake is basically a wave moving along the land. As the earth vibrates, all buildings on the ground surface will respond to the vibrations in varying degrees. Foundations fix a building to the ground. As the foundation of a building moves, the superstructure including its contents tends to shake and vibrate. In effect, there is a distinct horizontal force acting on the building, which may be from any direction. This external horizontal force must be compensated by equal and opposite forces coming from the strength of the building if it has to withstand the collapse. As force is a product of mass and acceleration it is obvious that if a structure is top heavy, the building has to have more internal strength. Studies have also shown that the intensity of a shock is directly related to the type of soil on which it is founded. Buildings built on solid rock and firm soil often fare better than those on soft ground. Buildings sited on flat open ground respond better than those on narrow ridges, steep slopes and between high hills.

The buildings are generally of two types, namely engineered and non-engineered. The engineered buildings are those that are built on the basis of special codes, building provisions and byelaws. These are designed by qualified engineers and architects. The non-engineered buildings are those, which are built with the help of local semi-skilled masons and small non-professional contractors. In such constructions, there is no adherence to any building codes and byelaws.

The earthquake-resistant houses in particular need to take cognisance of the following:

- Avoiding hill slide slopes for location of building.
- Following symmetry in the building as a whole or its various blocks.
- Separating a large building into blocks.
- Doing away with ornamentation such as large cornices, vertical or horizontal cantilever projections etc. But wherever it is introduced reinforcing it with steel and embedding it on to the main structure of the building is required.
- Detailing of joints for example, wall to roof, and wall to wall.

In case of cyclone-resistant construction of buildings, the following guidelines need to be adhered to:

- Designing of houses, schools, hospitals etc., in accordance with the wind velocity of the area. The shape of the roof, limitations on projections in the buildings etc., need to be adopted accordingly.
- Choosing of building site at a ground level above the probable maximum tide level.
- Providing for inclined roofs instead of flat roofs.
Disaster Preparedness with Relevance to Housing, Infrastructure and Livestock

- Ensuring connection of roof trusses to Reinforced Concrete Cement (RCC) or masonry walls through properly designed anchor bolts and base plates.
- Avoiding projecting elements such as antennas and tall chimneys or these are to be kept low and anchored to the structure.
- Reinforcing walls with vertical steel enforcement.
- Encouraging the use of reinforced masonry, which includes brick walls, hollows, concrete block masonry etc.

Reducing the use of glass in windows or doors and substituting it with glazing bars or Mullions.

In case of flood-resistant house or building construction, following measures can be resorted to reduce damage:

- Constructing buildings on best bearing soil and highest ground.
- Incorporating ground drainage and escape lanes in the layout.
- Growing thick plantation around the structure.

Compacting the structures and providing rigid framework construction or bracing them.

In general, in designing and executing small and medium-scale buildings, the following precautions need to be taken:

1) Vertical tension members must be introduced at building corners so that all forces from the roof are transferred to the foundation. In single and two floor buildings with load bearing walls it could be a single steel bar of 10 mm diameter which is encased in concrete using a pipe sleeve as movable shuttering for the encasing concrete.

2) Buildings should not be top heavy which means buildings should not be lifted off the ground on freestanding columns. When the horizontal force acts on the building it is likely to collapse at the junction of the two floors. If a floor is required at the ground level for parking etc., the columns should be cross-braced. Secondly, the roof should not be heavy by itself.

3) Walls if heavy, must be buttressed to keep them together. When walls are made of random rubble, "through stones" must be evenly distributed over its entire area.

4) Walls must be as light as possible. By this logic a 190-mm thick brick wall (the CBRI bond) is better than a 230-mm brick wall. Due to cavities and consequent reduction in weight by 25 per cent where random rubble masonry is used with a minimum thickness of 350 mm, like the desert districts of Rajasthan, replacement with hollow concrete blocks or re-constituted stone masonry walls of 200 mm thickness would be appropriate.

5) Mortars used in walls must have strength equal to the building block for the wall to act as a monolithic at times of stress. In addition to standard mixes it also calls for proper filling of all joints between the building blocks, plumb walls, proper interlocking of courses at all right angle joints.

6) Tension members in the form of bands may be added at plinth, lintel and roof level to tie the walls together so that the entire structure moves in unison. Each of these...
horizontal ties must be structurally integrated with the adjacent member and must not rely on gravity or inertia to keep itself in place. In case of sloping roofs the gable end wall must have its triangular portions of masonry enclosed within a band with the horizontal part continuous with the eaves level or roof level band. A truss with lightweight roofing material as cover for the gable end is preferable over a solid gable.

7) Cantilever forms protruding from the box-like shape like balconies, chajjas, parapet walls, chimneys, and eaves boards must be minimised as their independent movement during the tremor can cause active damage to the structure. Ornamentation like cornices and large fascia stones must be avoided. Any projection from the structure must have appropriate reinforcement, which is then fed to the main structure of the building.

8) Building plans should preferably be symmetrical about both axes. In case, “U”, “T”, “E”, or “L” shaped buildings are to be designed it is better to build them as separate sections as rectangular blocks with suitable gaps between them.

9) When building on slopes, stable rocky sections should be selected. A series of small blocks on independent terraces is preferred over one large block with variegated founding levels.

10) Openings in load bearing walls must be minimised. Length of openings by themselves must be reduced as the number of floor increases. Broadly the total area of opening on all walls must be less than 50 per cent in the case of a single storey building, less than 40 per cent in the case of a double storied building and less than 30 per cent in the case of a three storied building.

11) Openings must also be placed away from “L” and “T” junctions by a minimum of 60 cm or more to maintain rigidity of the structure. These must not be placed one above the other. Adherence to broad guidelines can minimise damage to buildings from earthquakes to a great extent (Grover,2006).

India is among the few countries with no regulatory mechanism to control building activities and construction sector workers. South Africa, for example, has the most exhaustive regulations for construction activity. The Council for Built Environment is the nodal agency that coordinates all construction works. The Construction Industry Development Board Act (No. 38 of 2000) licenses and registers professionals, contractors and workers engaged in building activities. New Zealand has indicated in its motto of Building Act 2004 “to make buildings right the first time”. The Act gives guidance on achieving high quality construction. Only qualified people are allowed to design, construct and impact buildings. All building materials are licensed (The Hindustan Times, 2005).

A.S. Arya (2005) opines that unless states including Delhi take steps to make buildings structurally sound, it might prove too late when disaster strikes again. Though nodal building byelaws were framed in September 2004, no state has incorporated them so far. Multi-storied buildings have come up in flagrant violation of norms. People living in single-storey houses have added three storeys using walls that are only half-brick thick. These vertical extensions are most likely to collapse in an earthquake. Trained structural engineers are not used by builders. As a result, most of the buildings do not have seismic bands and lack proper reinforcement. Awareness is crucial and people should enquire about the safety aspects in the building, the structural engineers involved and steps taken to ensure that the building is safe.
Infrastructure i.e., roads, railway tracks, telecommunication etc., must be built in such a manner keeping in view the vulnerability of the area to any hazard or disaster so that these can withstand the impact of disaster. Disaster preparedness with reference to housing and infrastructure need to take into account, the geo-climatic conditions of the area, the local traditional building techniques, the socio-cultural patterns of living. Awareness is also needed amongst the people regarding the design and construction keeping in view the local topography.

Sustainable Environment and Ecological Development Society (SEEDS), an NGO, demonstrated the use of earthquake-safe technology in house construction in village Patanka in Gujarat. Having tested a number of variations on the traditional housing construction of boulders and mud, they concluded that safer construction need not depend exclusively on cement and steel. But considerable care was needed to find the right ways of combining elements of modern and traditional materials and techniques to bring out the best features of both:

- Rubble was re-used from collapsed buildings to save resources.
- Stone masonry was employed, rather than brick or cement concrete blocks, as it was both vernacular and provided better thermal insulation.
- Traditional tile roofs were used rather than slab roofs, as tiles 'breathe', keeping inside temperature during the hot summers up to 5 degrees celsius lower than in building with slab roofs.
- Key seismic safety elements were integrated into the design, such as reinforced concrete plinths and lintels, and steel reinforcing gable bands and corner stitches.
- Houses were set in traditional rural configurations, surrounded by open spaces, rather than city-style terraces, which are unsuitable for rural life styles and more susceptible to earthquake damage (World Disasters Report, 2004).

**LIVESTOCK PREPAREDNESS IN DISASTERS**

Livestock is the most affected during disasters. In case of any disaster, the preparedness and relief efforts are initially directed towards the human population, while livestock protection comes later. But disasters affect the livestock in direct as well as indirect manner.

**Direct Effects of Disasters on Livestock**

The important direct effects of natural disasters on livestock can be summed up as follows:

- Generally the safety of people is the prior concern during disasters, which results in neglect of the safety of their animals. At times the animals run away in panic.
- Death of animals due to collapse of cattle sheds are common during earthquakes and landslides and animals get injured.
- It is reported that during the earthquake or even in cyclone, animals try to free themselves of the neck ropes or metal chains. Some times death occurs in this struggle due to asphyxiation.
- Drowning and washing away of animals in floods.
v) Animals and birds are reported as being blown away during cyclones and high winds.

vi) Animals get stranded on isolated elevated places.

vii) Many deaths of animals are caused by attacks by poisonous insects, snakes, rodents, and leaches etc. Long-term starvation deaths are also common.

Indirect Effects of Disasters on Livestock

The conditions arising out of the effect of disasters also have indirect effects on the livestock. These include:

- Water borne infections leading to diarrhoea etc.
- Moisture causing respiratory disorders.
- Parasitic infections caused by round worms, tapeworms etc.
- Loss of weight amongst animals.
- Insufficient production of milk.
- Lesser production of eggs in case of poultry.
- Interrupted supply and availability of fodder.

It is strange that in general, a large number of disaster teams to mitigate human sufferings rush from different parts of India and abroad, but no efforts are made to take care of either domestic or wild animals. We must keep in mind that the gross value of output from the livestock accounts for about 26 per cent of the total agriculture output (Ninth Five Year Plan of Government of India). Besides, the animals have life like human beings and are an essential component of eco-system. Hence, we must as well pay attention to livestock.

Livestock Management in Disasters

The precise numbers of the dead or missing animals, in case of disasters are generally unclear. Apart from the physical destruction and death described above, these events have resulted in extensive personal trauma, massive tragedy in families and severe dislocation of community life. Artisans lose their implements, farmers lose animals and ploughs, wells and water sources are clogged, and means of livelihood are completely disrupted. Infrastructure for health care, communication, education and the daily activities of the people are always badly dislocated. The extent and nature of such destruction need to be carefully studied and programmes for the rehabilitation of individuals, families and communities are to be launched.

Livestock Preparedness Plan

This needs to include:

- Database that provides information relating to hazards, community profile, herd profile and animals at risk.
- Assessment of resources including veterinary personnel, drugs and equipment, mobile veterinary units, veterinary hospitals etc.
• General awareness amongst the community, and volunteers about the livestock management aspects including their recovery, rehabilitation, and control of diseases.
• Construction of livestock shelters, and
• Contingency plan for movement of livestock to safer places.

Livestock Management During Disasters

The preliminary step to be taken during disaster situations is to rescue the stranded and affected livestock and take them to safer places and attempt to provide fodder, water and medical aid. The community and veterinary staff need to be trained to attend to the livestock in such emergencies. Animals are completely dependent on us, especially in disaster situations. When necessary precautionary measures are taken for safeguarding livestock, prior to a disaster as this increases their chances of survival. Following approach is recommended:

The first step is to assess and establish the airway. Quickly the airway is to be checked for the presence of any foreign material. If breathing appears to have stopped completely, i.e., there is no obvious rhythmical rise and fall of the chest in an animal which is showing no other sign of life, it is sensible to check for heart beat. Sometimes an unconscious animal can resemble a dead one. If the heart beat can be felt, one needs to proceed immediately with support for getting the animal extricated and such animals should be immediately removed to veterinary camps or for hospitalisation to veterinary hospitals. Where airway has already been established, one has to resort to artificial respiration and circulatory support. After basic life support, advanced life support and prolonged life support are to be provided to each animal. A short summary of this support includes:

Basic Life Support:
A - Establishment of airway
B - Breathing support
C - Circulatory support

Advanced Life Support:
D - Diagnosis and drugs
E - Electrocardiograph
F - Fibrillation control

Prolonged Life Support:
G - Gauging a patient's response
H - Hopeful measures for the brain
I - Intensive care

Provision of all these types of support will depend upon the facilities available in nearby veterinary institutes (hospitals or poly clinics) or camps. Deciding about the hospitalisation of animals is a tough question. Obviously several factors are important in making the decision.
The medical and surgical condition is the first factor to be considered. One crucial question must be answered "is there a need that can be fully filled only by hospitalisation?" For example is oxygen, special monitoring, intensive fluid therapy, or intravenous medication required? Will the animals receive proper observation and treatment of discharged animals? Is there even an owner to take care of the animal? Unfortunately, many a times cost factors determine these decisions. If the animal’s owner cannot afford hospitalisation and which is the most common situation in most post-disaster situations, veterinarians working for animal's welfare are faced with an important decision.

1) Is there a way by which an animal can be treated at home without endangering survival or there is some body to adopt that animal at his residence or farm?

2) If the condition is so severe is euthanasia a viable option?

The decision will be based on several factors:

a) Is there any owner for a particular animal?

b) If so, is he/she in position to provide health support to the animal?

c) If there is no owner, is the animal likely to be adopted by some private persons or farmers?

d) Are there enough funds available to veterinary institutes, which are treating such animals?

e) What is the extent to which mobile veterinary service in particular area is available?

Epidemiologically most of the diseases are associated with change in the host, the agent and the environment. Because of the major changes in the environment during most of disasters, occurrence of diseases due to agents like Virus, Bacteria, Fungi, Protozoa, Metazoa, Endoparasites and Ectoparasites cannot be ruled out. Special attention has to be paid to environmental determinants of disease in livestock enterprises for example in a State like Gujarat, which is the front-runner in dairying. This is through proper shelter management and appropriate diet to mitigate the sufferings of animals.

Stress is another factor that is going to be the key determinant. If the biological reactions are inappropriate or inadequate then stress may lead to pathological lesions. Many a times, stress is also accompanied by shock. So our main aim is to check all these determinants like pathogens, shock and stress by providing proper environment, boosting the immunity of animals against infections and parasitic diseases, providing proper diet and deworming etc. Therefore special attention during disaster by vaccination of animals against commonly occurring diseases, provision of mineral mixture and de-wormers to animals is of great help. Vaccination needs to be carried out in livestock for prevention of main diseases like foot and mouth disease (FMD), hemorrhagic septicemia etc.

Feeding of Animals During Disasters

Two weeks after the Gujarat earthquake, a national daily reported that thousands of cows were suffering from acute shortage of fodder following death of their owners on January 26, 2001. The scarcity of feed and fodder resulting in these areas, adversely affect livestock health and production. Such problems have to be tackled on a national scale so that feed and fodder from relatively surplus area are transported as quickly as possible to the affected area. Fodder banks are required to be organised on a large scale to meet such demands.
Animals such as cows, buffaloes, sheep, goat, etc., require fodder for sustenance. Bullocks and horses, that are not needed for work have to survive on maintenance ration, since they may not be required for work during famine and flood conditions. In case they are required for work, as it happens in some natural disaster, they accordingly are to be provided ration. Calves may be provided growth ration to some extent and if circumstances do not permit they may be fed only maintenance ration. After the calamity is over, the calves can be fed according to their weight. As far as the small pet animals are concerned, they get their feed along with their owners, as their requirements are almost identical.

** Provision of Health Care by Mobile Veterinary Units**

Many a times, livestock keeping is not the sole occupation of the people of disaster affected areas, as they are deriving only supplementary income from livestock. Hence taking sick animals to nearby hospitals and the treatment entails expenditure and resultantly, the livestock is neglected. Thus, it is envisaged to provide treatment to sick animals at the doorsteps of livestock owners by mobile veterinary units.

Non-governmental organisations (NGOs) can play a major role in providing relief to the livestock during the disaster in the following ways:

a) Establishment and running of cattle camps;

b) Collection/transport and distribution of food and fodders, forest grass, straw etc., for feed;

c) Accurate report on the extent of loss of livestock of individual farmers / damage assessment;

d) Disposal of animal carcasses; and

e) Providing training to the community for animal care during natural disasters.

**Livestock Management in Post-disaster Phase**

- Arrangements could be made for purchase of livestock that the farmers might want to sell, out of distress and the cattle can be rehabilitated in Goshalas.
- Farmers of the disaster-affected area could be encouraged to go for insurance of their livestock, so that they may be adequately compensated for the livestock lost by them or livestock incapacitated or diseased.
- There is a system of distribution of cash as relief money for the loss of animals. There could be provision of bullocks and milch animals to the affected people.
- Reconstruction of damaged veterinary and artificial insemination centre buildings should be given priority.
- After the disaster, cattle breed of high quality and resistance should be introduced in the area so that better genetic stock could be preserved for the future.
- Setting up of permanent fodder bank in drought and flood affected area will help the people in disaster situations. This will provide permanent feed security system in the vulnerable areas.

The farmers who have lost their animals and other means of livelihood can be helped by providing animals from other States. These animals can be purchased by government from
cattle fairs of other states, government breeding farms (like National Dairy Research Institute, Karnal etc.). This will not only provide source of income to the farmers, it also protects the nature and environment by re-establishing ecological balance. In the Ninth Five Year Plan, the major thrust in animal husbandry sector was on the control of animal diseases, creation of disease free zones, scientific management and upgrading genetic resources; and increasing availability of nutritious feed and fodder. In addition, there is a need to focus on creating financial support for procurement of livestock.

5.4 CONCLUSION

Disasters have impact not only on human beings, but also on livestock and property including housing and infrastructure. The biggest challenge before the government, community, and other agencies is to provide for disaster-resistant housing and construction. Presently, efforts are being made to develop a huge repository of information about codes, structural designs, layouts, etc. It is generally due to lack of awareness about these provisions, poor regulation and monitoring that implementation of building byelaws, adherence to codes takes a back seat. Disasters generally focus on humans and livestock management is something that needs to be addressed to. There is a need for veterinary disaster preparedness plan, and trained personnel to handle various facets of livestock management. In view of such large livestock population in our country, we need to preserve these and manage their welfare in crisis situations.

5.5 KEY CONCEPTS

Building Codes : These are regulations provided by the government, which lay down norms and standards to be followed while constructing a structure. Adherence to these is the responsibility of the engineers and architects supervising construction.

Cantilever : It is a projecting structure like a beam, which is supported at one end and carries load at the other end or along its length.

Euthanasia : It implies the humane destruction of an animal accomplished by a method that produces rapid unconsciousness and subsequent death without evidence of pain or distress, or a method that utilizes anaesthesia, which causes painless loss of consciousness and subsequent death (www.aphis.usda.gov/ac/cfr/cfr1.htm). It is also used in the context of mercy killing of an individual to prevent a prolonged and painful death.

Foot and Mouth Disease (FMD) : It is a highly contagious viral infection primarily of cloven-hoofed domestic animals (cattle, pigs, sheep, goats and water buffalo and cloven-hoofed wild animals). The disease is characterised by fever and vesicles with subsequent erosions
Disaster Preparedness with Relevance to Housing, Infrastructure and Livestock

in the mouth, feet etc. (www.antieumus
torbus.com/English/Animal.htm).

**Fibrillation**

* It is the rapid contraction of the heart muscles or fast uncontrolled heart beat.

**Hemorrhagic Septicemia**

* Generally develops in cattle and water buffaloes. It results in high temperature, respiratory distress, salivation, vassal discharge, swelling etc.

5.6 REFERENCES AND FURTHER READING


Dipal, Namintha, *The Need for Veterinary Disaster Preparedness and Management Plans in India*, (www.vethelplineIndia.com)


Ram Kumar, V, 1999, ”Role of Livestock and other Animals in Disaster Management”, International Conference on Disaster Management: Cooperative Networking in South Asia, IGNOU, New Delhi.

*The Hindustan Times*, 12 October, 2005.

5.7 ACTIVITIES

1) Observe a few buildings or any other ongoing construction in your area and enquire from the engineers about the adherence to structural specifications, building codes etc.

2) Visit any nearby dairy and elicit views from the owner about taking care of livestock in disaster situations.