

Disaster management in India: the case of livestock and poultry

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Summary

Developing countries are becoming increasingly aware of the importance of disaster management systems, and increasing efforts are being made to streamline preparedness, response and recovery mechanisms at all levels. It is well known that many developing countries, including India, are not always well-prepared to deal with disasters. A lack of well-developed disaster management plans results in a severe loss of human life, animal life and property, which could be saved if the necessary mechanisms were in place. A lot needs to be done to improve the situation, particularly in regard to livestock. This paper describes in detail, with particular reference to India, what can be done to care for animals when natural disasters occur. The authors review various types of natural disasters and their impact on livestock, and outline different preparedness, response, recovery, and mitigation strategies. The roles of different agencies, including veterinarians, are also considered.

Keywords

Community participation – Disaster management – India – Livestock – Man-made disasters – Natural disasters – Poultry – Veterinarian.

Introduction

The World Health Organization defines disaster as 'any occurrence that causes damage, economic destruction, loss of human life and deterioration in health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area'. It is an event, concentrated in time and space, which causes social, economic, cultural and political devastation and which affects both individual people and communities (23). No disaster is exactly the same as another, and the impact and consequences vary from region to region and community to community.

Types of disasters

Disasters can be categorised, according to what causes them, as natural disasters, i.e. the result of natural phenomena, or man-made disasters, i.e. the result of man's intervention or non-

intervention. Natural disasters account for nearly 80% of all disasters that occur in the world.

Disasters can also be classified, according to their impact, as localised, widespread, predictable or unpredictable, and also, major or minor.

Impact of disasters

The impact of a disaster can be categorised as direct, indirect or tertiary. Table I shows these various effects. Apart from the public health consequences of disasters, such as zoonotic diseases and the threat to the food supply, disasters also have negative economic consequences, particularly in developing countries. In these countries, not only do livestock provide milk, meat, traction power for farming and transport, dung, hides, wool, fibre, etc., animals also provide a relatively safe investment option and give the owner social importance (31). Disasters affecting livestock can therefore have a negative

Table I
The impact of disasters on various factors

Direct impact	Indirect impact	Tertiary impact
Human lives	Exports/imports	Health hazards
Livestock and other animals	Agricultural output	Long-term development
Private property	Industry/services output	Overall investment climate
Municipal infrastructure	Remittance income ^(a)	Funds reallocation ^(b)
Power/telecommunications infrastructure	Fall in earning potential (due to disability, trauma etc.)	Community migration/relocation
Health/education assets	Unemployment	

Source: adapted from Gupta (13)

(a) tax benefit provided by the Government of India to Municipal bodies

(b) funds which could have been used for developmental activities which are reallocated for disaster management

impact on the infrastructure of a country, reducing an important source of income in rural areas and hindering the distribution of food and goods.

Disaster and livestock

When animals are affected by disaster, the main problems are, as follows:

- a) the spoilage of food and/or the water supply
- b) zoonoses
- c) animal bites
- d) the significant impact on public mental health due to the emotional involvement of the owners with the animals
- e) reduced dairy and livestock production, due to the scarcity of feed and water, high livestock mortality rates, etc.
- f) the damage to both domestic and wild animal species, due to lack of feed and water and the diseases which spread during and after a disaster.

Experience has shown that during disasters, the prime concern of everyone, and the principal objective of every relief measure, is to help people. Although animals are also severely affected, people must take priority.

India and disasters

India is one of the top four most disaster-prone regions in the world. India, being a vast country with a tropical climate, experiences all types of natural disaster, except volcanic activity (9). The frequency of droughts, floods, earthquakes and

cyclones is increasing every year. Of the thirty-two States and Union Territories in India, twenty-two are disaster prone. 28% of the total cultivable land is prone to drought; 58% of the total area is prone to earthquakes. Based on disaster affinity, the country can be categorised into five sub-divisions, as follows (40):

a) the northern mountain region (including foothills): mainly prone to snow storms, leading to landslides and cold waves, heavy rainfall, and land and soil degradation. Massive snow avalanches occur in the Himalayan region, which have great destructive potential

b) the Indo-Gangetic plains: floods are a common occurrence here

c) the Deccan plateau: this area is prone to drought and has erratic rainfall. Earthquakes of varying intensities have also been reported in this area

d) the western desert: this area, known as the Thar Desert, has limited and unreliable rainfall and is prone to drought

e) the coastal areas: the coastal areas are vulnerable to sea erosion, cyclones, and tidal waves. Five to six tropical cyclones form in the Bay of Bengal and the Arabian Sea every year, two to three of these cyclones will be severe and will lash the densely populated coastal areas of India, causing extensive damage.

Phases of emergency management

There are four generally recognised phases of emergency management, namely, mitigation, preparedness, response, and recovery (8). Table II shows the main features of these four phases of emergency management, as reported by the Emergency Management Institute (EMI) (8). The same phases also apply to the management of animals, both livestock and pets, during disasters.

The loss of any form of livestock will have long-lasting effects on agriculture and the sustainable income of landless farmers in particular, who depend solely on livestock for their livelihood. 67% of small and marginal farmers, and landless people living on the edge of poverty, own 70% of the livestock in India. Small holders rear animals with virtually no capital resources or training, but they contribute significantly to the gross domestic product of developing countries. In India, these people produce 62% of total milk production. 70% of poultry are still reared in backyards. As such, it is the small, marginal and landless livestock owners who are most affected when natural disasters occur. Given these facts, it is essential to have a well-designed and practical disaster management plan for livestock.

Table II
Phases of disaster management

Phase	Action
Mitigation Preventing future emergencies or minimising their effects	Includes any activities that prevent an emergency, reduce the chances of an emergency happening, or reduce the damaging effects of unavoidable emergencies, e.g. buying flood and fire insurance for homes Mitigation activities take place before and after emergencies
Preparedness Preparing to handle an emergency	Includes plans or preparations made to save lives and to help response and rescue operations, e.g. evacuation plans and stocking food and water Preparedness activities take place before an emergency occurs
Response Responding safely to an emergency	Includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting preparedness plans into action, e.g. seeking shelter from a tornado or turning off gas valves in an earthquake Response activities take place during an emergency
Recovery Recovering from an emergency	Includes actions taken to return to a normal or an even safer situation following an emergency, e.g. getting financial assistance to help pay for the repairs Recovery activities take place after an emergency

Source: adapted from EMI (8)

Care of animals in disaster

Care of livestock and horses

Disaster preparedness is important for all animals, but it is particularly important for livestock because of the size of the animals and the requirements needed to transport them and shelter them (17). Livestock owners should follow the local construction regulations when building their barns and other buildings, these regulations vary from area to area, depending on the type of disaster prevalent in the region. According to The Humane Society of the United States of America (USA) (17), the Maryland Emergency Management Agency (27) and the EMI (8), in case of any emergency or disaster, the following should be the modus operandi for taking care of animals:

- a) a local emergency management committee should be formed involving local people
- b) a safe shelter for farm animals and a disaster plan to protect property, facilities, and animals, should be planned, ahead of time, in conjunction with the local community. Potential places include fairgrounds, other farms, etc.
- c) animals should be evacuated and taken to shelter as soon as there is news of an imminent disaster. Every animal must have some form of durable and visible identification, e.g. the animals should be branded or tagged
- d) the community should have arrangements for appropriate transport, suitable for specific animals
- e) a farm disaster kit should be prepared in advance so that supplies are readily available in the event of a disaster. The kit should be placed in a central location and everyone in the family or community should know where it is. The contents must be checked regularly to ensure fresh and complete

supplies. The following items should be included in the kit, plus items that are used everyday:

- an up-to-date list of all animals, including their location and records (feeding, vaccination, tests)
 - supplies for the temporary identification of animals, such as tags, livestock markers and paints
 - a basic first aid kit
 - handling equipment, such as halters, cages, etc.
 - water, feed and a bucket
 - the tools and supplies needed for sanitation
 - other safety and emergency items for vehicles and trailers, e.g. extra tyres, winches, tools, etc.
 - food, water and disaster supplies for the family
- f) stranded animals should be rescued and taken to safer places. If the stranded place is considered safe for the next week or so, the animals may be left there but should be provided with feed, fodder and drinking water. Arrangements should be made so that veterinary and paraveterinary personnel can quickly reach all affected animals to perform treatment, vaccination and deworming. Officials and other personnel engaged in relief work should also gather intelligence on the extent and nature of the damage to individual farms and villages so that appropriate relief measures can be implemented (32).

Sastry (32) recommends the building of multi-purpose livestock shelters in flood/cyclone-prone areas: they are very effective in protecting animals during floods and cyclones, and at all other times they can be used as fodder stores, veterinary centres, or government training centres where technical experts can provide advice and training in animal management, vaccine awareness and disease prevention. He also recommends

ensuring that farmers are aware of the simple but effective steps they can take to mitigate the effects of disasters, e.g. un-tethering animals at the first sign of a storm, moving them to cattle shelters or safer areas, performing pre-monsoon vaccinations against certain diseases and quickly disposing of carcasses.

Care of birds

Birds need special care during disasters. The EMI (8) has made the following particular recommendations for birds:

- a) birds should have a sufficient supply of water. Adding chlorine to the water (ten drops of chlorine bleach per gallon of water) will prohibit the growth of bacteria. This chlorinated water should be stored in large containers, away from sunlight
- b) aviaries should be equipped with overhead sprinkler systems, which minimise smoke inhalation, cool the air and reduce the chances of burn injuries
- c) farms should have enough carriers to evacuate all birds during emergencies
- d) birds should not be left exposed to smoke and fumes, as they are very sensitive to smoke and fumes and succumb much more quickly than most other animals
- e) birds should be checked for injury and chemical exposure, and a veterinarian should be consulted if necessary. Any bird showing signs of lethargy, loss of appetite, depression or injury should be evaluated by a veterinarian
- f) if the birds are moved to a new surrounding, they should not be removed from their cages immediately, as they may be frightened and may fly away. Keeping the birds warm can reduce stress, so if electricity is available, heating should be provided, if not, blankets placed over the cages will have a similar effect.

Common disasters in India and their management

Drought

Drought is a condition of moisture deficit, sufficient to have an adverse effect on vegetation, animal, and man, over a sizeable area (43). There are four main categories of drought: meteorological, agricultural, hydrological and socio-economic. Meteorological drought is a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area (18). Agricultural drought is a climatic excursion involving a shortage of precipitation sufficient to adversely affect crop production or range production. Hydrologic drought is a period of below average water content in streams, reservoirs, ground-water aquifers, lakes and soils (44). Socio-economic drought occurs

when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply. It associates economic good with the elements of meteorological, agricultural, and hydrological drought. It is different from the other definitions in the fact that it defines drought based on the process of supply and demand (29).

Drought is a common phenomenon worldwide, both in developed and developing countries, which has a negative impact on national economies. Even developed nations like the USA, Canada, Australia, etc. find it hard to control drought. Several provinces in Canada experienced consecutive droughts in 2001 and 2002. The United States Department of Agriculture Drought Information website reported that several states experienced severe drought in 2002 (39). In 2002, more than one third of the USA was reported to be in severe stages of dryness, well above the average 15% of most other years (22). Also in 2002, there were reports of drought in eastern and central Australia, which were thought likely to cause the loss of at least Aus\$3 billion to the Australian economy (1).

In India, droughts are a regular occurrence every single year. Drought results when the principal monsoons, namely, the South-West Monsoon and the North-East Monsoon, fail, or do not provide as much water as usual (10). The erratic behaviour of the monsoons causes periodical droughts in both low (less than 750 mm per year) and medium (750 mm-1,125 mm per year) rainfall regions, which constitute 68% of the total area of India (12). Monsoon failure results in crop failure, water scarcity and a shortage of food and fodder for humans and animals. In the years 2000 and 2001, 146.3 million people and 69.3 million cattle were affected by droughts in India (35). Table III presents provisional data on the extent of the damage caused by droughts in 1999 and 2000, as estimated by the Government of India (12).

In 2002, as a result of the worst monsoon in the last decade, India suffered one of the most severe droughts it has ever experienced. Over 14 states were officially declared drought-stricken. Bhanutej *et al.* (4), reported that in Shidanpura village in Karnataka, one of the worst hit states, the scarcity of fodder had compelled people to sell their cows for only 200 Indian rupees (INR) (approximately US\$4). In Kouthe village in Maharashtra, they observed that the long spell of drought had halved the village milk production, which was usually 2,500 litres per day. In Rajasthan, another state severely affected by drought in 2002, they noted that villages had just one-fifth of the livestock they had three years ago, and the price of buffaloes had come down from INR 15,000 (approximately US\$320) three years ago, to only INR 800 (approximately US\$17).

India's response to drought

India has developed numerous strategies to cope with droughts, e.g. harnessing water through medium reservoirs,

Table III
The extent of the damage caused by drought in 1999-2000 (provisional information provided by the Government of India on 10 November 2000)

State	Districts (number)	Affected			Damage	
		Villages (millions)	Population (millions)	Cattle (millions)	Crop area (million hectares)	Estimated value of crops (INR millions)
Chhatisgarh	16	NA	6.90	3.61	NA	113.6
Gujarat	17	945	25.00	7.13	NR	NR
Madhya Pradesh	22	1485	2.66	3.43	0.95	3514.8
Orissa	24	NR	NR	NR	27.00	90.3
Rajasthan	31	3058	3.25	40.00	8.75	NA

Source: Government of India (11)

INR: Indian rupees

NA: data not available

NR: not reported

developing traditional systems of tanks, exploiting groundwater, etc. In 1973 the Government initiated projects such as the Drought Prone Area Programme (DPAP) in 149 districts. The average annual investment on long- and medium-term irrigation projects rose from INR 750 million in the First Five Year Plan (the first five year economic plan in India, 1951-52 to 1955-56) to INR 25,000 million in the Eighth Five Year Plan (1992-93 to 1996-97), thereby creating a total potential of 38 million hectares (ha) of land for irrigation. Alongside the DPAP, the Desert Development Programme started in 1977-1978 and was initially implemented in 7 states. The aim of this programme was to control the process of desertification and mitigate the adverse effects of drought in desert areas through a combination of afforestation, sand-dune stabilisation, shelterbelt plantation, grassland development and soil moisture conservation. Other mitigation strategies currently being implemented include public and private sector efforts to address the highest priority problems, taking into consideration both ground and surface water flow (based on the United States Environment Agency Watershed Approach), with a budget of INR 22.6 billion (35), and the Command Area Development Programme, which aims to strengthen water management capabilities and enhance the effectiveness of irrigation programmes.

India's response to drought management means that the country is now less vulnerable to the effects of drought. Current drought management practices include the following (34):

a) the operation of an early warning system: meteorological conditions, particularly the monsoon rains from June to September, and hydrological conditions, such as reservoir and groundwater levels, are closely monitored. Early warning means that better preparations can be made, which improves the effectiveness of drought mitigation strategies

b) drought preparedness measures: this involves communities developing plans so that health care and veterinary care institutions, water resources and disaster assistance resources can expand their services in times of drought

c) conservation of water: developing additional water supplies for drought-affected areas and those with chronic shortages

d) stabilising crop production: contingency crop planning, which involves trying to prevent crops from drying out, planting alternative crops, using seed reserves, and implementing measures to improve production in order to stabilise crop production in drought-prone areas

e) ensuring access to food: a national food security system has been implemented to make grain available at a reasonable price and to stabilise the market price. Food is transferred from areas where there is a surplus to areas where there is a deficit. Nutritional surveys help to identify the communities most in need, and additional food supplies are distributed accordingly

f) preserving farmers' assets: employment generation schemes are offered to the rural work force to stabilise incomes. In addition, to enable farmers to keep their livestock, fodder from areas where there is a surplus is transferred to those areas where there is not enough.

At district level, a standard procedure for drought mitigation is in place, which, if implemented promptly, can substantially reduce the vulnerability of people and livestock (20). However, seasonal vulnerability to drought is a reality in India and the transfer of food, fodder and water resources to drought-affected areas is costly and may increase dependency and undermine the ability of local community systems to cope. Therefore, what is needed urgently is to strengthen the local system or the traditional household system and ensure that there is local community involvement in disaster mitigation strategies.

Earthquakes

An earthquake is a wave-like movement of the surface of the earth. The earth's crust and upper part of the mantle push and move against each other along the fault lines. When rock masses slip along the fault, the energy of an earthquake is released in the form of seismic waves. The damage caused by

an earthquake depends on its magnitude and intensity. The Richter scale is widely used to measure the magnitude of earthquakes; it measures the energy released when large rock masses in the upper earth suddenly shift. A change of one full point in the Richter scale represents a difference of a factor of 30 in the energy released. For example, an earthquake of magnitude 8.0 is roughly 30 times as powerful in terms of energy release as one of magnitude 7.0.

India has a very long history of earthquake occurrence. It has experienced some of the most devastating earthquakes in history, with magnitudes as high as 8.7 on the Richter scale. Approximately 50% to 60% of the total land area in India is vulnerable to seismic activities of varying intensity (12). According to Gupta (13), the entire country can be divided into seven seismic regions, depending on their degree of seismicity:

- a) Kashmir and the Western Himalayas
- b) the Central Himalayas
- c) North-East India
- d) the Indo-Gangetic Basin and Rajasthan
- e) Cambay and Rann of Kutch
- f) Peninsular India including Lakshwadeep
- g) the Andaman and Nicobar Islands.

The Himalayan mountain ranges constitute one of the most seismically active regions in the world. Earthquakes cause damage to buildings, utility lines, bridges, and dams. Water supplies can become contaminated by seepage around broken water mains. Damage to roadways and other means of transportation results in food and other resource shortages for both people and animals. Aftershocks may cause additional damage to buildings and other properties. The actual movement of the ground is rarely the direct cause of death or injury to people or animals. Partial or total building collapse, flying glass from broken windows, overturned large furniture

falling on people and animals, fires resulting from broken gas lines, electrocution from fallen power lines, and exertion and fear leading to heart failure, are more often the actual causes of injury or death during an earthquake. Table IV summarises the effects of earthquakes in India on people and animals in recent times.

Cyclones

Due to the low-depth ocean bed topography and the coastal configuration, the Indian sub-continent is affected by cyclones more than any other area in the world. The Indian Ocean is one of the six major cyclone-prone regions of the world. India has a long coastline of 7,516 km which is exposed to tropical cyclones arising mainly in the Bay of Bengal and the Arabian Sea. The states most exposed to tropical cyclone surges are West Bengal, Orissa, Andhra Pradesh and Tamil Nadu along the Bay of Bengal, and Gujarat and Maharashtra along the Arabian Sea. The frequency of the tropical cyclones in the Bay of Bengal and the Arabian Sea is greater than anywhere else in the world: on average, about five cyclones occur there every year (6). They produce great disruption to normal life and business by causing damage to human and animal life and property, failure of power transmission and communication lines, and flooding of roads and residential areas.

One of the most famous cyclones in recent times is the Orissa Super Cyclone. It occurred on 29th and 30th October 1999, devastating eleven coastal districts of Orissa. The effect of this 'super' cyclone on livestock population is presented in Table V. Bhanja *et al.* (3) reported that after the cyclone, the major problem confronted by the animal husbandry department was the disposal of decomposed carcasses, as it lacked the necessary manpower, resources and know-how to cope with the challenge. They observed that the amount allocated for the disposal of each decomposed large animal carcass, INR 150, was totally inadequate. Immediate veterinary aid was not available because of the damage to the veterinary infrastructure caused by the cyclone. In the aftermath of the cyclone, feed and

Table IV
Human population affected and animal lives lost due to major earthquakes in India in recent times

Date	Place	Magnitude (on Richter scale)	Population affected	Livestock losses	Damage to property (US\$)
26 January 2001	Gujarat	7.9	38 million	20,000 heads, worth US\$1.22 million ^(a)	4,519 million ^(a)
29 March 1999	Chamoli, Northern India	6.6	372,000 ^(b)	Very high	Not known
30 September 1993	Latur and Osmanabad (Maharashtra)	6.4	30,000 ^(c)	15,800 heads ^(c)	11 billion ^(c)
20 October 1991	Uttarkashi, Tehri and Chamoli (Uttar Pradesh)	6.1	307,000 ^(d)	3,096 heads ^(d)	Not known

a) Source: Vatsa (42)

b) Source: Sharma (33)

c) Source: Menon (28)

d) Source: Jain *et al.* (19)

Table V
Livestock losses due to the 'super' cyclone which devastated 11 coastal districts of Orissa, eastern India, on 29th and 30th October 1999

Species	Total population before cyclone	Population loss	Percentage loss of livestock	Estimated loss in INR million
Cattle				
Cows	1,818,277	346,200	19.04	187.71
Bullocks	1,904,209	52,937	2.78	132.43
Calves	2,219,726	90,343	4.07	36.09
Buffaloes	330,287	13,476	4.08	20.20
Sheep	812,210	103,151	12.70	25.78
Goats	2,268,055	196,187	8.65	49.05
Pigs	43,840	2,812	6.43	0.45
Poultry	4,735,273	1,151,145	24.31	28.78

INR: Indian rupees

Source: Bhanja et al. (3)

fodder were scarce and consequently many animals starved to death, veterinary dispensaries and livestock aid centres were in a dilapidated condition, the productivity of animals decreased, and agriculture in the region was severely affected due to the heavy mortality of bullocks (in Orissa there was very little mechanised farming and agriculture was heavily dependent upon bullocks to plough the fields). In another study, Bandyopadhyay (2) remarked that after the Orissa 'super'

cyclone, providing aid for the agricultural sector seemed to be the last priority of the State Government. The estimated total loss in the livestock sector due to the cyclone was approximately US\$36 million (2).

Table VI presents a brief history of the most intense cyclones in the North Indian Ocean from 1970 to 2000, as reported by the India Meteorological Department. The table shows that cyclones of severity T-5.0 to T-7.0 (T-numbers are used to measure the intensity of cyclones, they are part of the Dvorak Scale, a methodology for estimating the intensity of tropical cyclones) are a regular occurrence in the subcontinent. The strategies formulated by the Government of India for the management and mitigation of cyclones are presented in Table VII. As this table shows, suitable policies and technologies are needed so that the existing systems for the management and mitigation of cyclone-related disasters can be improved and brought in line with the practices of developed countries.

Flood

Floods have become a regular annual event in India, causing extensive damage to agricultural production, loss of property and livestock and loss of human life. In addition, in the aftermath of a flood, the environment, rivers and drinking water become contaminated. Animals standing in contaminated floodwater for long periods become susceptible to infections of their hooves and skin. In addition, the cuts

Table VI
The most intense cyclones in the North Indian Ocean region between 1970 and 2000

Name and/or location of cyclone	Date and year	Intensity (T-number)	Observed/estimated maximal wind after landfall	Damages
Bangladesh (Chittagong)	12-13 November 1970	Not know	224 km/ph	3 million people died
Balasore, Orissa	26-31 October 1971	Not know	185 km/ph	10 thousand people died and one million people were rendered homeless
Gujarat Cyclone	19-24 October 1975	Not know	213 km/ph	85 people died
Andhra Cyclone	14-20 November 1977	Not know	259 km/ph	8,547 people died
Gujarat Cyclone	5-13 November 1978	Not know	278 km/ph	Damage to property reported
Sriharikota (Andhra Pradesh)	9-14 November 1984	T-6.0	213 km/ph	604 people died
Indo-Bangladesh Border	24-30 November 1988	T-6.0	213 km/ph	2,000 people died and 6,000 were reported missing in Bangladesh
Kavali (Andhra Pradesh)	1-9 November 1989	T-6.5	235 km/ph	69 people died
Machalipatnam (Andhra Pradesh)	4-9 May 1990	T-6.5	235 km/ph	967 people died
Kandla Cyclone (Gujarat)	5-9 June 1998	T-5.0	167 km/ph	1,680 people died
Arabian Sea Cyclone (crossed Sindh Coast of Pakistan)	16-22 May 1999	T-5.5	195 km/ph	454 people died and 5,104 cattle perished in India
Gopalpur Cyclone (Orissa)	15-19 October 1999	T-5.0	170 km/ph	198 people died and 402 people were injured
Super Cyclone (Orissa)	25-29 October 1999	T-7.0	260 km/ph	9,887 people died and 12.92 million people were affected

T-number: tropical number (this number rates the intensity of the storm)

km/ph: kilometres per hour

Source: Indian Meteorological Department, New Delhi, as cited in Government of India (11)

Table VII

The current strategies of the Government of India for the management and mitigation of cyclones and the improvements which should be made to bring the country in line with international best-practice in cyclone management

Strategy	Current national status	Improvements needed
Three stage warning	<i>Pre-cyclone-alert</i> : at the time of cyclogenesis ^(a) <i>Cyclone alert</i> : 36 to 48 hours in advance of the commencement of adverse weather <i>Cyclone warning</i> : 24 hours in advance of cyclone landfall	On a par with arrangements around the world. However, further improvements can be made, particularly in the area of disaster manager response to the warnings (modifications needed in the national, state and district level contingency plans)
Warning language	District-wide warnings not to go fishing, and warnings about winds, tidal waves, storm surges, evacuation	The Saffir-Simpson scale ^(b) could be used to give the public a better understanding of the damage an impending cyclone could cause
Action by cyclone managers	Preparedness: High Power Committee meetings at state level and CDMC meetings at district level at the beginning of cyclone season Mitigation: Central, state and district level co-ordination with the India Meteorological Department at the time of disaster and relief and rehabilitation after the disaster	Much better co-ordination between authorities is required, particularly at the time of disaster Short and long-term planning should be improved
Long-term planning	Many states do not have enough cyclone shelters (particularly Orissa and West Bengal) to accommodate everybody in the event of evacuation. Long-term planning for houses, dykes, and shelter belts is not adequate	There is a need for: very many more cyclone shelters of adequate specifications along the coastline, dykes for protection against storm surges (technology is available in Japan); shelter beds for protection against strong winds; adequate escape routes for densely populated areas/major installations; construction of cyclone proof houses; a mass education programme (such as the one in the Philippines, which has included disaster preparedness/mitigation in the school/university curriculum); risk assessment and vulnerability analysis: Hazard Risk Mapping of the coastal areas (useful at the time of evacuation); insurance of belongings and crops in cyclone affected areas
Short-term planning	Stock piling of food/medicines at safer places Radio transmitters/power generators/helicopters/boats/other transports to be kept in readiness Selection of appropriate sites for evacuation Trains/surface transport traffic to be regulated so as to avoid the risk area Continuous broadcast/telecast of warnings through mass media Defence forces to be kept under full alert Removal of road blocks/clearing of highways to provide better escape routes Dredging of river mouths to minimise the impact of storm surge Adequate storage of drinking water/clothing Proper planning of health care in the event of disaster Provision of reliable telecommunications (satellite based/Ham radio sets)	Gap areas lie in the actual execution of the plans. Countries like the Philippines, the United States of America and the People's Republic of China have made good progress in executing short-term plans during disasters

CDMC: Central Disaster Management Committee

(a) initiation of cyclonic circulation in the atmosphere

(b) the Saffir-Simpson scale measures the intensity of hurricanes (categories 1-5) and is used to estimate potential property damage and flooding

Source: National Centre for Medium Range Weather Forecasting, New Delhi, as cited in Government of India (11)

acquired from disaster debris make animals more vulnerable to tetanus and toxins contained in the floodwater. Common animal illnesses caused by sewage-contaminated water include tetanus, hepatitis, dysentery, and food poisoning. In addition to this, pathogenic viruses, bacteria, and other organisms present in floodwater can enter the body through openings in the body.

Table VIII presents the average annual flood damage in India. As is evident from the table, livestock are more vulnerable than

people to the adverse affects of floods. This is confirmed in Table IX, which presents data on the damage caused by heavy rains, landslides and floods during the South-West Monsoon in 2000.

India's response to floods

Between 1957 and 1995, INR 40 billion was invested in building infrastructure for flood mitigation in India. This included the construction of new embankments (16,200 km

Table VIII
Average annual flood damage in India (based on data from 1953-1994)

Entity affected	Damaged caused
Land	7.56 million hectares affected
Population	32.03 people million affected
Human life	1,504 lives lost
Livestock	96,713 animals lost
Houses	Cost of damages – INR 1.37 billion (11,683 properties affected)
Crops	Cost of damages – INR 4.6 billion
Public utilities	Cost of damages – INR 3.77 billion

Source: Manage disasters (26)

and drainage channels (32,000 km), and raising 4,700 particularly vulnerable villages above the flood level, which ensured the protection of an estimated 14.4 million ha of agricultural land. During the 1960s and up until the 1980s, there was a dependence on structural measures for flood mitigation, but as these alone did not yield the desired results, non-structural measures are now being encouraged. These cost-effective and time-effective measures include flood forecasting, flood plain zoning, flood proofing of the civic amenities of affected villages, changing the cropping pattern, and public participation in flood management.

Landslides and mudflows

Landslides are characterised by down slope movement of rock, soil or other debris. They can be triggered during earthquakes, volcanic eruptions, storm-generated ocean waves, or other landslides, freeze-thaw cycles, shrink-swell cycles, natural erosion or deposition, etc. Landslides cause disruption to utility and transportation systems, loss of revenue for affected communities, loss of animals and damage to, or loss of, buildings that house people and animals. Associated dangers include damaged electrical, water, gas, and sewage lines. Damaged electrical wires and gas lines may start fires. Other long-term dangers include the continuous threat of landslides due to unstable land.

In India, as a consequence of deforestation and anthropological activities (41), road construction activities (5, 41) and mountain development activity (7), the frequency and instability of landslides and mass wasting have increased substantially in the Himalayan mountain belt in recent times. That said, there are several slides caused by natural phenomenon. These natural slides are generally triggered by heavy rain, cloud burst and the toe cutting of streams (the toe of a stream bank is where the bank meets the stream bed, it receives the most erosive force from the water and is therefore the most likely to be eroded enough to cause bank failure) (21). These landslides cause the loss of hundreds of human and animal lives. Tolia (37) reported that, on average, two to five minor/major landslides occur every kilometre in Garhwal

Table IX
Damage due to heavy rains, landslides and floods during the South-West Monsoon in 2000

States	Disaster	Total districts (number)	Affected district (number)	Affected villages (number)	Population (in millions)	Damaged crop area (in millions of hectares)	Estimated value of damaged crops (in INR billions)	Damaged houses (number)	Estimated value of damaged houses (in INR billions)	Estimated value of damaged public properties (in INR billion)	Human casualties (number)	Cattle casualties (number)
Andhra Pradesh	HR/F	23	18	4,522	2.94	0.42	0.95	104,374	–	7.76	257	5,368
Arunachal Pradesh	HR/F/L	13	4	30	0.04	0.00	–	17	–	–	26	9,131
Assam	HR/F/L	23	19	3,474	3.61	0.22	2.5-3.0	NR	–	–	32	NR
Bihar	HR/F	53	3	11,696	7.97	0.39	2.23	312,076	1.68	7.92	274	1,861
Gujarat	HR/F	25	10	389	0.41	NR	NR	23844	0.03	–	116	406
Himachal Pradesh	HR/F	12	3	–	–	NR	NR	NR	–	–	149	NR
Karnataka	HR/F/L	–	27	–	–	0.06	–	54,591	0.16	3.89	152	690
Kerala	HR/F/L	14	14	1,049	–	NR	0.27	9,474	0.06	–	75	NR
Madhya Pradesh	HR/F	61	6	459	–	NR	–	3,297	–	–	13	147
Punjab	HR/F	17	7	40	–	0.03	Neg	35	–	–	7	NR
Sikkim	HR/F/L	4	1	–	–	NR	–	140	–	–	11	NR
Uttar Pradesh	HR/F	83	49	6,893	4.84	0.44	–	33,649	–	–	462	888
West Bengal	HR/F	17	9	1,412	21.82	1.92	38.66	2,194,858	4.39	–	1,474	83,630
Total		345	200	29,964	41.62	3.48	42.11	2,736,355	6.31	19.57	3,048	102,121

F: Flood L: Landslide HR: Heavy rains NR: Not reported Neg: Negligible
Source: Government of India (12)

Himalaya. The damage caused by landslides in the region was estimated by Li (25) to be more than US\$1 billion, causing more than 200 deaths every year, which is about 30% of the total of such losses world wide.

Landslides also occur in the Western Ghats, but they are not massive and they are less destructive compared to those in the Himalayan region. Drainage correction, proper land use measures, afforestation of the areas occupied by degraded vegetation and creation of awareness among local people are the chief mitigatory measures that have been adopted in the Western Ghats (23).

On the slopes and areas where landslides occur, planting ground cover is an essential preventative measure. As well as this, the walls of homes and barns must be reinforced. Instead of flexible pipes, stiff pipes should be used to avoid gas and water leaks (25). Once warned of an impending landslide or mudflow, evacuation with family and animals should be prompt. Animals should not be left behind.

Man-made technological hazards

The principal technological hazards are spills of hazardous material and radiation hazards. Hazardous materials can be released by accidents or in disasters and may contaminate the environment and the human food supply. Animals exposed to hazardous chemicals are a potential threat to humans, and, similarly, people who have been exposed to chemicals pose a threat to animals and other people. It is vital, therefore, that hazardous chemicals be dealt with by qualified professionals. Radiation hazards can occur if there are problems at nuclear power plants, or during the production of nuclear weapons, or during the manufacture, transport, or storage of nuclear and other radioactive materials. The most effective methods of protecting animals from radiation hazards are as follows:

- to keep them away from the source of radioactivity
- to evacuate them from the affected area
- to create a barrier between the animals and the radioactive source by using material which protects people and animals from radiation e.g. lead, iron, concrete or water
- to keep them in appropriate shelters, i.e. those made from appropriate shielding materials as listed above, or in caves and tunnels covered by at least one meter of earth
- to use food and water supplies that have not been contaminated by radiation, e.g. unopened canned and packaged foods, plants which grow underground, plants which can be de-contaminated by peeling or washing, underground water supplies such as springs and wells that are naturally filtered, water that has been stored in closed containers, etc.

To be prepared for man-made hazards, communities must be aware of potential sources of danger in the immediate environment and know how to store any hazardous material

properly. The clinical signs of different toxins should be known so that in the event of an accident the exposed person or animal can receive prompt treatment. A veterinarian should be consulted if it is suspected that an animal has been exposed to a hazardous substance. Water sources can be covered temporarily using plastic sheets; this may protect the water from immediate fallout.

One of the most famous man-made technological disasters in India is the Bhopal gas tragedy. On 3 December 1984, the Union Carbide India Ltd (UCIL) pesticide formulation plant in Bhopal accidentally released approximately 40 metric tonnes of methyl isocyanate into the atmosphere. The incident was a catastrophe for Bhopal. An estimated 8,000 or more people died and more than 4,000 animals perished within minutes of exposure to the gas. Almost 15,000 animals suffered from various degrees of morbidity, and many of these animals died within one month of being exposed to the gas (30). The immediate effects were respiratory distress with open mouth breathing, red conjunctive and a dry muzzle, followed by death within 10 minutes to an hour of exposure (30). The long-term effects of gas exposure included a low suppressed cough, liver and kidney dysfunction, various degrees of interstitial fibrosis of the lungs, compensatory right heart enlargement, etc. In another survey, conducted by Greenpeace International, drinking water supplies and land, within and surrounding the former UCIL pesticide formulation plant, continued to be substantially and significantly contaminated with heavy metals and persistent organic contaminants, even as late as 1999 (24).

Responsibilities of stakeholders

Community participation in animal disaster management

In India, relief often does not reach affected areas until quite late on, usually between 24 and 72 hours after the disaster has struck. In most cases, this is because of communication problems and because the relief teams do not have the capacity to get there any quicker. Furthermore, the relief operations are not always professionally organised (2). Therefore, it is the affected people themselves who must be the first to respond to the disaster; they must guide and take care of themselves until outside relief arrives. Even after a disaster they play a major role in facilitating that relief.

In regions where natural disasters are a common occurrence, the community usually has some inbuilt socio-cultural systems to deal with them. For example, through the ages, the Somali pastoralists have developed effective survival mechanisms to mitigate the impact of droughts and increase the chances of their own survival and that of their livestock. For example, they rear two or more species of livestock as a buffer against the loss of animals in drought, and members of the clan who can afford

it offer animals to the less fortunate members (14). In developing countries, local resources and expertise, which can identify common hazards and prioritise mitigation and planning strategies to reduce the impact of disasters, need to be integrated with government initiatives. One programme which takes this approach of involving the local community in disaster preparedness is the Community-based Disaster Preparedness programme. This programme aims to strengthen the capacity of local communities to cope with emergencies arising from sudden natural or man-made disasters, by mobilising all the local and external resources that are available.

Development issues in India have traditionally followed a top-down approach without much consideration of local demands and sensitivities. Community involvement in development programmes is an area that is usually neglected. However, local government, or Panchayati Raj Institutions (PRIs), have a vital part to play in disaster management and their role must not be ignored, as without an effective local government relief agency, proper disaster management, community based or top-down, is impossible. Community based relief requires an effective local government relief agency that initiates, facilitates, encourages, monitors, and matches the local community-based efforts. When disasters occur, it is local governments that are in the best position to provide leadership, supervise the distribution of relief goods and medicine, manage evacuations and provide equipment and tools. They can also play a significant role in long-term risk reduction.

Recognising the importance of community involvement in disaster management, a community based disaster management programme is being implemented in Orissa by the Orissa State Disaster Mitigation Authority (38). Block level PRIs (for administrative purposes each district in India is divided into blocks which contain several villages; there are usually nine or ten blocks in a district) are the agencies through which the project is being implemented, with the aim of establishing a disaster management plan practical enough to minimise the impact of disasters and to educate the local community in disaster management practices.

Government responsibilities

The main responsibility for disaster relief lies with the state governments, and the Government of India supplements the efforts of the state governments by offering logistic and financial support. As per the recommendations of the Eleventh Finance Commission, two schemes, namely, the Calamity Relief Fund (CRF) scheme and the National Calamity Contingency Fund (NCCF) scheme have been established for the period 2000-2001 to 2004-2005 (12). Both these funds are available for meeting the cost of providing immediate relief to the victims of natural disasters. Each state has a CRF, and when disaster occurs 75% of the total budget for disaster management is

provided by the central government and the remaining 25% by the state government (12, 36). The NCCF provides assistance to the states in the event of severe natural calamities where the expenditure on relief exceeds the prescribed norms and cannot be met by the existing funds in the CRF of the state concerned. The state governments have a state cabinet and a state Crisis Management Group (CMG), headed by a chief secretary.

Figure 1 shows the national mechanism for responding to natural disasters. Various government agencies play different roles in disaster management as presented in Table X. When disasters occur, the armed forces, under the Ministry of Defence, and the central para-military forces, under the Ministry of Home Affairs, are deployed for emergency rescue work in the affected areas.

A national body called the National Committee on Disaster Management was recently established under the Chairmanship of the Prime Minister, with representatives from all political parties at both national and state level. Its purpose is *inter alia* to suggest what institutional and legislative measures should be included in an effective and long-term strategy for dealing with major natural calamities in the future. Furthermore, a High Powered Committee (HPC) was established in August 1999 to prepare comprehensive model plans for the management of disasters at National, State and District levels (36).

The National Committee on Disaster Management and the HPC have recognised the importance of the involvement of the PRIs in disaster management. At village, district, and block levels, committees should monitor relief work. Ideally, as suggested by the EMI (8), the main responsibility of disaster relief should lie with local government, and the state government should monitor their work and provide financial support. The central government should provide training, information on the latest disaster mitigation measures, financial assistance, subsidies, guidance, and co-ordinate the services for disaster response and recovery activities.

Voluntary agencies and organisations

Disasters can overstretch the emergency resources of local, state and central governments and when this happens the value of additional support from voluntary agencies has been demonstrated time and again in different countries. One method of involving voluntary agencies in the planning for disasters is to group them, where appropriate, on the basis of their mandate and link them to the statutory authorities responsible for those functions. This functional grouping can clarify the contributions which individual voluntary organisations can make and enable the statutory authorities and voluntary organisations to make the most of the voluntary contribution.

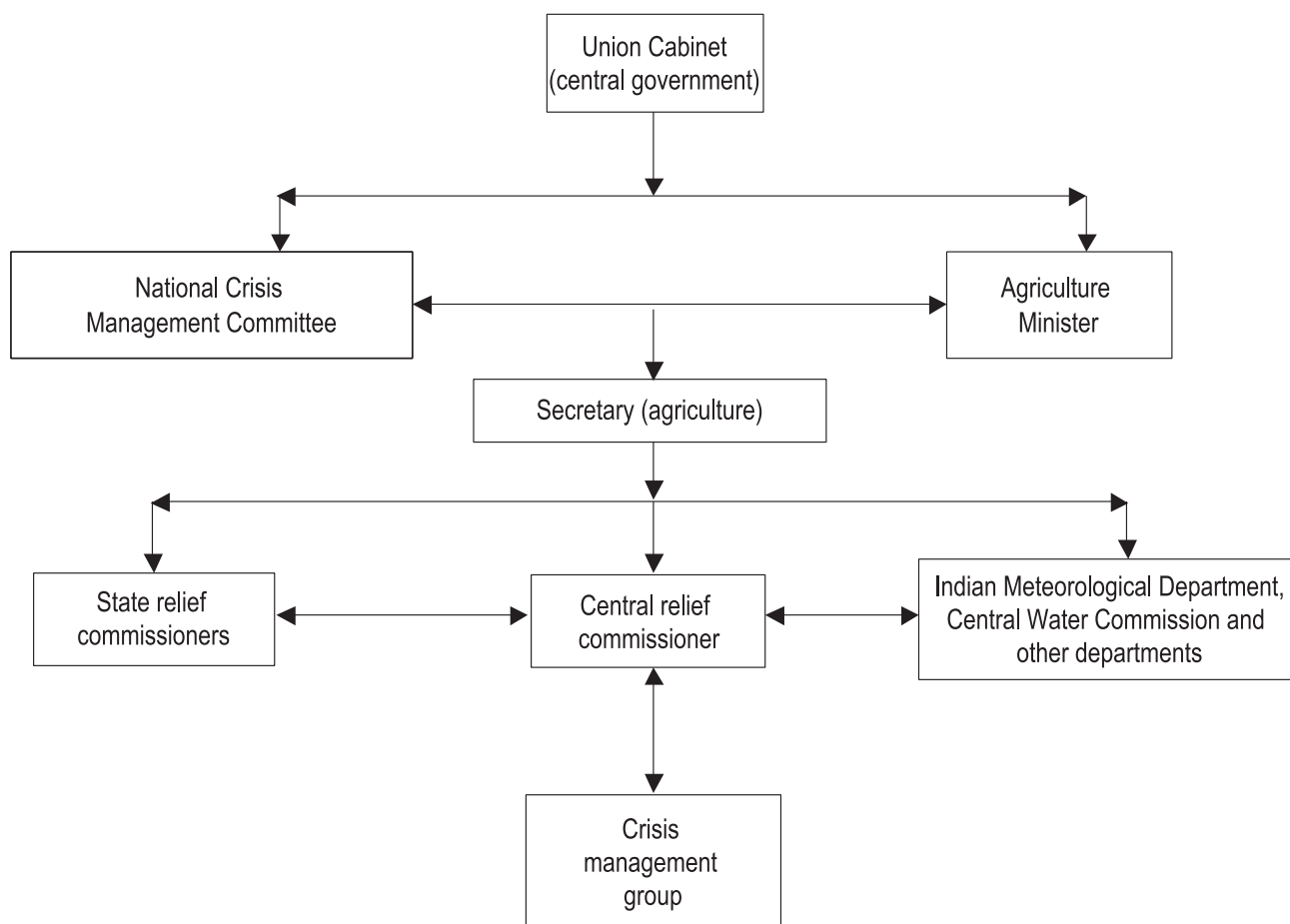


Fig. 1
National natural disaster response mechanisms
Source: Swami (36)

Table X
Agencies associated with disaster mitigation in India

Disaster	Agencies
Earthquake	Indian Meteorological Department State Earthquake Research Institute Geological Society of India
Flood	Indian Meteorological Department Irrigation Department*
Cyclones	Indian Meteorological Department
Epidemics	Public Health Department*
Industrial chemical accidents	Industry Mutual Aid and Response Group Departments of Industry, Police* Bhabha Atomic Research Centre
Drought	Indian Meteorological Department Public Health Department*

* State government departments. All other government agencies listed above belong to the Union (Central) Government
Source: Manage disasters (26)

Role of veterinarians in disaster

During disasters, the role of veterinarians is to ensure high standards of animal health and to reduce mortality among animals. Veterinarians can play a major role in promoting local pre-disaster planning at community level, which places a high priority on facilitating livestock and pet evacuation (16). Heath suggests that an ‘all hazards’ approach would facilitate the integration of veterinarians into disaster management efforts (16). This approach is based on the concept that regardless of the impact of different types of disasters, the socio-economic consequences, including the economic impact on animal agriculture, are similar. Veterinarians have a role to play in all stages of disaster mitigation and management, but it is during relief efforts that they can play a crucial role in increasing the survivability of animals that are victims, and of those that are deployed in rescue teams. The contribution of veterinarians will be most effective if they integrate their expertise with other

local, national and international groups and agencies involved in disaster management (15).

Conclusion

In developing countries, like India, disasters are a common phenomenon every year. The most badly affected are the poor and marginalised communities in India, who suffer most in terms of human and property loss when disaster strikes. Not only are they the worst hit, but also, their capacity to recover from disaster is limited by the social, economic and political conditions in which they live. In many developing countries the institutional mechanisms for facing disaster are not sufficient to meet the challenge. This results in the severe loss of human and livestock life which could be saved, to a greater or lesser extent, if preparedness, response and recovery mechanisms were in order. In terms of disaster preparedness, developing countries are well behind the developed nations. Thus, the measures for the care and rehabilitation of livestock suggested in this article are drawn from the experiences of developed countries.

Protecting and saving human life is the first priority in disaster relief and protecting property (which includes animals) is the

second. Because of this, emergency management officials in India are not trained to deal with animals or to restore animal related business. This is something that requires more attention from the National Crisis Management Committee and the state CMGs, and livestock relief after natural disasters needs to be given greater emphasis. The disaster-prone states of India should also develop disaster mitigation and management plans for livestock. Experience has shown that disaster management to date has been reactionary rather than proactive and preventative. Livestock relief plans should be developed as a part of preparedness activities and not during a natural disaster.

Disaster management should be integrated with long-term development planning, and a holistic approach, rather than a segmented approach, should be taken, with popular participation involving local communities. Development and disaster management planning should go hand-in-hand and development models must have in-built components for disaster reduction, mitigation and preparedness.

The findings, interpretations, and conclusions presented in this paper are entirely those of the authors and should not be attributed in any manner to the organisations to which they belong. ■

La gestion des catastrophes en Inde : le cas du bétail et de la volaille

A. Sen & M. Chander

Résumé

Toujours plus conscients de l'importance des systèmes de gestion des catastrophes, les pays en développement redoublent d'efforts pour rationaliser à tous les niveaux les dispositifs de préparation, de réaction et de rétablissement de la situation. Il est de notoriété publique que de nombreux pays en développement, y compris l'Inde, ne se sont pas toujours bien préparés à faire face aux catastrophes. L'absence de plans bien structurés de gestion des catastrophes se solde par de lourdes pertes, que ce soit en vies humaines et animales ou en biens, qui auraient pu être évitées par la mise en place des dispositifs requis. Il reste beaucoup à faire pour améliorer la situation, notamment en ce qui concerne le bétail. Les auteurs détaillent les mesures qui, dans le contexte particulier de l'Inde, permettraient de prendre soin des animaux durant les catastrophes naturelles. Ils passent en revue les différents types de catastrophes naturelles et étudient leur impact sur le bétail. En outre, ils exposent les grandes lignes des stratégies de préparation, de réaction, de rétablissement de la situation et de mise en œuvre de quelques palliatifs. Le rôle des divers acteurs, y compris les vétérinaires, est également pris en considération.

Mots-clés

Bétail – Catastrophes liées à l'action de l'homme – Catastrophes naturelles – Gestion des catastrophes – Inde – Participation de la collectivité – Vétérinaire – Volaille. ■

La gestión de catástrofes en la India: el caso de los bovinos y las aves de corral

A. Sen & M. Chander

Resumen

Los países en desarrollo son cada vez más conscientes de la importancia que revisten los sistemas de gestión de catástrofes, por lo que vienen intensificando sus esfuerzos para perfeccionar en todos los niveles sus mecanismos de preparación, respuesta y recuperación. Es bien sabido que muchos países en desarrollo, la India entre ellos, no están siempre correctamente preparados para hacer frente al advenimiento de fenómenos catastróficos. La falta de planes detallados de gestión de catástrofes se traduce en graves pérdidas humanas, materiales y animales, que podrían evitarse si existieran los mecanismos necesarios. Queda mucho trabajo por delante para mejorar la situación, sobre todo en lo que concierne al ganado. Haciendo especial referencia a la India, los autores describen en detalle las medidas que pueden tomarse para socorrer a los animales en caso de catástrofe. Tras pasar revista a varios tipos de catástrofes naturales y sus respectivos efectos sobre el ganado, exponen sucintamente distintas estrategias de preparación, respuesta, recuperación y atenuación. También se refieren al papel de las distintas instancias oficiales, especialmente los veterinarios.

Palabras clave

Aves de corral – Bovinos – Catástrofes de origen antrópico – Catástrofes naturales – Gestión de catástrofes – India – Participación comunitaria – Veterinarios.

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