trained in all aspects of veterinary medicine, including public health and epidemiology, and that operates under the authority of the government of the country in question. Mitigation (strengthening the veterinary profession) against transboundary diseases is a global issue in which every country plays a role

The common approach to mitigation in developed countries is to attempt to prevent the entry of transboundary diseases through extensive border controls. However, conventional border controls at ports are becoming increasingly futile, because of the sheer number of tourists who travel between countries with and without diseases The lack of awareness of these travellers and the volume of travel make the introduction of transboundary disease an increasing concern. There are many examples of countries in the Americas where the threat of transboundary diseases prevails Recent threats have included classical swine fever (hog cholera) from the Dominican Republic and Haiti, and screwworm from Cuba Another threat is the act of terrorism, where infected material may have been deliberately introduced into a country.

Although the identification of illegally imported goods at ports in the USA has been improved in recent years by random baggage sampling at ports, these methods are derived from statistical theory on how to estimate the amount of illegally imported goods to the USA. The random sampling methods, however, cannot prevent importation in all cases, and are insufficient to detect deliberate acts of terrorism.

Developed and less developed countries can only expect to prevent the introduction of diseases by forming partnerships with their trade and travel counterparts to deal with diseases at their endemic sites Countries with well-developed veterinary professions must offer and share their resources Only a strong global veterinary community will be able to reduce the impact of all types of disasters, especially those due to epizootic disease.

Many developing countries have suffered an erosion of the effectiveness of their Veterinary Services in periods of economic difficulty Veterinary Services have become weakened as the animal health service budget is reallocated away from disease control programmes and applied to salaries to maintain the number of people employed in the Service In other countries, indications of a weakened veterinary profession are a lack of access to or familiarity with current disease diagnostic and monitoring techniques or an insufficient number of veterinarians. The effect of weakened Veterinary Services has been the continued presence of diseases which could be eradicated given adequate human and financial resources. Some countries that have privatised animal health programmes have suffered new outbreaks of diseases that were once considered eradicated. In countries where these disease outbreaks are transboundary and notifiable in other countries, the economic impact of export restrictions dwarf most other costs related to disasters

Supporting the education of veterinarians in other countries should become a major focus of mitigation against the introduction of transboundary diseases in developed countries. Mitigation implies that those countries in a position to assist should be present and provide support to countries with transboundary diseases by offering training, expertise, and resources to eradicate diseases that are a threat to animal health worldwide.

Mitigation programmes that should be supported are those that focus on epidemiology and clinical and laboratory diagnosis of disease, herd health management, nutrition and public health. Furthermore, programmes that improve animal identification should be developed, so that trace-back procedures become an efficient component of disease control and eradication Finally, mitigation for the livestock industries of developing countries should involve financial planning for post-disaster recovery Effective financial mitigation includes the insurance of the livestock industries of entire countries against catastrophic losses (known in insurance terms as uncorrelated risks), and international mutual trade arrangements with neighbouring countries, so that replacement livestock that are environmentally and culturally suitable can be exchanged for other goods and money should the need arise

Mitigation programmes for geophysical disasters also involve implementing early-warning systems of pending floods (river water flow metres) and food storage banks for droughts. Construction of holding facilities for livestock, using indigenous technology which has developed over the centuries, can also prevent losses from common natural hazards, such as hurricanes and earthquakes

Preparedness

The essence of an effective preparedness phase of disaster reduction programmes in developing countries is in the development and implementation of timely (seasonal) education that is community based. Examples include weather forecasting and river flow monitoring which can be used to advise farmers on the optimal time to move cattle

The FAO operates two programmes in these areas These are the Global Information and Early Warning System (GIEWS) for food and agriculture and the Emergency Prevention System (EMPRES) against transboundary animal and plant pests and diseases. The latter is used to watch globally for signs of emerging threats from pests and epidemics whereas the GIEWS monitors food supply and demand across the world, and provides policy makers and analysts with up-to-date information on crop prospects and gives early warning on imminent food crises The goal of these systems is to enable governments and international organisations to take early action should the need arise (3).

Educational programmes may provide an added incentive to ensure more rapid and thorough dissemination of knowledge. A 'pyramid of education' is an example, whereby government officials or industry generate appropriate materials for education and offer this information to livestock producers. Livestock producers who pass the information on to others become eligible for bonuses. The incentive for passing on this education would therefore, be linked to bonuses (e.g. access to information technology, participation in programme development, early access to research information, lower drug costs) Farmers who receive this information and disseminate it to yet others would also be eligible for bonuses and those responsible for the initial sharing of information would receive additional bonuses. Every few years the focus of education can be revised and a new pyramid created.

Response

In the response phase to disasters, several major issues need to be addressed regarding the livestock industry. Animals will be displaced and will congregate, resulting in the increased potential for disease transmission. In addition, substantial donations will be received, some of which will originate in countries that would normally not be accepted for import because of animal or plant health restrictions. These products need to be identified and dealt with appropriately, so that the animal and plant health of the disaster-affected country are not compromised further, and so that diplomatic relations between donor and recipient countries are not harmed Early intervention to support animal health is likely to be highly cost-effective (Table VII).

Facilities provided for displaced subsistence farmers should provide separate facilities for animals; it is important to keep animals and people apart. Animals should be vaccinated and treated if necessary upon arrival. Human vaccination programmes could be co-ordinated with animal vaccination programmes as vaccination programmes for humans have been shown to have a high compliance rate when conducted in concurrence with animal vaccination programmes.

Areas in which large numbers of animals congregate should be prepared with a layer of at least 5 cm of lime, and channels should be dug for adequate drainage. Some typical disease problems that will arise and potential protocols for treatment are listed in Table VI.

Following floods, large numbers of carcasses are often scattered throughout the countryside (Fig. 2). It is often not possible to bring these to a common site for disposal, therefore, on-site disposal is often the only practical solution. While many carcasses in remote areas will be scavenged (Fig. 3), carcasses lying close to human or animal habitation, or water sources, should either be removed or destroyed rapidly. Composting on site may be the most practical alternative in many cases to dispose of large carcasses (Fig 4).

Increased rates of rotation and reduced availability of land make pastures extremely sensitive to overgrazing, which may result in decreased productivity for several years. Increased grazing intensity also dramatically increases the need for preventive health care, such as the need to treat animals against internal and external parasites. This can become such a problem, that livestock farming becomes unprofitable The only cost-effective measures that can be used to counteract decreased efficiency are to either decrease the stocking density of cattle (decrease herd size or increase available pasture) or to increase use of parasiticides and feed (e.g. by feeding flood-damaged crops, such as bananas, that can no longer be used for human consumption). However, neither of these approaches are likely to be able to sustain economic viability for the producer, unless they are subsidised by disaster-relief funding.

To some degree, overgrazing can be prevented by offering supplemental feed to livestock Damaged crops which were originally intended for human consumption are often available for use as feed for livestock. The use of these feeds, however, requires funding to pay for transportation and processing. Making funds available to do this is a cost-effective response activity that should be included as part of disaster-relief efforts Following a large-scale disaster, donors should consider applying disaster relief funds to preventive measures, because these measures are cost-effective in preventing greater losses at a later stage

Table VII
Estimation of the benefit/cost ratio for intervention measures for the care of animals owned by 100 subsistence farming families
In this example the benefit/cost ratio is >10 1 (5)

Species	Number	Intervention (US$)		Non intervention (US$)		
		Replacement value	Cost of vaccination	Replacement value	Lost production	Human health costs
Chickens	400	600	NA	600	1,500	6,000
Pigs	50	2,000	250	2,000	4,000	20,000
Dogs	100	NA	500	NA	NA	NA
Subtotals		2,600	750	2,600	5,500	26,000
Total		**3,350**			**34,100**	

NA, Not applicable

Photo courtesy of C A Zepeda Sein, Organismo Internacional Regional de Sanidad Agropecuaria

Fig. 2
Thousands of animals drowned in Central America after Hurricane Mitch, 1998

Photo courtesy of C A Zepeda Sein, Organismo Internacional Regional de Sanidad Agropecuaria

Fig. 3
Scavengers play an important role in carcass disposal after a natural disaster