EMPRES
Transboundary Animal Diseases Bulletin

EMPRES
EMERGENCY PREVENTION SYSTEM

EMPRES e-mail: empres-livestock@fao.org – Web site: www.fao.org/empres

No. 20/1 – 2002

EARLY WARNING

TOWARDS A GLOBAL EARLY WARNING SYSTEM FOR ANIMAL DISEASES

The concept of a global early warning system for priority transboundary animal diseases (TADs) of livestock was initially raised during the review of the EMPRES programme in 1996 (expert consultation, 24–26 July 1996). This became necessary in order to help member countries to be better prepared to fight animal diseases of an epizootic nature (see page 14).

THE FRUIT OF LESSONS LEARNED OVER THE YEARS

In cataloguing some of the experiences with early warning systems given in this bulletin, several important points should be taken into consideration – the fruit of lessons learned over the years during TAD outbreaks and of experience in their control. The examples chosen cover a worldwide geographical area and range from smaller outbreaks of foot-and-mouth disease to those that developed into epidemic proportions (see page 5).

TRADITIONAL EARLY WARNING SYSTEMS

Traditional early warning systems represent the whole body of knowledge developed early in the 1900s among pastoral communities to anticipate the coming of rains and thus enable them to mitigate the effect of droughts on their livestock – the backbone of their livelihoods.

The recent study by Dr Christopher Pratt of Tufts University (United States) shows the importance of traditional early warning systems and coping strategies in pastoralist communities of East Africa (see page 21).

and...

Early warning as the weakest link in disease surveillance systems

Early, accurate warning of new outbreaks of epidemic livestock diseases, and particularly the spread of such diseases to new areas, is an essential prerequisite for the effective containment and control of these diseases. As observed recently, the blame for the global spread of diseases such as foot-and-mouth disease has been put on the weaknesses of disease surveillance systems and the inability to control major diseases at their source, along with the globalization of trade.

In this publication, early warning is identified as all disease initiatives, based predominantly on epidemiological surveillance, targeted to improve the awareness and knowledge of disease or infection distribution, which might also lead to early and accurate forecasting of the evolution of an outbreak.

There have been many instances where outbreaks of serious epidemic livestock disease in new areas eluded the attention of central veterinary authorities for several weeks or months. The diseases were thus allowed to spread unchecked during this period. The consequences have been unnecessary production losses and difficult and more expensive control and disease eradication measures – or, outright, the impossibility of both.

PHOTO COURTESY OF G.R. THOMSON

Rinderpest epidemic in South Africa that caused acute and peracute signs in cattle

Transboundary animal diseases are not only a threat to household food security but also represent a barrier to international trade, and hence an impediment to economic and livestock development

Failure to report new disease occurrences to neighbouring countries and trading partners either directly or through international organizations such as the Office international des épizooties (OIE) and FAO has meant that other countries have been unable to take the necessary steps to prevent the introduction of the disease. Furthermore, as observed during the Rift Valley fever epizootic in the Horn of Africa and the Arabian Peninsula, the negative impact of transboundary animal diseases (TADs) on trade is also of critical importance to food security matters and human livelihoods. Indeed, many countries are removed from the international livestock market – or were simply never able to enter it – because diseases such as those mentioned above occurred on their soil. This meant that a potential lucrative trade never developed because it was pre-empted from the start by disease occurrence – a quite negative impact, often not fully realized. It then follows that TADs are, therefore, not only a threat to household food security, but also represent a barrier to international trade, and hence an impediment to economic and livestock development. It is widely recognized that to ensure sustained livestock development, the financial return to farmers from livestock trade is necessary.

THE IMPACT OF TRANSBOUNDARY ANIMAL DISEASES IN THE ABSENCE OF AN EARLY WARNING SYSTEM

Rinderpest virus disease. Rinderpest is perhaps the most serious cattle plague because of its high morbidity and high mortality rates. When this virus disease was first introduced into Africa in the late nineteenth century, it spread over almost the whole continent within ten years, killing an estimated 10 million cattle and untold numbers of wildlife – irrevocably changing livestock husbandry and wildlife ecology. Another rinderpest pandemic, in the early 1980s, which saw a resurgence of the disease throughout much of sub-Saharan Africa, was estimated in Nigeria alone to have caused losses to livestock production in the order of US$2 billion. Wildlife populations, including endangered species in Africa, have suffered considerably from rinderpest epidemics passed on to them from cattle. The relatively small and fragmented populations are increasingly at risk from a future resurgence of the disease, as illustrated by the loss of 60 percent of the African buffalo population of the Tsavo National Park in Kenya in 1994/95.

In 1994, rinderpest spread to previously long-time free, mountainous areas of northern Pakistan, killing an estimated 40 000 cattle and yaks and devastating local agriculture. The continuing presence of rinderpest in Pakistan has resulted in trade bans that for many years have denied access of countries to high-quality meat and, perhaps more important, breeding stock of high genetic value.

Classical swine fever. Outbreaks in the Netherlands in 1997–98 led to the death or slaughter of some 12 million pigs as part of the eradication campaign. The cost of these outbreaks was estimated to be US$2.5–3 billion, half of which was public money while the other half was about equally shared among farmers and other participants in the livestock production chain. The effects of the epidemic were so severe that the Netherlands Government approved a national pig-restructuring plan, which foresaw a reduction in the national pig herd of about 25 percent within two years.

African swine fever. African swine fever (ASF) has no vaccine and no treatment, and the mortality rate is usually close to 100 percent. Pig production has become increasingly important and, owing to the changing dietary patterns and growing demand for animal protein, subsistence peri-urban production systems have turned to short-cycle species, namely poultry and pigs, to meet the increasing market demand. This trend has given rise to many peri-urban commercial pig-producing units, rearing improved and often pure exotic breeds. Recent outbreaks have caused significant losses and have threatened entire pig populations in some countries.

ASF is endemic in many parts of East, Central and southern Africa. It occurred for the first time in Côte d'Ivoire in 1996, where it killed 25 percent of the pig population and cost the country, according to various estimates, between US$13 and 32 million in direct and indirect losses and eradication costs. There has since been a serious spread of ASF to Benin, Cameroon, the

Gambia, Nigeria and Togo within West Africa. Estimates indicate that in the past five years, the disease has killed almost half of the total standing pig population of the West African region. The disease also seriously constrains swine production development in a number of other countries including Angola, Malawi, Mozambique and Uganda.

FAO's contribution to various ASF intervention measures in the past five years has amounted to over US$3 500 000.

In view of the nature of the disease, control and eradication rely on early detection and, where possible, immediate and rapid stamping out should be implemented. This can only be done if there is a system in place to detect any outbreak at its earliest appearance.

With the increasing speed of global transportation and communication, ASF poses a serious threat to pig-producing areas throughout the world. Preventing and mitigating the serious effects any outbreak might have will strongly rely on an early detection mechanism.

Some of the common problems that are manifest in early warning systems for serious livestock diseases include:

- lack of farmer awareness programmes on high-threat epidemic livestock diseases and generally inadequate contact between field veterinary staff and farmers;
- disease reporting systems that are based primarily on passive reporting of outbreaks rather than active disease surveillance;
- inadequate training of veterinary and paraveterinary staff in the clinical and gross pathological recognition of epidemic diseases that may be either unusual or exotic for the country, in the implications of delayed action, and the collection and transportation of appropriate diagnostic specimens;
- poor coordination of field and laboratory veterinary services;
- lengthy and overcomplicated routine disease reporting chains and failure to institute an emergency reporting system for serious disease outbreaks;
- failure to establish confirmatory diagnostic capabilities for the target diseases within national laboratories;
- inadequate liaison with international reference laboratories, coupled with the failure to send in new virus strains, sourced from outbreaks, to these laboratories on a regular basis for specialized antigenic, genetic and epidemiological analysis;
- lack of an epidemiology unit and expertise to analyse new disease outbreaks, including traceback and traceforward activities;
- failure to report new disease occurrences to the appropriate international organizations, e.g. OIE, within an acceptable time;
- lack of central contingency planning and other emergency preparedness for epidemic disease.

There is therefore no doubt that early warning, which is a key component of disease surveillance, needs to be strengthened at the national, regional and international levels. The following section illustrates, through concrete examples taken from previous epizootics, the lessons that can be learned from the past.

Understanding early warning with reference to past outbreaks

In cataloguing some of the experiences of early warning given below, several important points should be taken into consideration – the fruit of lessons learned or not learned over the years during TAD outbreaks and efforts for their control. The examples chosen cover a worldwide geographical area and range from smaller outbreaks of foot-and-mouth disease (FMD) to those that developed into epidemic proportions.

FMD epidemics in the United Kingdom

Background

The most recent major FMD outbreak in the United Kingdom (UK) was recorded in 2001. Before the 1981 Isle of Wight (UK) occurrence, the last major epidemic in the UK was in 1967/68. Many articles and publications were generated on this episode, such as the Report of the Committee of Inquiry on FMD (called the Northumberland Report), which illustrated the importance of early detection of an epidemic. The studies, parameters and policy generated by the 1967/68 outbreak quickly developed into a model. However, with the recent UK 2001 epidemic, new data and parameters have been generated and will be used for further studies on the epidemiology of the disease and to develop new models.

Weaknesses in the early warning mechanism

A retrospective analysis of the UK epizootic shows that a delayed warning was responsible for the wide spread of the disease in the country. Indeed, the introduction of the FMD virus has been confirmed to have occurred early in February or late January, while clinical detection took place only on 20 February, about three weeks after initial introduction. It has also been advanced that an earlier introduction of a national ban on animal movements (introduced instead officially on 23 February 2001) would have greatly contained the spread of the FMD epidemic – by approximately 43 percent. Indeed, by the time the national ban on livestock movements was implemented, 74 cases were already incubating in other parts of the country.

The Executive Committee of the European Commission for the Control of FMD clearly warned member countries about the dramatic deterioration of the FMD situation worldwide. One of the follow-up recommendations of its 65th session was to urge countries to reappraise their strategies and operations to account for these new realities

If the early warning mechanism at national level showed some signs of weakness, it can also be questioned whether or not the introduction of FMD in Europe was somehow predictable, and if the international community could have been more active in alerting national authorities.

During its 65th session in November 2000, the Executive Committee of the European Commission for the Control of FMD (EUFMD) clearly warned member countries about the dramatic deterioration of the FMD situation worldwide. One of the follow-up recommendations of this meeting was to urge countries to reappraise their strategies and operations to account for these new realities. This declaration came as an echo of the recommendations of the meeting of the Research Group, held earlier in September 2000, and from the results of the expert elicitation workshop on the risk of introduction of FMD to Europe.

However, it must be highlighted that, at the time, there was a consensus of experts that the FMD threat to Europe would come mainly from its southeastern region, particularly from Turkey. The results of the above-mentioned workshop also indicated that the first point of introduction of FMD to Europe was more likely to be the Balkans, followed by eastern Europe, southern Europe and, to a lesser extent, western Europe and the "Islands" (UK).

Consequently, although the reintroduction of FMD to Europe was not a complete surprise in the current epidemiological situation worldwide, the pattern of introduction of the disease was fairly different from what had been imagined earlier.

Given the globalization of trade and the wide distribution of FMD in the world, it is likely that FMD-free countries will have to face other incursions of the disease in the future. It is therefore critical to develop emergency preparedness and contingency plans at national and regional levels to prevent the occurrence of other disasters.

FMD in Taiwan Province of China in 1997

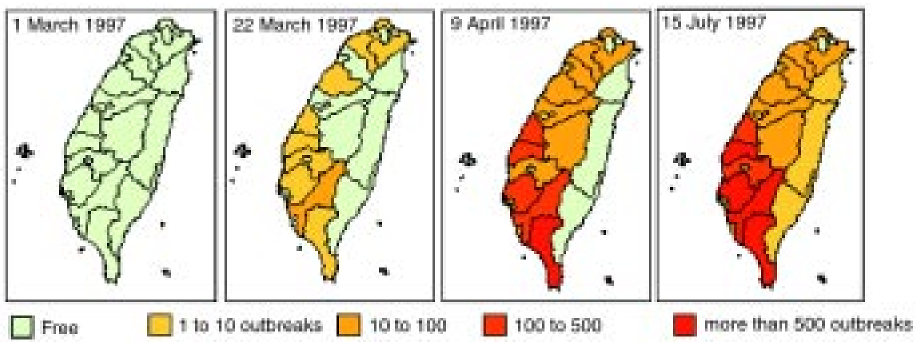
Background

In 1997, an epidemic of FMD broke out in Taiwan Province of China and spread throughout the island in less than two months.

An outbreak was first detected in Hsinchu province (western part of the main island) on 14 March 1997, and successive cases were reported in the same prefecture on 17 March. Following these outbreaks, emergency vaccination of pigs and susceptible zoo animals was carried out by the authorities, to control the spread of the disease and particularly to protect the eastern part of the main island.

Nevertheless, the entire island, measuring 380 by 140 km, was infected in approximately 50 days, from the first reported FMD case on 14 March until 3 May 1997. During that period, more than 6 000 farms were infected and 3.8 million pigs were slaughtered, while 13 million doses of vaccine were used during the vaccination exercise.

FMD spread in Taiwan Province of China



Weaknesses in the early warning mechanism

It is believed that the FMD infection could have been present on the Taiwanese mainland six weeks before the disease was first detected. How can such a delay in disease recognition be explained?

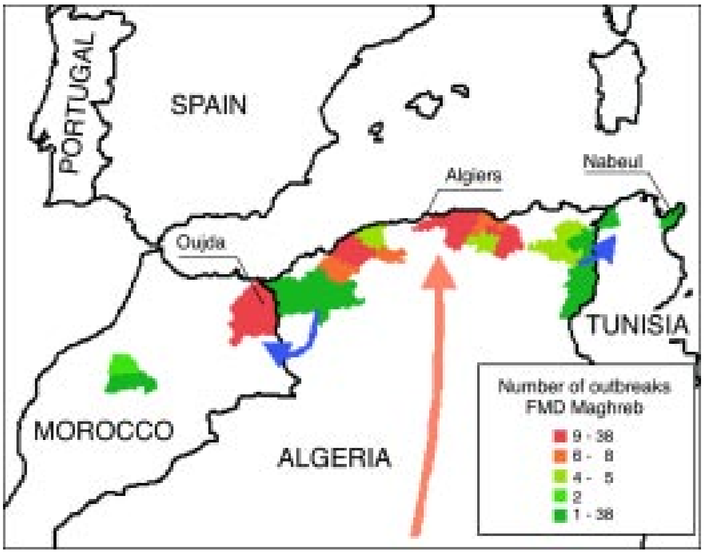
First, Taiwan Province of China had been free of FMD since 1929, which may explain a lack of awareness with regard to the disease. Furthermore, swine vesicular disease (SVD), which cannot clinically be distinguished from FMD, had been observed in 1997, suggesting that FMD could have been misdiagnosed as SVD. In addition, the disease appeared at the time of the Chinese New Year, a period traditionally known for an increase in animal movements. This association of risk factors certainly fostered the introduction and spread of the disease in the island, and shows the importance of differential diagnosis in disease emergency preparedness.

FMD in North Africa in 1999

Background

FMD infection has been cyclic in the Maghreb region for several decades. The infection has been regularly introduced into the region from the east and west. Its main routes of introduction have been from Egypt and the Libyan Arab Jamahiriya in the east (the Tunisian FMD virus infections of 1969, 1975, 1979, 1982 and 1989) or from the west through either South America (1977) or Spain (1983). Throughout this period, the Sahara desert has played the role of a protective barrier, preventing disease infection and spread from the infected countries of West Africa.

Algeria. In 1999, FMD was detected in beef cattle near the capital city, Algiers. A limited spread eastward and westward to different localities was also reported (see map). In total, 165 farms and 139 communes were infected, while 1 605 animals were destroyed, 2 153 slaughtered and 1 270 685 vaccinated.



FMD spread in North Africa – 1999

Morocco and Tunisia. FMD occurrences were reported in Morocco on 25 February 1999, in the province of Oujda near the Algerian border. Only two outbreaks were reported in Tunisia: one on 2 March in Grombalia (Nabeul Governorate) and the other on 11 March in Jendouba, on the border with Algeria.

Weaknesses in the early warning mechanism

The 1999 FMD occurrence in Algeria registered a complete change in the epidemiological feature of FMD in the Maghreb region. The close relationship recognized between the Algerian FMD strain and strains found in West Africa showed the emergence of a new route of virus introduction into the Maghreb region, represented by the Sahara.

However, the disease spread in Algeria and neighbouring countries was limited for two main reasons:

- The local population was partly protected by the blanket vaccination implemented earlier (following the 1997 and 1998 FMD occurrences in Morocco and Tunisia, respectively).
- While it is true that the Islamic festivities, which took place during the epidemic, increased animal movements, it also led to the slaughter of several million susceptible animals.

The FMD outbreak in the Maghreb is an excellent illustration of disease spread through new routes of introduction. Increase in trade exchanges, improvement of means of communication and transportation create opportunities for TADs to enter new populations and areas

As observed in the FMD epidemic in the United Kingdom, the FMD outbreak in the Maghreb is an excellent illustration of disease spread through new routes of introduction. Increase in trade exchanges, improvement of means of communication and transportation create opportunities for TADs to enter new populations and areas. Hence known traditional patterns may need to be reassessed frequently as changes occur throughout the world.

African swine fever outbreak in the United Republic of Tanzania in 2001

Background

The presence of African swine fever (ASF) has previously been reported in the United Republic of Tanzania, with the most recent and serious outbreaks affecting the Mbeya and Kilimanjaro regions in the 1980s.

The 2001 ASF outbreak in the capital city, Dar-es-Salaam, was confirmed at Onderstepoort Veterinary Institute, South Africa, in May 2001, and occurred principally among pig units of pig meat traders receiving pigs from the northern regions of Mbeya, Morogoro, Dodoma, Tanga, Arusha and Kilimanjaro.

The virus was described to have no relation with the warthog related strains and closely resembled the Mozambique/Malawian strains, suggesting that the disease might have originated from these known endemic foci in the northern region of Malawi and eastern parts of Zambia, both of which border with Tanzania.

Control strategies

FAO assisted the Tanzanian Government in implementing an ASF emergency control programme, through the technical cooperation project "Emergency surveillance for rinderpest and other transboundary animal diseases" (TCP/URT/0067). Since a stamping-out policy was not adopted, alternative control measures were taken, such as the identification of affected pigs through epidemiological investigation, the implementation of quarantine measures and dissemination of information through the media on the main features of the disease to avoid further spreading.

Weaknesses in the early warning mechanism

On 20 February 2002, a workshop was held in Dar-es-Salaam, attended by Tanzania's senior animal health staff and a FAO consultant, to review the 2001 ASF outbreaks and the lessons learned. Delay in disease reporting and ineffective disease investigation seem to have been the main factors responsible for the spread of the disease

Although ASF was diagnosed in peri-urban areas of Dar-es-Salaam towards the end of May 2001, it is now known that there were high pig mortalities, suggestive of acute ASF, in the Mbeya area as early as February. These outbreaks were not properly investigated and the information was not communicated to the Central Epidemiology Unit of the Veterinary Services in the capital. There were further delays when the disease reached Dar-es-Salaam, as the first cases were seen and treated by a private veterinary practitioner and not reported to government veterinarians for at least two weeks. In addition, the laboratory diagnosis for ASF was not in place in Tanzania in 2001 and specimens had to be sent to Onderstepoort Veterinary Institute in South Africa for confirmation.

The absence of laboratory diagnostic capacity for ASF, the lack of disease awareness at national and regional levels, and the delay in disease reporting are the main shortcomings of the disease surveillance and early warning system with regard to the ASF epizootic in the United Republic of Tanzania

Furthermore, in late 2000, it was known that ASF was very active across the border in Malawi and this could have raised "alarm bells" since movement of pigs from this country into Tanzania is known to occur. Also, the local government authorities (LGAs) failed to strengthen the initial response actions of the municipal veterinary services with their own emergency response. The LGAs' negligence was attributed to lack of financial resources. Moreover, at the LGA level, no one was assigned to follow up and document all the outbreak cases until the Zoosanitary Unit intervened at the ministerial level. The emergency disease response mechanism was also not implemented at the national level, which could probably be attributed to the low disease priority status accorded earlier to ASF.

However, it is now realized that threats of ASF to Tanzania are increasing because of the recent upsurge of the disease in many parts of Africa, improved means of transport and expansion of the pig industry in the country.

In conclusion, the absence of laboratory diagnostic capacity for ASF, the lack of disease awareness at national and regional levels, and the delay in disease reporting are the main shortcomings of the disease surveillance and early warning system with regard to the ASF epizootic in Tanzania.

Eradication of ASF in Côte d'Ivoire

Background

During the last six years, ASF has leapt to prominence in Africa as a re-emerging disease. In 1996, a devastating ASF epizootic occurred in Côte d'Ivoire, destroying a flourishing pig industry around Abidjan and also in the central and western parts of the country. The epidemic, which was introduced in April 1996 in Abidjan and rapidly spread in July to the central and western regions of the country, resulted in the loss of 80 percent of the commercial pig herd. The extension zones for ASF have followed illegal movements of pigs and pork products from the infected areas.

The disease was eradicated within a year, but at a very high cost, and the industry is only now showing signs of recovery.

Occurrence of the disease

The first case was recorded on 16 April 1996 among 43 pigs in a backyard piggery of Abidjan. At first, the farmer slaughtered some of the diseased pigs, but sold some others to farmers in Abidjan, fostering the spread of the disease. Two weeks later, on 1 May, one of the farmers whose pigs were affected by the disease decided to contact a veterinarian, who alerted the Direction of Veterinary Services and the Central Veterinary Laboratory. Lesions of acute ASF were apparent from clinical observations and the necropsy that was performed. The laboratory confirmation was carried out at the ASF reference laboratory in France on 21 May 1996. A preliminary epidemiological investigation revealed that the source of infection was likely to be product wastes that had been brought in from an ASF-infected country to feed the pigs.

Weaknesses in the early warning mechanism

In spite of early efforts to stamp out the epizootic, the disease spread to village pigs in various parts of the country, and can be related to:

- delayed communication resulting from the lack of farmers' disease awareness (veterinary attention was sought on 1 May, two weeks after probable infection);
- lack of knowledge of animal movements, especially illegal movements from infected areas;
- late disease diagnosis owing to inadequate laboratory facilities (the Laboratoire central de pathologie animale had excellent facilities but lacked the capability to perform ASF confirmatory diagnostic tests).

Although ASF eradication in Côte d'Ivoire can be seen as a successful example of disease control as the disease was in fact eradicated, it should not be forgotten that this epidemic ruined all the efforts by the government and professionals for the development of the pig industry in the country. The economic loss was estimated at around 10 539 million CFA francs (US$14 000), and more than 25 percent of the national herd was lost.

Early detection of Rift Valley fever

Rift Valley fever (RVF) is a mosquito-borne viral zoonotic disease. The first recorded outbreak of RVF in Egypt in 1977 caused an estimated 200 000 human cases of the disease with some 600 deaths, as well as large numbers of deaths and abortions in sheep and cattle and other livestock species.

The disease occurrence in Mauritania in September 1998 also registered human deaths and huge livestock losses. An outbreak of the disease in East Africa in 1997–8 not only caused considerable livestock losses and human deaths, but also seriously disrupted the

RVF sentinel herd monitoring in Mali

PHOTO COURTESY OF VINCENT MARTIN/EMPRES

valuable East African livestock export trade to the Near East. This resulted in severe sociological problems, especially in Somalia, where ruminant trade is almost the only means of livelihood for many families and communities.

In September 2001, RVF was reported for the first time outside the African continent, in Saudi Arabia and Yemen, here also causing human deaths and major losses in the livestock population. It was considered the first documented RVF outbreak outside the African continent, although the virus could have been endemic in the wadi zones for some years in cryptic foci.

Weaknesses in the early warning mechanism and solutions

On all these occasions, RVF fever was first detected in humans, while the disease was actually evolving in the livestock population without being reported. This observation has led to the conclusion that earlier detection of viral circulation in domestic animals would have been essential to avoid the spread of the disease to the human population.

In order to address this issue, FAO has been actively involved in strengthening early detection of the disease, particularly in West Africa where a regional RVF regional surveillance system was established in 2000. The project's activities have focused on developing early warning capacity at national and regional levels, combining classical disease surveillance techniques and the monitoring of climatic indicators stemming from satellite imagery.

The RVF regional initiative in West Africa shows that early detection of the disease could be a reality in the future if the system is actively instituted. However, interepizootic periods can be long and have a negative impact on disease awareness. The combination of the system with other disease surveillance initiatives could be a solution to keep stakeholders' interest and provide an important contribution to public health

Two years of regional surveillance in Mali, Mauritania and Senegal have shown the relevance of the system, which operates during the rainy season – considered as the high-risk period for the disease. After the 1998 epizootic, no viral circulation was observed in 2000 in Senegal and Mauritania, whereas some very low-level viral circulation was detected in Mali.

The absence of clinical signs of the disease was ascertained by field investigation missions in Mali. Follow-up field missions and serological surveys were carried out to ensure the disease would not develop into epizootic proportions. Population sensitization and education were also addressed to prevent human contamination whenever the disease occurs.

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Early warning lessons from the above experiences

The past decade has been rich in disease epizootics of different natures, often changing the traditional understanding of veterinary epidemiology concerning disease introduction and geographical distribution.

In the light of the most recent events, lessons should be learned to prevent the re-emergence of major disasters, focusing in particular on the following issues:

- farmer and veterinary awareness;
- updating knowledge of possible new routes of disease introduction;
- enhanced knowledge of animal movements, including those for religious festivities;
- communication among laboratories;
- strengthening national and regional emergency preparedness;
- good communication between human health institutions and veterinary services;
- use of new technology for disease early warning, towards the prediction of major epizootics.

Interview with Dr Soumana Diallo, delegate of Mali to OIE

EMPRES: As Chief of the Division de la prévention des risques, protection des animaux et des végétaux, Direction nationale de l'appui au monde rural, as well as in your capacity as delegate of Mali to OIE, could you kindly tell us what are the major constraints the Direction of Veterinary Services has to face in Mali when it deals with early detection of animal diseases?

SD: The major constraints faced by our service stem from the necessity to cover a vast territory in spite of limited or absence of means of transport (vehicles, motorbikes), availability of maintenance funds and understaffing. Extensive husbandry practices and animal movements also contribute to the difficulty of efficient delivery of veterinary services at the grassroots level. Lack of training of field agents and veterinarians is also a critical issue that needs to be addressed.

EMPRES: As an active member of a regional early warning and surveillance system for RVF, what lessons do you draw from this experience?

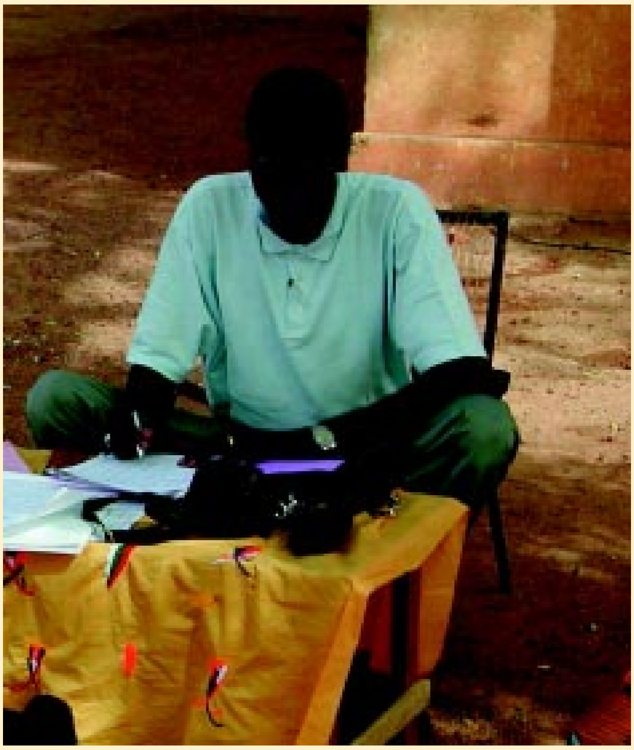


PHOTO COURTESY OF VINCENT MARTIN/EMPRES

Dr Soumana Diallo during a field visit to sentinel herds in the region of Mopti

SD: Many lessons have been learned from this experience. One of the most important is that, with only limited resources, it is possible to detect the early signs of epizootic diseases through farmer awareness (posters in local languages, manuals) and exchange of information between neighbouring countries.

EMPRES: In your opinion, what aspects or areas of early warning still need to be strengthened, taking Mali as an example?

SD: In my opinion, surveillance and early detection of diseases need to be strengthened through subregional cooperation, based on a reliable information system. Involvement of all stakeholders (public health, diagnostic laboratory, the media, veterinary services and livestock owners) at the national level is also essential.

EMPRES: Good farmer and, by extension, public awareness is another strong early warning component. Is the Malian public aware of the risks of TADs, and their impact on food security?

SD: In rural areas, farmers tend to have a good knowledge of livestock epizootic diseases. However, they often ignore their real impact on food security.

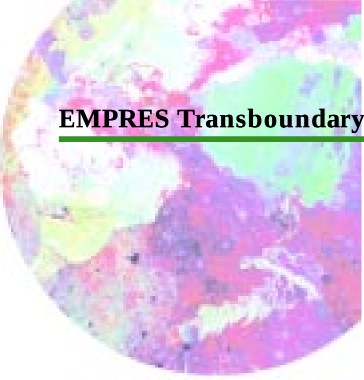
EMPRES: What is the level of preparedness in the context of early reaction of the Malian Veterinary Services?

SD: With the implementation of the National Disease Information System (EPIVET-MALI) in 1999, and in the framework of the Pan African Programme for the Control of Epizootics (PACE) funded by the European Union and the Malian Government, the level of preparedness and early reaction can be considered as good today.

EMPRES: How much more can FAO, through its Animal Health Service / EMPRES programme, help in assisting your work?

SD: FAO and EMPRES could assist the Veterinary Services to achieve the following objectives by:

- provision of training and information material for field agents and farmers (newsletter in national languages);
- provision of computer equipment with modem connection for rapid exchange of information with neighbouring countries;
- installation of TADinfo software and adequate training of staff;
- training in risk analysis with regard to the Sanitary and Phytosanitary Agreement.



Disease intelligence as a prerequisite to early warning

While in-country surveillance usually makes use of "formal" data gathering mechanisms, disease intelligence goes further than this and makes use of additional information sources, many of them informal and often based outside the country's standard surveillance system. Disease intelligence is therefore used to boost awareness of disease threats and developments that may otherwise remain unknown.

As an example, the World Health Organization (WHO) "Global Outbreak Alert and Response" system has developed, in collaboration with Health Canada, a disease intelligence system called the Global Public Health Intelligence Network (GPHIN). GPHIN is an Internet-based "early warning" application that gathers reports of public health significance from global electronic media (news wires, Web sites) and uses human review and computerized text mining to filter, organize and classify this information. It is then disseminated to WHO headquarters in Geneva, Switzerland, and to other public health professionals around the world by means of a secure Web site and e-mail. Through this mechanism, GPHIN serves as a global initiator for risk identification, assessment and management. GPHIN has effectively bypassed the traditional national infectious disease surveillance systems in which data from case reports at a local level are progressively aggregated up to the national level to trigger public health actions. Economic and political concerns have historically inhibited countries from timely reporting of outbreaks of public health importance to the international level (e.g. to WHO). GPHIN provides real-time, informal information that, unlike ProMed,[1] is assessed by WHO experts for its potential public health importance and then, through its privileged access to member countries, proactively verifies the information. The system enables timely responses with the goal of minimizing the health and economic impacts of outbreaks. GPHIN's original scope focused on infectious diseases. Additional modules that include food, water, radiation and product safety and therapeutics have since been developed. GPHIN has successfully begun to harness the vast amounts of information available on the Internet and changed the paradigm in which public health professionals function (keynote for the 6th World Congress on the Internet in Medicine [MEDNET 2001], Udine, Italy, 29 November – 2 December 2001).

Source: Communicable Disease Surveillance and Response Web site: *www.who.int/emc/index.html*

[1] The Programme for Monitoring of Emerging Diseases (ProMed) is a policy initiative of the Federation of American Scientists (FAS), calling for global monitoring of emerging diseases. Web site: www.fas.org/promed/

Towards a global early warning system for TADs

Origin of the concept

At the end of the nineteenth century, a pandemic of rinderpest decimated the livestock and wildlife animal populations of Africa. It is estimated that some 90 percent of the cattle population were eliminated by the plague. Incursions of the disease into Europe, and most notably the epizootic that occurred in Belgium in 1920, led to the creation of the Office international des épizooties (OIE) in 1924.

The twentieth century witnessed a steady decline in the incidence and extent of epizootic diseases in industrialized countries of Europe, thanks to developments in technology, the farming industry, animal health services and the dedicated investment of adequate resources. However, towards the end of the twentieth century and now at the beginning of the twenty-first, epidemic livestock diseases have been showing an alarming tendency to spread, *inter alia,* through increased mobility of people, goods and livestock, changes in farming systems, climatic changes and weakened livestock health services.

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It is in this context that the concept of a global early warning system for priority transboundary animal diseases of livestock was initially raised during the review of the EMPRES programme in 1996 (expert consultation, 24–26 July 1996). This became necessary in order to help member countries to be better prepared to fight animal diseases of an epizootic nature.

In 1998, the International Committee of the OIE further endorsed the concept of early warning for animal diseases through its Resolution No. XIII (Forecasting systems using the laboratory and epidemiology to prevent outbreaks of existing and emerging diseases). Chapter Six of this Resolution states:

"Member countries, the OIE and the World Health Organization (WHO) collaborate with the Food and Agriculture Organization of the United Nations (FAO) to progressively develop a hierarchical global early warning system, including pilot projects to be carried out on a regional basis, which complements, but does not duplicate or replace, the existing reporting obligations of the OIE."

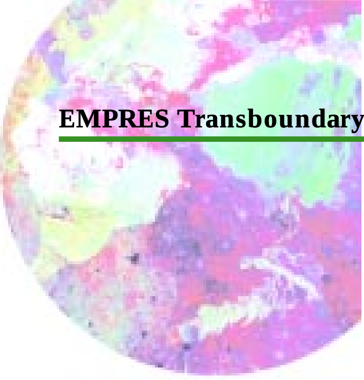
Finally, at the Ministerial Meeting on FMD held at FAO headquarters, Rome, on 6 November 2001, during the thirty-first session of the biannual FAO Conference, the FAO Director-General, Dr Jacques Diouf, reaffirmed the need to establish a system similar to that already developed in FAO for food crops under the name "Global Information and Early Warning System on Food and Agriculture" (GIEWS, see box). The envisaged early warning system for transboundary animal diseases would take account of the official reporting system of the OIE along with ground truth disease investigations, and epidemiological and laboratory studies to aid prediction modelling and international early warning.

GLOBAL INFORMATION AND EARLY WARNING SYSTEM ON FOOD AND AGRICULTURE

GIEWS was established in 1975 in the wake of the world food crisis of the early 1970s on the recommendation of the World Food Conference (1974). The Conference recommendations were endorsed at the twenty-ninth session of the UN General Assembly. The ultimate aim of GIEWS is to avert hunger and suffering by providing policy-makers and policy analysts with accurate, timely and appropriate information on food supply and demand. In the above context, early warning signifies the prediction of a food crisis before it occurs.

GIEWS monitors global food supply and demand in order to provide timely warnings of impending food supply problems facing individual countries.

The system continually receives economic, political and agricultural information from a wide variety of official and unofficial sources. Institutional links and information-sharing agreements have been established with several UN organizations, 116 governments, 4 regional organizations and over 60 non-governmental organizations (NGOs). The system maintains



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GIEWS helps to improve food security by monitoring global food supply and demand

regular contact with FAO's regional, subregional and country offices and most of FAO's technical units for information sharing and for the development of methodologies.

In Africa, GIEWS is currently using the Advanced Real-Time Environmental Monitoring Information System (ARTEMIS) to assess crop production in Africa and underline areas at risk of facing food security problems.

ARTEMIS and the Agrometeorological Group in support of GIEWS

ARTEMIS has been in operation since August 1988, receiving, processing, archiving and disseminating low-resolution remote sensing imagery in support of FAO's programmes on early warning for food security, and migrant pest and disease control.

ARTEMIS supports the operational monitoring of seasonal growing conditions and vegetation development over Africa. The monitoring is based on hourly Meteosat and daily NOAA-AVHRR data, for use in early warning for food security and desert locust control. This includes routine distribution of ARTEMIS images, containing information about rainfall and vegetation activity, by electronic means to users at FAO headquarters and at regional and national levels.

FAO continues to support the establishment and / or improvement of local reception and / or processing systems using low-resolution environmental satellites, including the development of improved interpretation techniques and user-friendly analysis software.

ARTEMIS uses Meteosat-based products, such as Cold Cloud Duration (CCD), to generate estimated ground rainfall digital images. ARTEMIS also uses the NOAA / AVHRR and SPOT-Vegetation based assessments of vegetation cover, such as the Normalized Difference Vegetation Index (NDVI), for operational monitoring of crop conditions in the Horn of Africa.

Assessments of crop growing conditions and related food production outlook are based on agrometeorological observations combined with remote sensing and other relevant socio-economic information.

Principles to be followed in establishing a global early warning and response system for transboundary animal diseases

In order to be effective, a global early warning system for TADs should be:

Tightly focused. It should be tightly focused on major epizootics, such as the OIE list A diseases (see box), and utilize and build on existing national and international disease reporting structures and disease intelligence mechanisms.

OIE LIST A DISEASES

- Foot-and-mouth disease
- Vesicular stomatitis
- Swine vesicular disease
- Rinderpest
- Peste des petits ruminants
- Contagious bovine pleuropneumonia
- Lumpy skin disease
- Rift Valley fever
- Bluetongue
- Sheep pox and goat pox
- African horse sickness
- African swine fever
- Classical swine fever
- Highly pathogenic avian influenza
- Newcastle disease

Accurate and timely. Emphasis must be given to helping member countries to access accurate and timely information, which is necessary to understand the epidemiology of a disease at international and regional levels and the subsequent threat on national boundaries. This encompasses fully utilizing all potential sources of information on disease incidents, well-coordinated field and laboratory services, and passive and active disease searching in the field.

However, formal mechanisms of disease reporting have often failed to bring to the fore an emergency situation and the early signs of a disease. While these systems must be strengthened, it is critical to use innovative methods to overcome this problem (see previous section on disease intelligence). This will become even more important during the advanced stages of a disease eradication campaign, e.g. the Global Rinderpest Eradication Programme, when it will become critical to detect remaining pockets of infection in an otherwise susceptible livestock population. In such circumstances, it will be necessary to utilize a mix of techniques that includes comprehensive seromonitoring, abattoir monitoring, incentive-aided disease searching, etc.

Value-added. The system should develop capabilities that will enable it to undertake comprehensive epidemiological analysis and risk assessments of disease outbreaks that will form a solid platform for advising the outbreak country, neighbouring countries and trading partners on the most appropriate prevention control actions. The epidemiological analysis may include antigenic and molecular analysis (nucleotide sequencing) of virus strains at reference laboratories, disease mapping, disease tracing, risk assessment, immune status of livestock populations, insect vector identification and population dynamics.

Action-oriented. It is important to stress that the ultimate goal of the system should be to provide advice and assistance to countries on request following early warning of an imminent disease threat. The envisaged Global Early Warning System (GEWS) for TADs must therefore be linked to early reaction which would quickly initiate visits of experts, technical cooperation programmes, quarantine advice, contingency plans, disease recognition and diagnostic assistance, and vaccine sourcing. It is essential to understand that an early warning system without the follow-up response would be a purely academic exercise with little practical value. Therefore, it is vital that the early assessment and warning are linked to the response mechanism so that the end goal of helping the people affected by the crisis is achieved.

The envisaged GEWS for TADs must be linked to early reaction which would quickly initiate visits of experts, technical cooperation programmes, quarantine advice, contingency plans, disease recognition and diagnostic assistance, and vaccine sourcing

Accessible. To improve international preparedness for epidemic response, it is essential to collect information worldwide on ongoing outbreaks, or rumours of outbreaks, and then disseminate this information (verified information only) at regional and national levels to allow timely action and prevent the disease from spreading. The critical point is that the information must get to the key people who will use the information by the most direct and fastest route. Disease distribution maps, epidemiological analysis reports and emergency disease advice notices should be made available rapidly through newsletters, emergency bulletins, Web sites and mailing lists. In particular situations, more direct communication with affected and threatened countries is necessary.

OIE, WHO and FAO join efforts to realize a global early warning system

The eighth joint OIE/WHO/FAO coordinating meeting was held at FAO headquarters in Rome on 5 and 6 February 2002 and deliberated extensively on the feasibility of an international consortium on “Global Early Warning Systems for Animal Diseases”. The tripartite meeting was attended by representatives of the three international organizations, and was chaired by the OIE Director-General, Dr Bernard Vallat.

Decision-making tools for early warning developed by FAO were presented during the meeting, including the livestock geography expert system, the Global Livestock Production and Health Atlas (GliPHA), TADinfo software and the RVF regional surveillance network in West Africa. The new OIE policy for animal health information focusing on early warning and the WHO Global Outbreak Verification System were also presented during this session.

At the end of the meeting, it was agreed that a joint OIE/WHO/FAO global early warning system would be an extremely valuable tool for the international community. It was also decided that a series of meetings involving a focal point nominated by each organization will be organized to draft a project document outlining the features of this global system.

Existing early warning systems for livestock and food security

In addition to officially established regional disease information systems, national and regional early warning systems are developing fast to deal with human and animal health issues. These systems aim at improving the rapidity of reaction in emergency situations and preventing the occurrence of major disasters. A collection of early warning systems dealing with food security is presented below, with their different scopes and objectives.

Livestock Early Warning System

The Livestock Early Warning System (LEWS) is an early warning system for monitoring nutrition and livestock health for food security of humans in East Africa. It is a subproject within the Global Livestock Collaborative Research Support Program (GL-CRSP) being implemented by Texas A&M University and funded by the United States Agency for International Development (USAID).

The system was specifically developed for East Africa to provide the capability of detecting changes in the well-being of free-ranging livestock before they are normally detected by the pastoralist or crisis monitoring organizations. Information on emerging problems will be provided to in-country policy-makers, international organizations, NGOs and pastoralist communities. Timely spatial information on trends of livestock well-being allows pastoralists and policy-makers to learn about more rational crisis mitigation and reduced land degradation risk.

More information available at *http://cnrit.tamu.edu/lews*

Famine Early Warning System

The USAID Famine Early Warning System (FEWS) for Africa provides data, information and analyses to decision-makers so they can evaluate and anticipate the need for famine interventions. The goal of FEWS is to strengthen the abilities of African countries and regional organizations to manage threats of food security through the provision of timely and analytical early warning and vulnerability information. The FEWS programme has entered its fourth phase, referred to as FEWS Net. One of the principal goals of FEWS Net is to provide timely access to satellite data and products in order to identify potential or actual problems related to drought and/or flood risk in Africa. FEWS Net activities include capacity development, network building and strengthening, and developing information useful for policy formulation and forming consensus about food security problems and solutions.

More information available at *www.fews.net*

Project on risk evaluation, vulnerability, indexing and early warning

The United Nations Environment Programme/Global Resource Information (UNEP/GRID) in Geneva operates the project on risk evaluation, vulnerability, indexing and early warning (PreView), which includes three components:

- ***PreView IMS.*** An interactive Internet map server showing the risk associated with five types of natural disasters at the global level. To facilitate integrated analysis, users may overlay natural disaster information with baseline data, such as national park limits, lakes and rivers, or with background information, such as population density, human development index, vulnerability, elevation or satellite imagery.
- ***PreView NET.*** An Internet directory of organizations working in the field of early warning for 16 kinds of natural and human-induced disasters (e.g. floods, drought, fires, oil spills, volcanoes, erosion and biodiversity loss).

- ***Preview articles.*** Articles and maps prepared by UNEP/GRID-Geneva, all accessible on a theme basis.

More information available at *www.grid.unep.ch/activities/earlywarning/preview/index.html*

Early Warning and Response Network, southern Sudan

Southern Sudan, an area with an estimated human population of 5.4 million, is the scene of frequent displacement, tribal conflict, flooding, famine, drought and disease outbreaks. In 1988, over one-quarter of a million people were estimated to have died from famine and as a result of drought. In response to this serious complex emergency situation, Operation Lifeline Sudan (OLS) was launched in 1989, under the leadership of the United Nations Children's Fund (UNICEF). The mandate of OLS is to channel humanitarian relief services to those affected. In March 1998, WHO joined UNICEF and began to operate within the OLS framework. In 1998 and 1999, international experts investigating a reported outbreak, later confirmed to be relapsing fever, reiterated the need for an early warning alert and response system on a wider scale.

In collaboration with several agencies, the Early Warning and Response Network (EWARN) was initiated in July 1999 with WHO as the lead agency. In 2000, technical, financial and material support were secured through the United Nations Fund for International Partnership (UNFIP) comprising the Rockefeller Foundation, the UN Foundation and the Gates Foundation. Currently, there are more than 40 health agencies (including NGOs, the International Committee of the Red Cross, UNICEF and WHO) participating in EWARN activities, as well as church groups, community leaders and local counterparts. In southern Sudan, as in many geographically inaccessible areas or resource-poor countries, the need to develop partnerships for a greater efficiency is crucial, and allows maximizing and coordinating the use of existing resources.

The objectives of EWARN are as follows:

- early detection, alert and prompt investigation of suspected outbreaks in southern Sudan;
- establishment and strengthening of outbreak preparedness and rapid response;
- provision of regular feedback and technical guidance to all involved;
- building local capacity for early detection, prompt investigation and rapid response.

The development of an early warning and response network in southern Sudan, built on the experiences and resources of existing NGOs, has provided a model of success in using scarce resources to build capacity and make a difference within a multidisease or integrated disease surveillance and response framework.

Source: ProMED-mail, available at *www.promedmail.org*

Disaster Relief Web site

The Disaster Relief Web site is a cooperative effort between the American Red Cross, CNN Interactive and IBM. Its mission is to help disaster victims and the disaster relief community worldwide by facilitating the exchange of information on the Internet.

More information available at *www.disasterrelief.org*

Traditional early warning systems in East Africa

Traditional early warning systems represent the whole body of knowledge developed early in the 1900s among pastoral communities to anticipate the coming of rains and thus enable them to mitigate the effects of drought on their livestock – the backbone of their livelihoods.

The recent study by Dr Christopher Pratt of Tufts University (United States) shows the importance of traditional early warning systems and coping strategies in pastoralist communities of East Africa.

Early warning indicators

Pastoralists need to know how to interpret the behaviour of animals and plants, which serve as valuable indicators for subtle fluctuations in temperature and humidity. Appropriately interpreted, local pastoralists can forecast major rains four weeks before their arrival

Dr Pratt states in his study that "traditional early warning systems are based on three precepts:

- First, pastoralists must have a detailed knowledge of when the major rains should arrive – understanding what is implied about the probability of future rain by variance in wind, humidity and temperature from expected conditions.
- Second, pastoralists need to know how to interpret the behaviour of animals and plants, which serve as valuable indicators for subtle fluctuations in temperature and humidity. Appropriately interpreted, local pastoralists can forecast major rains four weeks before their arrival. Similarly, the absence of these natural indicators suggests the absence of rain, i.e. drought.
- Third, observed historical trends allow for reasonable predications of future weather patterns. However, the increasing severity and frequency of drought over the last decade have rendered this latter form of forecasting less reliable than it has been in the past."

In order to implement some of the traditional drought mitigation practices based on the understanding of climatic changes as described above, early warning indicators have been used by the Kenyan-Somali pastoral communities of East Africa.

A Tugen herdsman´s flock of sheep at a water-hole near Lamalock, Baringo District, Rift Valley Province of Kenya

FAO/10941/F. MATTIOLI

Two categories of indicators are discernible:

- The observed ways animals and plants respond to meteorological/climatic changes in their environment. The behaviour of animals may be further divided into four categories, namely: the behaviour related to animal reproduction; the practical behaviour in response to changes, or anticipated changes, in the physical environment caused by rain; the seasonal behaviour that occurs irrespective of rain; and other behaviour. Of the four animal behaviour categories, the strongest indicator for rains appears to be animal behaviour that is related to reproduction, e.g. the nesting of birds. As an example, the absence of this behaviour in the month before the rainy season is an indicator of drought. In addition, given the proximity and interaction humans have with livestock, most of the indicators relating to drought come from the observed behaviour of domesticated animals with livestock, particularly camels and cattle.

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- The observed cycles or multiyear cycles of drought and rain that correspond to longer-term weather patterns.

  Seasons: The seasons represent one of the most important pastoralists' traditional early warning indicators. Knowledge of the seasons, when and when not to expect rains, helps to reach conclusions on the probability of drought and the subsequent course of action on the part of pastoralists.

  Multiyear cycles: Until very recently, multiyear cycles of drought and rain were regarded as a strong indication of the weather that might be expected in a given year. These cycles represented longer-term weather patterns in the region as observed over past centuries. As an example, fluctuations in ocean temperatures off the coast of the western Americas, commonly known as El Niño, have roughly followed a multiyear cycle until the past decade, with decreases in ocean temperatures resulting in above average precipitation for those years.

  Similarly, these Kenyan-Somali drought cycles are products of centuries of observations handed down through oral tradition, which nevertheless have to be taken with care, i.e. as rough estimates, in consideration of the complexities of weather systems, and particularly following the erratic weather patterns of the last decade.

  The most commonly cited indicator for drought is the cycle of 8, 15 and 50 years; i.e. during each of these cycles, drought has often been observed regularly in their communities.

Drought, livestock and favourable conditions for mobility

In the past, the single, most important traditional coping strategy was mobility, with pastoral populations moving from areas of mean resources to areas with improved resource conditions. Indeed, mobility also allows pastoralists to continue their livelihoods with minimum livestock losses, and is facilitated by faster pasture regeneration and faster livestock recovery. The better condition of the physical environment in the past (less environmental stress) and lower population also contributed as favourable conditions for mobility.

Today, as drought becomes more frequent in different regions (droughts were registered in 1991–92, 1994 and 1999–2001, and the El Niño floods in 1997, causing huge livestock destitution), populations and the number of permanent settlements and watering points are on the increase, thanks to development processes. Greater human and livestock populations translate into limited resource availability, and the decline in the constitution of livestock among pastoral communities. Therefore, to preserve the life of pastoralism and traditional early warning systems, development strategies, e.g. the promotion of agriculture in and around new administrative centres within the East African pastoral communities, need to be pursued with greater attention.

Pastoralism, oral tradition and modern early warning mechanisms

Traditional strategies employed by pastoralists to mitigate the effects of drought have evolved over the years under very different conditions.

On the merits of pastoralism, Dr Pratt concludes: “Processes of urbanization, development, formal education and changing religious ideologies have all contributed to the decreasing practice of traditional early warning systems and coping strategies. Because this knowledge is in many cases preserved as an oral tradition, the increasing absenteeism of youth from pastoral communities and the decreasing practice of traditional knowledge pose a threat to the continued existence of this body of experience. This is cause for concern because the number of emergency responses available to communities has been reduced. Conditions that exist today, particularly access to relief food or other resources supplied by the government or external agencies, may change in the future. Likewise, climatic or other conditions may improve or deteriorate. Given these uncertainties, it is important that these communities have as many choices as possible to employ in their overall survival and livelihood strategies. It is important to preserve these practices in some form.”

Source: C. Pratt. 2001. *Traditional early warning systems and coping strategies for drought among pastoralist communities.* Fletcher School of Law and Diplomacy, Tufts University, Medford, MA, United States.

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